Vol. 58 No. 8 JOCCAB 58(8) 271-324 (1975) August 1975

The target for 1976!

Closing date for applications to exhibit:
1 October 1975

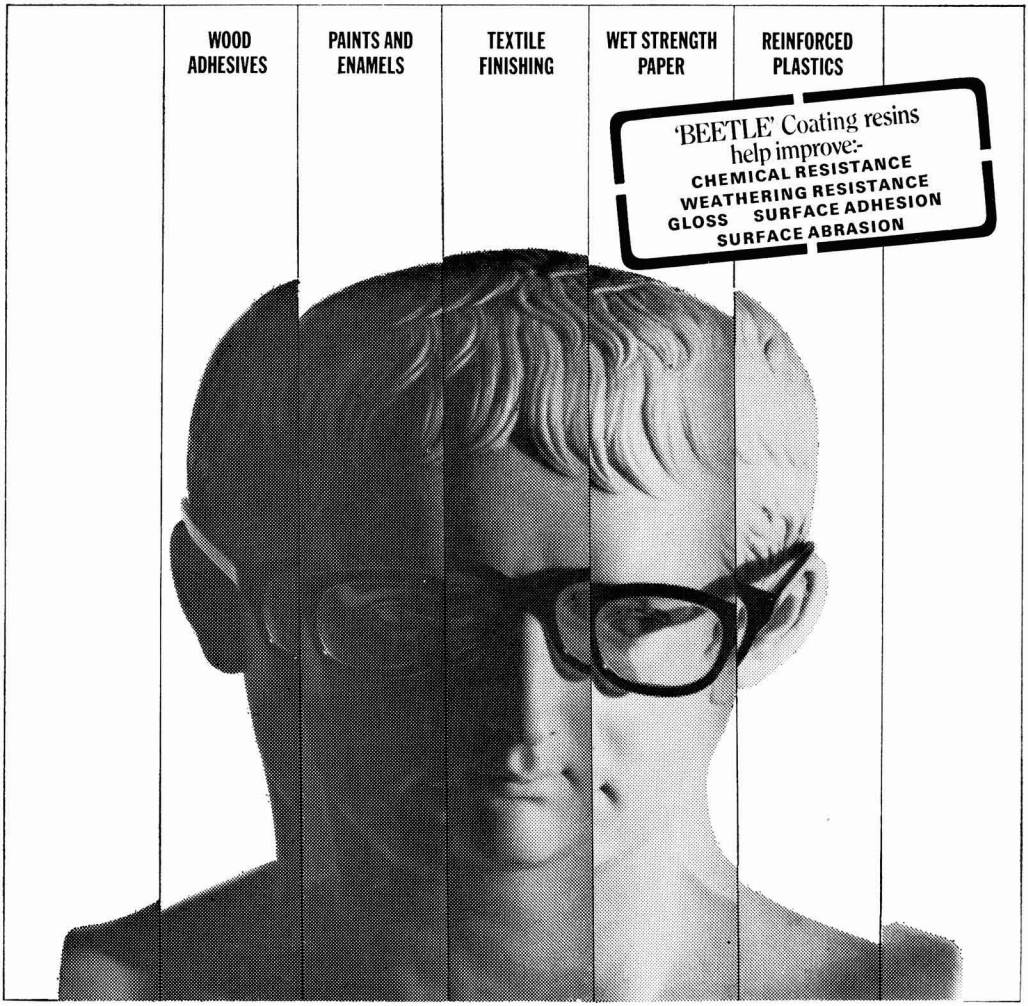
JOCCA

JOURNAL OF THE OIL & COLOUR CHEMISTS' ASSOCIATION

Priory House, 967 Harrow Road, Wembley, Middx, England HA0 2SF

Think Profitably
Think BEETLE Resins

BEETLE Resin representatives are specialists to a man-each concentrating on one specific industry. They are all able to provide practical help if you need to reformulate because of material shortages. With material costs escalating, it is now even more important to get the best from your plant. Think profitably- Think BEETLE resins.

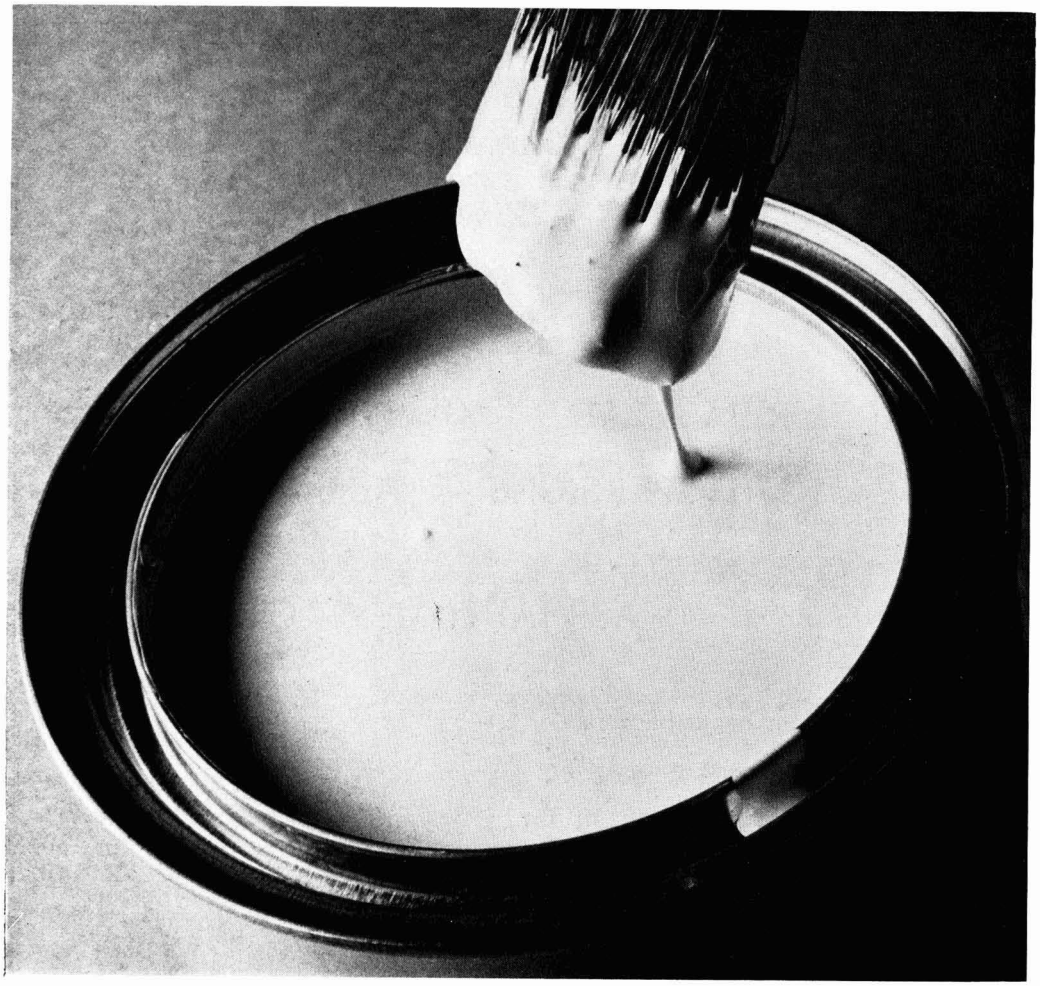


BIP

Chemicals Division

British Industrial Plastics Limited P.O. Box 6, Oldbury, Wadey, West Midlands B69 4PD Tel 021-552 1551 Telex 33347

TURNER & NEWALL LIMITED



Johns-Manville Technology developed Celite® extenders and flatting agents to help you control paint surface characteristics.

With Celite extenders you have complete control, from flat to gloss, depending on how much you add. They're pure, inert and non-reactive diatomaceous silica. Their high flatting efficiency results in uniform gloss and sheen reduction, from a silky semi-gloss to dead flat.

Celite extenders are available in several grades for both solvent and water-thinned paints. These grades give you the flexibility you need depending on your formulations, desired degree of gloss and sheen reduction, type of dispersion equipment and the desired degree of final film smoothness (up to 6 Hegman fineness).

Johns-Manville Technology has been at work in the paint industry for over 30 years. Let us help you.

Contact A. Masters, Johns-Manville (Great Britain) Ltd., Parkbridge House, The Little Green, Richmond, Surrey, TW9 IQU, Great Britain.

JM
Johns-Manville

Johns-Manville International Corporation: Denver/New York/ Miami/San Francisco/Affiliated Companies: Beirut/Buenos Aires/ Caracas/Ghent/Goteborg/ Husavik/Johannesburg/London/ Mexico City/Milan/Mol/Nairobi/ Paris/San Juan/Sao Paulo/ Singapore/Sydney/Teheran/ Tokyo/Wiesbaden. Other Representation: Lima.

JOURNAL of the OIL AND COLOUR CHEMISTS' ASSOCIATION

Editorial correspondence should be addressed to the Hon. Editor, *JOCCA*, 49 Elms Drive, Kirk Ella, Hull HU10 7QH.

General correspondence should be addressed to:
R. H. Hamblin, MA, FCIS,
Director & Secretary,
Oil & Colour Chemists' Association,
at the address below.

Tel: 01-908 1086
Telex 922670 (OCCA Wembley)
Telegrams: OCCA Wembley

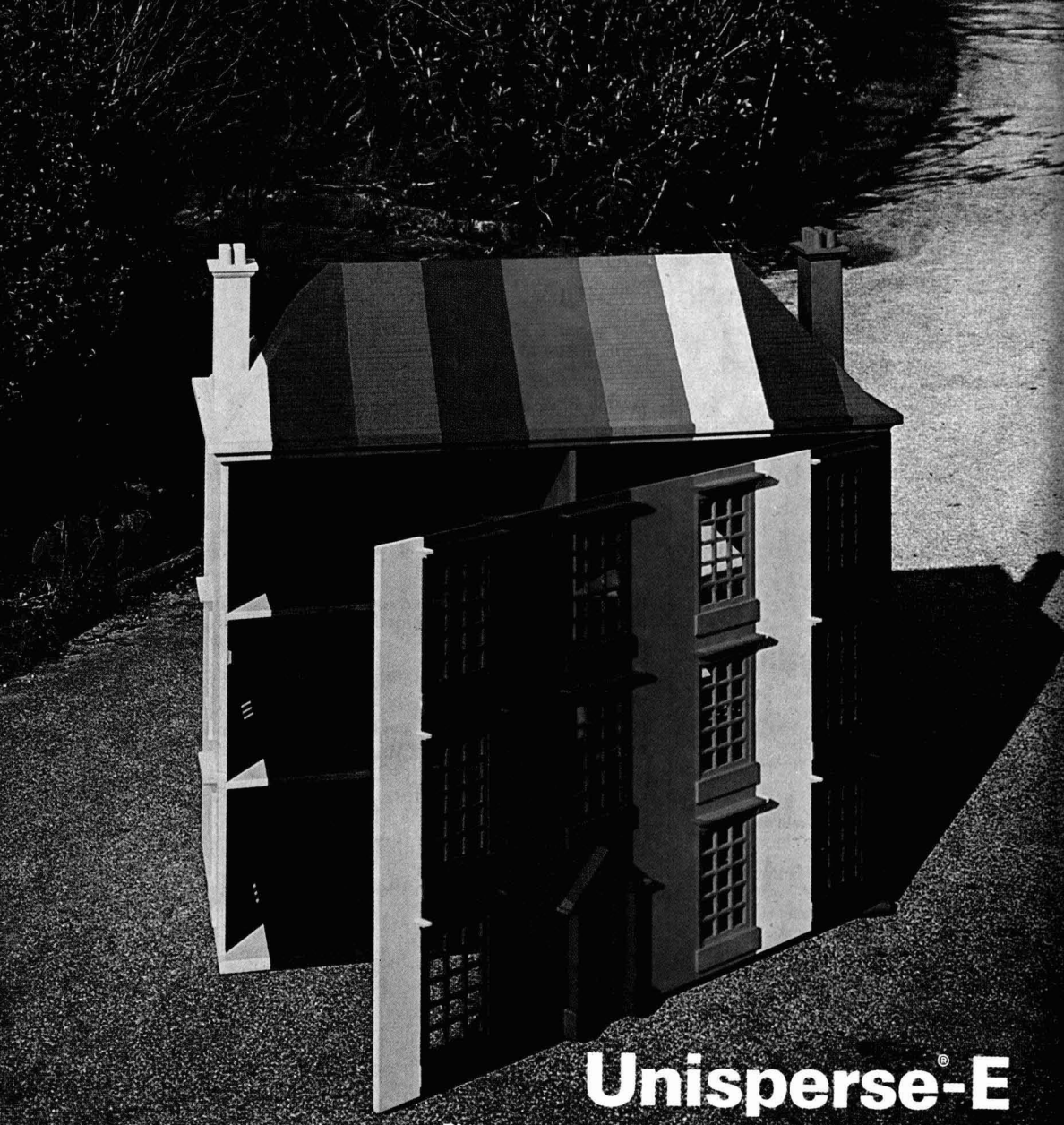
Assistant Editor: C. A. Tayler, BSc

Annual subscription to non-members: £20 ($50), post free by surface mail, payable in advance.

Single copies £2 ($5), post free by surface mail, payable in advance.

Contents **Vol. 58 No. 8** **August 1975**

Published by
OIL AND COLOUR CHEMISTS' ASSOCIATION
Priory House, 967 Harrow Road, Wembley, Middlesex, England HA0 2SF



Unisperse®-E

Pigment pastes for interior and exterior emulsion paints

Another landmark on the road to technical perfection.

In 1951 we launched IRGALITE PV, a specialised range of quality controlled pigment pastes which fully satisfied the emulsion paint requirements of the day. Like time, however, emulsion paint technology did not stand still, and neither did we. Our development in 1956 of the IRGALITE SPV range of improved paste dispersions was followed in 1961 by the highly successful IRGALITE CPV range of products, which are still available today.

And now, in 1975, to meet the current needs of the emulsion paint technologist, we introduce UNISPERSE-E, a new, wider range of paste dispersions with increased compatibility, high strength and brightness and excellent durability which are also suitable for the newer higher sheen finishes.

CIBA–GEIGY

Pigments Division CIBA-GEIGY (UK) Limited Roundthorn Estate Wythenshawe Manchester M23 9ND

1974

Journal of the Oil and Colour Chemists' Association

Vol. 58 No. 8 August 1975

Oil and Colour Chemists' Association

(Founded 1918, incorporating the Paint & Varnish Society 1924)

Council 1975-76

President A. T. S. Rudram, FTSC, 12 Leighton House, Oak Hill Road, Surbiton, Surrey.

Immediate Past President L. H. Silver, SPL Group, 513 Bradford Road, Batley, Yorkshire WF17 8LW.

Vice-Presidents

J. F. Beachen, MSc, ATSC, 102 Huia Road, Titirangi, Auckland 7, New Zealand.

A. S. Gay, ATSC, 42 Norman Road, Park Hall, Walsall, Staffordshire.

A. G. Holt, BSc, BPharm, FTSC, Morantine, 16 Westfield Road, Maidenhead, Berkshire.

W. F. McDonnell, FRIC, AMBIM, Goodlass Wall & Co. Ltd., Goodlass Road, Speke, Liverpool L24 9HJ.

F. D. Robinson, ATSC, "Frays", 78 Stallingborough Road, Healing, Grimsby, Lincolnshire.

L. F. Saunders, FTSC, Iron Duke Paint Co. Ltd., PO Box 10, New Germany, 3620 Natal, South Africa.

F. D. H. Sharp, 57 Roffey Park Road, Oldhall, Paisley, Renfrewshire PA1 3ET.

Hon. Secretary D. J. Morris, Harlow Chemical Co. Ltd., Temple Fields, Harlow, Essex CM20 2AH.

Hon. Treasurer F. Cooper, BSc, 55 Orchard Road, Nettlestone, Seaview, Isle of Wight PO34 5JN.

Hon. Editor S. R. Finn, BSc, FRIC, FTSC, 49 Elms Drive, Kirk Ella, Hull HU10 7QH.

Hon. Research and Development Officer C. N. Finlay, ATSC, 23 Beach Grove, Springwell, Gateshead 9.

Elective Members

C. Butler, FTSC, 3 Kangel Close, Dallamires Lane, Ripon, Yorks HG4 1DE.

M. J. Heavers, White House, Shay Lane, Hale Barns, Cheshire.

J. R. Taylor, BSc, FRIC, FTSC, 51a Porth-y-castell, Barry, Glam.

N. H. Seymour, FTSC, 7 Beggarmans Lane, Knutsford, Cheshire.

A. A. Duell, ARIC, FTSC, 1 Westbourne Avenue, Grange Estate, Gosforth, Newcastle upon Tyne NE3 2HN.

H. C. Worsdall, FTSC, Worsdall Chemical Co. Ltd., Sole Street, Cobham, Kent DA13 OXY.

Section Representatives

Auckland: R. F. Meek (Chairman); F. Sowerbutts, BSc (Tech), FTSC.

Bristol: G. R. Duckett, LRIC (Chairman); L. J. Brooke, ATSC.

Hull: E. Armstrong, ATSC (Chairman); T. W. Wilkinson, FTSC.

Irish: D. P. Power (Chairman); P. McCrudden.

London: J. T. Tooke-Kirby (Chairman); H. A. Hipwood, FTSC.

Manchester: H. G. Clayton (Chairman); J. E. Mitchell, BSc, FRIC, FTSC.

Midlands: D. E. Hopper, ATSC (Chairman); R. J. King, BSc, AWP, ATSC.

Newcastle: K. G. Hodgson, FTSC (Chairman); C. N. Finlay, ATSC.

Scottish: A. McLean, BSc, ARCST, FRIC, FTSC (Chairman); J. D. W. Davidson.

South Africa: D. J. Pienaar, MSc (Chairman).

Thames Valley: J. L. Inshaw, ARIC, ATCT, FTSC (Chairman); M. H. Prigmore.

West Riding: R. P. Bartrum (Chairman); M. J. Cochrane.

Wellington: O. W. Brett, BSc (Chairman); G. Willison, FRIC.

Australian Federal Committee Chairman (co-opted): M. J. Leahey, c/o Berger Paints (Aust) Pty. Ltd., PO Box 118, Concord West 2138, NSW, Australia.

Representative for OCCA Australia (co-opted): L. Valentine, BSc, PhD, FTSC, Group Research Laboratory, Berger Jenson & Nicholson Ltd., Jenson House, Carpenters Road, Stratford, London E15.

Committees of Council

Finance Committee

Chairman: F. Cooper, BSc.
President: A. T. S. Rudram, FTSC.
Immediate Past President: L. H. Silver.
Vice-President: A. G. Holt, BSc. BPharm, FTSC.
Hon. Secretary: D. J. Morris.
Hon. Editor: S. R. Finn, BSc, FRIC, FTSC.
S. Duckworth, ARIC, FTSC.
A. A. Duell, ARIC, FTSC.
H. R. Hamburg, PhD.
J. Smethurst, AMCT, FRIC, FTSC.
F. Sowerbutts, BSc Tech, FTSC.

President's Advisory Committee

President: A. T. S. Rudram, FTSC.
Immediate Past President: L. H. Silver.
Hon. Secretary: D. J. Morris.
Hon. Treasurer: F. Cooper, BSc.
Hon. Editor: S. R. Finn, BSc, FRIC, FTSC.
Hon. Research & Development Officer: C. N. Finlay, ATSC.
E. Armstrong, ATSC.
D. P. Power.
H. G. Clayton.

Exhibition Committee

Chairman: F. Cooper, BSc.
President: A. T. S. Rudram, FTSC.
Immediate Past President: L. H. Silver.
Hon. Secretary: D. J. Morris.
Hon. Editor: S. R. Finn, BSc, FRIC, FTSC.
Hon. Research & Development Officer: C. N. Finlay, ATSC.
R. N. Wheeler, BA, ARIC.
F. Sowerbutts, BScTech, FTSC.
A. A. Duell, ARIC, FTSC.
A. S. Gay, ATSC.
R. H. E. Munn, LRIC, FTSC.
H. C. Worsdall, FTSC.

Publications Committee

Chairman: S. R. Finn, BSc, FRIC, FTSC.
President: A. T. S. Rudram, FTSC.
Immediate Past President: L. H. Silver.
Vice-President: F. D. Robinson, ATSC.
Hon. Secretary: D. J. Morris.
Hon. Treasurer: F. Cooper, BSc.
Hon. Research & Development Officer: C. N. Finlay, ATSC.
R. McD. Barrett, BSc, MSc.
R. J. King, BSc, AWP, ATSC.
J. R. Taylor, BSc, FRIC, FTSC.
L. J. Watkinson, MSc, PhD, ARIC, FTSC.

Section Representatives

Auckland: M. T. Cotter.
Bristol: J. R. Taylor, BSc, FRIC, FTSC.
Hull: D. M. Wilson, LRIC.
Irish: R. C. Somerville.
London: B. A. Canterford, LTSC.
Manchester: A. McWilliam, ARIC, FTSC.
Midlands: F. W. Cole, ATSC.
Newcastle: B. Hulme, M.Sc, PhD, ARIC.
Scottish: G. H. Robertson, BSc, PhD.
South Africa: P. A. J. Gate, BSc, ARIC, FTSC.
Thames Valley: E. H. A. Bishop, LRIC, MICorrT, FTSC.
Wellington: L. H. Oliver.
West Riding: R. A. C. Chappell, ARIC.

Liaison Committee

President: A. T. S. Rudram, FTSC
Immediate Past President: L. H. Silver.
Hon. Secretary: D. J. Morris.
President, Birmingham Paint, Varnish and Lacquer Club: R. Allen.
Chairman, Midlands Section: D. E. Hopper, ATSC.

Technical Education Committee

President: A. T. S. Rudram, FTSC.
Immediate Past President: L. H. Silver.
Hon. Secretary: D. J. Morris.
Hon. Editor: S. R. Finn, BSc, FRIC, FTSC.
N. J. P. Buchanan.
J. E. Mitchell, BSc, FRIC, FTSC.
A. R. H. Tawn, FRIC, FInstPet, FIMF, FTSC.
H. C. Worsdall, FTSC.

Jordan Award Committee

Chairman: C. N. Finlay, ATSC (Hon. Research & Development Officer).
President: A. T. S. Rudram, FTSC.
Immediate Past President: L. H. Silver.
Hon. Secretary: D. J. Morris.
Hon. Editor: S. R. Finn, BSc, FRIC, FTSC.

Technical Committee

Chairman: C. N. Finlay, ATSC (Hon. Research & Development Officer).
President: A. T. S. Rudram, FTSC.
Immediate Past President: L. H. Silver.
Hon. Editor: S. R. Finn, BSc, FRIC, FTSC.
T. R. Bullett, BSc, FInstP, FInst Corr T.
G. H. Hutchinson, ARIC, AFInstPet, FTSC.
D. J. Morris.
A. G. Holt, BSc, BPharm, FTSC.
A. McLean, BSc, ARCST, FRIC, FTSC.

Professional Grade Committee

President: A. T. S. Rudram, FTSC.
Immediate Past President: L. H. Silver.
C. Butler, FTSC.
R. R. Coupe, BSc, FTSC.
S. R. Finn, BSc, FRIC, FTSC.
J. G. Gillan, PhD, FTSC.
J. L. Inshaw, ARIC, ATCT, FTSC.
H. W. Keenan, PhD, FRIC, FTSC.
J. E. Mitchell, BSc, FRIC, FTSC.
S. A. Ray, BSc, FRIC, FTSC.
F. M. Smith, BSc, PhD, FRIC, FSDC, FTSC, MIOP.
A. R. H. Tawn, FRIC, FInstPet, FIMF, FTSC.
J. R. Taylor, BSc, FRIC, FTSC.
R. J. Woodbridge, LRIC, FTSC.

Professional Grade Sub Committees

Auckland Section: T. Whitfield, FTSC.
J. F. Beachen, MSc, ATSC.
P. F. Sharp, BSc, ATSC.

Wellington Section: T. W. Slinn, BSc, FTSC.
M. D. Taylor, FTSC.
D. G. Caldwell, FTSC.

South African Section: P. A. J. Gate, BSc, ARIC, FTSC.
K. R. McDonald, BSc, ATSC.
L. F. Saunders, FTSC.

Section Officers and Committees 1975-76

The President, A. T. S. Rudram, FTSC, is an ex-officio member o all Section Committees

Auckland

Chairman: R. F. Meek, 40 Omana Road, Papatoetoe, Auckland

Hon. Secretary: W. G. Paul, Polychem (NZ) Ltd., PO Box 6435, Wellesley Street, Auckland

Hon. Treasurer: R. A. White, MSc, A. C. Hatrick (NZ) Ltd., PO Box 2359 Auckland, New Zealand

Hon. Publications Secretary: M. T. Cotter, Neill Cropper & Co. Ltd., PO Box 9, Auckland

Hon. Programmes Officer: M. Newton, Brown & Dureau, PO Box 2192, Auckland

Immediate Past Chairman: P. F. Sharp, BSc, ATSC, Lusteroid Pty (NZ) Ltd., PO Box 33-122, Otahuhu, Auckland

Representative on Council: F. A. Sowerbutts, The Warren, Cranbourne Avenue, Meads, Eastbourne, Sussex, England

Committee:

R. Ness, Mobil Oil (NZ) Ltd., PO Box 1709, Auckland

T. Whitfield, MSc, 387 Hillsborough Road, Mt. Roskill, Auckland

D. W. Sell, 4 Claude Road, Manurewa, Auckland

R. Spargo, BSc, 15a Lucinda Place, Glen Eden, Auckland

I. H. Feder, BSc; 76 Mountbatten Avenue, Glenfield, Auckland 10

G. P. Cryer, BSc, 11 Park Avenue, Grafton, Auckland 1

G. L. Armstrong, PO Box 5641, Auckland

Bristol

Chairman: G. R. Duckett, LRIC., The Orchard, High Street, Pensford, Nr. Bristol

Vice-Chairman: L. J. Brooke, ATSC, 39 Abbots Way, Westbury on Trym, Bristol

Hon. Secretary: D. N. Fidler, MSc, 28 Marine Drive, Barry, Glamorgan CF6 8QP

Hon. Treasurer: L. J. Brooke, ATSC, 39 Abbots Way, Westbury on Trym, Bristol

Hon. Publications Secretary: J. R. Taylor, BSc, FRIC, FTSC, 51a Porth-y-Castell, Barry, Glamorgan

Representative on Council: L. J. Brooke, ATSC, 39 Abbots Way, Westbury-on-Trym, Bristol

Hon. Social Secretary: Mrs E. N. Harper, 9 Griggfield Walk, Hengrove Farm, Hengrove, Bristol BS14 9UF

Hon. Auditor: W. J. McWaters, "Overton", Homefield Road, Saltford, Bristol

Committee:

K. A. Chippington, ATSC, Olympic Varnish Co. Ltd., Brimscombe, Stroud, Gloucester

G. W. Fowkes, 14 Wells Close, Chippenham, Wilts SN14 0QD

W. A. Gill, 11 Manor Road, Saltford, Bristol

E. J. Hurst, Romany Rye, 19 Karen Drive, Brackwell, Bristol BS19 3JT

A. C. Lagen, ARIC, 4 Yeomanside Close, Bristol BS14 0PZ

J. A. Wall, 529 Wells Road, Knowle, Bristol BS14 9AL

Hull

Chairman: E. Armstrong, AMBIM, ATSC, Ryeland Hill, South Cave, East Yorkshire

Vice-Chairman and Representative on Council: T. W. Wilkinson, AMCT, FTSC, "Priory View" Little Cawthorpe, Louth, Lincs

Hon. Secretary: J. W. Wenham, Blundell-Permoglaze Ltd., Sculcoates Lane, Hull

Hon. Treasurer: A. Pipes, 32 Astral Road, Cambridge Road Hessle, East Yorkshire

Hon. Publications Secretary: D. M. Wilson, LRIC, "Charnwood" Chapel Lane, South Cockerington, Louth, Lincs

Hon. Research Liaison Officer: F. D. Robinson, BSc, ATSC, "Frays", 78 Stallingborough Road, Healing, Grimsby, Lincs

Hon. Social Secretary: A. R. Vanspall, 40 Belvedere Drive, Ganstead, Hull

Hon. Lanternist: P. Adamson, BSc, 33 Solfreton Lane, Willerby, East Yorkshire

Hon. Auditor: F. S. Wilson, FCIS, AACCA, 255 Cottingham Road, Hull, East Yorkshire

Committee:

D. G. Dowling, BSc, 36 The Meadows, Cherry Burton, Beverley, E. Yorkshire

P. R. Gagg, MSc, 8 Willow Green, Gilberdyke, East Yorkshire

B. J. Howells, LRIC, ATSC, 11 Paul Crescent, Humberston, Lincs DN36 4DF

N. F. Lythgoe, FRIC, 172 Kenilworth Avenue, Hull

K. B. Smith, MSc, ARIC, Yewhurst, 22 White Walk, Kirkella, Nr. Hull

J. R. Tinegate, 3 Briarfield Road, National Avenue, Hull

Irish

Chairman: D. P. Power, 4 Glendhu Road, Navan Road, Dublin 7

Chairman Elect: Patricia Magee, "Cabra Villa," Cabra Road, Phibsborough, Dublin 7

Hon. Secretary: Patricia Magee (*Chairman Elect*)

Hon. Treasurer: J. Corrigan, 34 Kilbarrack Road, Sutton, Co. Dublin

Hon. Publications Secretary: R. C. Somerville, St. Clement, 152 Howth Road, Sutton, Co. Dublin

Representative on Council: P. McCrudden, Berger Paints Ireland Ltd., Malahide Road, Coolock, Dublin 5

Hon. Programmes Officer: R. N. Rea, 8 St. Anthony's Avenue, Clondalkin, Co. Dublin

Hon. Auditor: M. O'Callaghan, 32 Ballytore Road, Rathfarnham, Dublin 14

Committee:

M. O'Hanlon, Hoechst Ireland Ltd., Bluebell Industrial Estate, Baas Road, Dublin 12

D. Pountain, Berger Paints Ireland Ltd., Malahide Road, Coolock, Dublin 5

R. F. Patton, BSc, 106 Rathdown Park, Greystones, Co. Wicklow

London

Chairman: J. T. Tooke-Kirby, 8 Falmer Close, Goring-by-Sea, Worthing, Sussex BN12 4SR

Hon. Secretary: H. C. Worsdall, Worsdall Chemical Co. Ltd., Sole Street, Cobham, Kent DA13 0XY

Hon. Treasurer: D. B. Bannington, ATSC, 70 The Drive, Loughton, Essex

Hon. Programmes Officer and Representative on Council: H. A. Hipwood, FTSC, 147 Abbotts Road, Mitcham, Surrey

Hon. Publications Secretary: B. A. Canterford, LTSC, 20 Varney Close, Flamstead End, Cheshunt, Herts

Elective Members:

P. Barnes, BSc, ATSC, "Briarcroft," Howbury Lane, Slades Green, Kent

A. J. Newbould, 72 St. Vincents Road, Dartford, Kent

W. E. Huddart, FRIC, Hoechst Chemicals Ltd, Plastics Department, Hoechst House, Salisbury Road, Hounslow, Middlesex

R. C. Denney, BSc, PhD, FRIC, "Manteo," 21 Lake View Road, Sevenoaks, Kent

K. J. Wiseman, 59 Hyland Way, Hornchurch, Essex

B. H. Ducker LRIC, 83 Woodlands Park, Bexley, Kent

Ontario Branch

Chairman: P. Birrell, Dominion Colour Corporation Ltd., 199 New Toronto Street, Toronto, Ontario, Canada

Hon. Secretary: H. Lomas, BSc, 61 Maple Avenue, Dundas, Ontario, Canada

Manchester

Chairman: H. G. Clayton, Ciba-Geigy (UK) Ltd., Central Purchasing Department, Rushworth House, Wilmslow Road, Handforth, Wilmslow, Cheshire

Vice-Chairman: J. E. Mitchell, BSc, FRIC, FTSC, The Walpamur Co. Ltd., PO Box 57, Crown House, Darwen, Lancs BB3 0BG

Hon. Secretary: R. G. Handley, Imperial Chemical Industries Ltd., Manchester Sales Office, Piccadilly Plaza, Sunley Building, Manchester M60 7JT

Hon. Treasurer: N. H. Seymour, FTSC., The Sterling Varnish Co. Ltd., Fraser Road, Trafford Park, Manchester M17 1DU

Hon. Publications Secretary: A. McWilliam, ARIC, FTSC, England, Hughes Bell & Co. Ltd., Valley Works, Monton Road, Eccles, Manchester M30 9HU

Hon. Research Liaison Officer: A. C. Jolly, BSc, FTSC, Synthetic Resins Limited, Beckacite House, Edwards Lane, Speke, Liverpool L24 9HS

Hon. Social Secretary: P. H. Turner, Kronos Titanium Pigments Limited, St. Ann's House, Parsonage Green, Wilmslow, Cheshire

Hon. Programmes Officer: W. G. Topham, FRIC, Goodlass Wall & Co. Ltd., Goodlass Road, Speke, Liverpool L24 9HJ

Hon. Auditors: H. Archer, AMCT, FRIC, FTSC, 12 Winchester Road, Hale Barns, Cheshire and K. W. G. Butcher, FTSC, Donald Macpherson & Co. Ltd., Warth Mills, Radcliffe Road, Bury, Lancs

Hon. Student Activities Secretary: F. B. Redman, ATSC, The Walpamur Co. Ltd., PO Box 37, Crown House, Darwen, Lancs BB3 0BG

Committee:

I. S. Moll, "High Trees," 137 Higher Lane, Whitefield, Manchester M25 7WH.

N. W. Piper, 17 Barwood Lea, Ramsbottom, Lancs

G. T. Flood, 2 Brook Close, Timperley, Altrincham, Cheshire

D. A. Plant, BSc, PhD, Imperial Chemical Industries Limited, Organics Division, Hexagon House, Blackley, Manchester M9 3DA

A. E. Thornhill, 41 Sunningdale Avenue, Sale Moor, Sale, Cheshire

C. Williams, Synthetic Resins Limited, Beckacite House, Edwards Lane, Speke, Liverpool L24 9HS

G. W. Hurst, Synthetic Resins Limited, Beckacite House, Edwards Lane, Speke, Liverpool L24 9HS

Midlands

Chairman: D. E. Hopper, ACT(Birm), ATSC, "Iona," 163 Stanway Road, Shirley, Solihull, Warwicks

Vice-Chairman and Representative on Council: R. J. King, BSc, AWP, ATSC, Blundell Permoglaze Ltd., James Road, Tyseley, Birmingham B11 2BD

Hon. Secretary: L. P. G. Goodale, 127 Monmouth Drive, Sutton Coldfield, Warwicks

Hon. Treasurer: A. G. Eades, APT, Chemicals Division, BIP Ltd., PO Box 18, Tat Bawr Road, Oldbury, Warley, West Midlands B69 4PD

Hon. Publications Secretary: F. W. Cole, ATSC, Postans Ltd,, Aston Church Road, Birmingham B7 5RQ

Hon. Student Liaison Officer: R. B. Tennant, 19 Mullion Croft, Kings Norton, Birmingham 30

Hon. Social Secretary: D. D. Kimber, BSc, ARIC, 15 The Flashes, Gnosall, Staffs

Chairman of the Trent Valley Branch: J. A. Burns, E. Earnshaw & Co. Ltd., Mill in the Hole, Gauntley Street, Basford, Nottingham

Committee:

R. McD. Barrett, 26 Kidderminster Road, West Hagley, Worcs

G. D. C. Bird, ATSC, 28 Orchard Close, Dosthill, Tamworth, Staffs

R. L. Devenish, The Corner House, Longdon, Nr. Tewkesbury, Gloucestershire GL20 6AT

R. F. Dunster, 61 Brabazon Grove, Castle Vale, Birmingham 35

D. Penrice, Newtown Industrial Finishes Ltd., Ratcliffe Road, Atherstone, Warwicks

E. C. Wallace, 192 Comberton Road, Kidderminster, Worcs

Trent Valley Branch

Chairman: J. A. Burns, E. Earnshaw & Co., Gauntley Street, Basford, Nottingham

Vice-Chairman: S. N. Hawley, W. Hawley & Son Ltd., Duffield, Derbys DE6 5FG

Hon. Secretary: J. R. Tomlinson, 543 Tamworth Road, Long Eaton, Nottingham NG10 3FB

Hon. Treasurer: D. M. Bishop, MSc, 6 Springfield Drive, Duffield, Derbys

Hon. Publications Secretary: J. R. Kitchen, ATSC, The Forge, 1 Grantham Road, Bingham, Notts

Hon. Social Secretary: G. V. White, Cromford Colour Co. Ltd., Cromford, Matlock, Derbyshire DE4 3RR

Hon. Auditors: E. Hare, Via Gellia Colour Co., Matlock, Derbyshire DE4 3PT and G. V. White, Cromford Colour Co. Ltd., Cromford, Matlock, Derbyshire DE4 3RR

Committee:

J. E. Fowles-Smith, 96 Ley Lane, Mansfield Woodhouse, Notts

M. D. Key, Hopton Mining Co. Ltd., Brassington, Derby DE4 4ES

V. Sercombe, 77 Trent Avenue, Willington, Derbys

S. Watson, 21 Delamere Drive, Mansfield, Notts NG18 4DE

Newcastle

Chairman: K. V. Hodgson, FTSC, c/o A. C. D. Coatings Ltd., Factory 69 Hutton Close, Crowther, Washington NE38 0HA

Vice-Chairman: F. Hellens, ARIC, MCIC, 8 Westcroft Road, Forest Hall, Newcastle upon Tyne 12

Hon. Secretary: A. Laws, ARIC, 29 Warwick Avenue, Whickham, Newcastle upon Tyne

Hon. Treasurer: J. Clark, BSc, The White House, White House Drive, Bishopton Road West, Stockton, Co. Durham

Hon. Publications Secretary: B. Hulme, MSc, PhD, ARIC 19 Oxford Road, Middlesbrough, Cleveland TS5 5DY

Representative on Council: C. N. Finlay, ATSC, 23 Beach Grove, Springwell, Gateshead 9

Hon. Research Liaison Officer: K. F. Baxter, 5 Greybourne Gardens, Sunderland, Co. Durham

Hon. Social Secretary: H. Fuller, 552 Acklam Road, Acklam, Middlesbrough, Cleveland

Hon. Auditors: F. G. Palmer, FRIC, Polperro, 62 York Avenue, Jarrow, Co. Durham and E. G. Elphinstone, 9 Victoria Terrace, East Boldon, Co. Durham

Student Group Secretary: Mr S. Lynn, ARIC, 19 Waskerley Close, Sunniside, Newcastle upon Tyne NE16 5XX

Co-ordinating Officer for Technical Education: J. Bravey, ARIC, 37 Ingram Avenue, Chapel Park, Newcastle upon Tyne NE5 1TG

Committee:

S. Farthing, 19 Carlton Terrace, Low Fell, Gateshead, Co. Durham

J. Bell, 18 Linden Way, Darras Hall, Ponteland, Northumberland

J. G. Goodrum, "Elgar," Burnpark Road, Houghton le Spring, Co. Durham

H. M. Cadell, c/o International Paints, Stoneygate Lane, Felling, Co. Durham

J. G. N. Smith, c/o Crown Decorative Products Ltd., Hadrian Paints, Haltwhistle, Northumberland

F. B. Richardson, Derwent Hill Cottage, East Lane, Ebchester, Consett, Co. Durham

Scottish

Chairman: A. McLean, BSc, ARTC, FRIC, FTSC, 46 Lindsay Road, East Kilbride, Glasgow

Vice-Chairman and Representative on Council: J. D. W. Davidson, FIPE, "Acton," 31 Highburgh Drive, Burnside, Rutherglen, Glasgow

Hon. Secretary: H. B. Smith, BSc, 38 Kylepoule Crescent, Uddingston, Glasgow

Hon. Treasurer: C. S. MacLean, 41 Victoria Park Drive North Glasgow, W4

Hon. Publications Secretary: G. H. Robertson, BSc, PhD, 19 Corsebar Crescent, Paisley, Renfrewshire

Hon. Research Liaison Officer: T. L. M. Humphrey ATSC, 4 Kelso Avenue, Balgonie, Paisley, Renfrewshire

Hon. Programmes Officer: D. Rowley, 57 Linn Drive, Glasgow S4

Hon. Auditors: J. S. Hutchinson 39 Hazlewood Avenue, Newton Mearns, Renfrewshire and A. S. Fraser, 42 Busby Road, Carmunnock, Glasgow

Hon. Student Section Liaison Officer: A. M. L. Stevenson, 44 Ferguson Avenue, Renfrew

Hon. Education Officer: R. F. Hill, CRIC, ATSC, 32 Rosewood Avenue, Paisley, Renfrewshire

Immediate Past Chairman: E. M. Burns, 104 Woodvale Avenue, Bearsden, Glasgow

Committee:

A. G. Gardiner, c/o Alexander G. Paterson Ltd., 180 Hope Street, Glasgow G2

Mrs A.McA. Gibson, 122 Munro Road, Jordanhill, Glasgow G13 1SE

H. Glen, 4 Lombard Place, Linburn, Erskine, Renfrewshire PA8 6AP

I. R. McCallum, 37 Burnbrae Avenue, Bearsden, Glasgow

R. Morrow, BSc, Tioxide International Ltd., 26 Park Circus, Glasgow G3 6AP

H. A. Munro, BSc, ATSC, Braidfield Road, Cludebank, Dunbartonshire

Eastern Branch

Information not received at time of going to press.

South African

Chairman: D. J. Pienaar, MSc, c/o SABS, Private Box X191 Pretoria

Vice-Chairman: E. Wright, c/o Shell Chemicals SA (Pty) Ltd., PO Box 494, Johannesburg

Hon. Secretary: E. A. Duligal, BSc, ARIC, ARTSC, FICorrT, c/o SABS, Private Bag X191 Pretoria 0001, S. Africa

Hon. Treasurer: G. H. Munro, BSc, 16 Stander Street, Brackenhurst, Alberton

Hon. Publications Secretary: P. A. J. Gate, BSc, ARIC, FTSC, PO Box 11270, Johannesburg

Committee:

I. Lancaster, 18 Cedarberg Road, Noordheuwell, Krugersdorp 1740 Tvl

T. G. Edwards, BSc, Pinecrest Farm, PO Box 334, Halfway House 1685 Tvl

C. E. Simons, c/o Plascon-Evans (Pty) Ltd., PO Box 10, Luipardsvlei, 1743 Tvl

Natal Branch

Chairman: D. J. House, BSc, PO Box 1386, Durban

Hon. Secretary: T. J. de Waal, MSc, ATSC, Private Bag 4, Umbogintwini

Hon. Treasurer: K. M. Englebert, PO Box 3783

Hon. Publications Secretary: L. F. Saunders, BSc, FTSC, PO Box 10 New Germany

Immediate Past Chairman: R. A. Eglington, BSc

Committee:

A. B. Spargo, c/o PO Box 78, New Germany 3600, Natal, South Africa

K. E. Piggott, BSc, FTSC

D. E. A. Williams-Wynne, MSc, PhD, FRIC

Cape Branch

Chairman: R. P. Johannsen, PO Box 42, Epping CP

Hon. Secretary: A. G. Shepherd, Box 6449, Roggebaai, RT 8012

Hon. Treasurer: H. J. Schone, PO Box 65, Strand CP

Hon. Publications Secretary: A. Byrns, Box 2441 CT

Committee:

E. G. Warman, Box 3847, CT

D. F. Smith, Box 15 Observatory CT

H. D. Saunders, 5 Private Road, Somerset West VP

Transvaal Branch

This is administered by the Section Committee acting as the Branch Committee.

Thames Valley

Chairman: J. L. Inshaw, ARIC, ACTC, FTSC, ICI Paints Division, Wexham Road, Slough SL2 5DS

Hon. Secretary: C. L. Hill, LIMF, AMICorrT, 76 Keep Hill Drive, High Wycombe, Bucks HP11 1DT

Hon. Treasurer: W. H. Tatton, ARIC, FIMF, FTSC, 45 Courtlands Avenue, Langley, Slough, Bucks

Tech. Meetings and Publications Secretary: E. H. A. Bishop, LRIC, MICorrT, FTSC, 9 Main Street, Gawcott, Buckingham, Bucks

Representative on Council: M. H. Prigmore, Elmwood, Barnes Corner, Tylers Green, Beaconsfield, Bucks

Programmes Officer: G. V. Hill, BSc, ATSC, 60 Heath Road, Holtspur, Beaconsfield, Bucks

Auditor: A. G. Holt, BSc, BPharm, FTSC, 16 Westfield Road, Maidenhead, Berks

Student Group Secretary: G. Harris, ICI Paints Division, Wexham Road, Slough SL2 5DS

Committee:

H. Bray, CGIA, 5 Beckford Close, Wokingham, Berks

M. D. T. Clark, Paint Research Station, Teddington, Middlesex

T. T. Tye, LRIC, ATSC, 5 Cowslip Road, Widmore End, High Wycombe, Bucks

R. H. Wright, 28 Bradfield Avenue, Buckingham, Bucks

Wellington

Chairman: O. W. Brett, BSc, c/o Ados Chemical Co. Ltd., PO Box 38160, Petone, New Zealand

Hon. Treasurer: G. L. Willis, BSc, c/o Shell Oil (NZ) Ltd., PO Box 2091, Wellington

Hon. Secretary: T. J. O'Flynn, MSc, c/o Dulux New Zealand Ltd., PO Box 30366 Lower Hutt, New Zealand

Hon. Publications Secretary: L. H. Oliver, c/o Mair & Co. Ltd., PO Box 30-037 Lower Hutt, New Zealand

Committee:

B. J. Tuckerman, c/o 2 Wai-iti Cres., Lower Hutt, New Zealand

R. S. Bluck, MSc, ANZIC, ATSC, c/o Mobil Oil (NZ) Ltd., PO Box 2497 Wellington

M. D. Thomson, c/o Polychem (NZ) Ltd., PO Box 9141, Wellington

M. D. Taylor, FTSC, Taubmans International (NZ) Ltd., PO Box 14046 Kilbirnie, Wellington

J. A. Oliver, NZCS, c/o Bostik (NZ) Ltd., PO Box 35093 Naenae, New Zealand

T. W. Slinn, BSc, FTSC, c/o Dulux New Zealand Ltd., PO Box 30-366 Lower Hutt New Zealand

J. McFetridge, BSc, c/o Giant Paints Ltd., PO Box 1772 Wellington

C. Gooch, 132 Plateau Road, TeMarua, Upper Hutt, New Zealand

West Riding

Chairman: R. P. Bartrum, Walmley, Layton Road, Rawdon, Leeds, Yorkshire

Vice-Chairman: M. J. Cochrane, 49 Almsford Drive, Harrogate, Yorkshire HG2 8ED

Hon. Secretary: T. Wood, BSc, ARIC, 10 Smithfield Close, South Grange, Ripon, North Yorkshire

Hon. Treasurer: T. R. Smith, "Beechwood," Burley Road, Menston, Ilkley, Yorkshire

Hon. Publications Secretary: R. A. C. Chappell, ARIC, "Lynwood," Halifax Road, Ripponden, Sowerby Bridge

Representative on Council: M. J. Cochrane, 49 Almsford Drive, Harrogate HG2 8ED, Yorkshire.

Hon. Social Secretary: N. Cochrane, 19 Rutland Road, Harrogate, Yorkshire

Hon. Auditor: K. Hargreaves, BSc, PhD, John Hargreaves & Son (Bradford) Ltd., 1-7 Harris Street, Bradford

Immediate Past Chairman: D. Morris, ATSC, 45 St. Leonards Oval, Harrogate, Yorkshire

Committee:

M. Baker, 20 The Sycamores, Horbury, Wakefield, Yorkshire

T. M. Wright, BSc, ARCS, 6 Amberley Close, Bolton, Lancashire

A. Jalil, Room F3 University Hall, University of Bradford, Bradford, Yorkshire

H. Young, 14 St. John's Crescent, Harrogate, Yorkshire

A. Heywood, Fairsnape, 19 Pinder Close, Waddington, Nr. Clitheroe, Lancashire

A. M. Haward, BSc, 35 Stillwell Drive, Sandal Grange, Wakefield, Lancashire

Co-opted Member: Major G. Bentley, ATSC, 85 Templegate, Leeds, Yorkshire

---

Director & Secretary: R. H. Hamblin, MA, FCIS.
Assistant Editor: C. A. Tayler, BSc.
Priory House, 967 Harrow Road, Wembley, Middlesex HA0 2SF. Tel: 01-908 1086.
Telex: 922670.
Auditors: Coopers & Lybrand, Abacus House, 33 Gutter Lane, London EC2.
Solicitors: Linklaters & Paines, Barrington House, 59-67 Gresham Street, London EC2.
Bankers: National Westminster Bank Ltd., 33 King's Road, Chelsea, London SW3 (Code No. 50-30-14; Account No. 03709957).

Oil & Colour Chemists' Association Australia

As from 1 January 1968 the five Australian Sections formed an independent organisation, Oil and Colour Chemists' Association Australia, having the same aims as, and maintaining a close liaison with, the Association.

J. Oil Col. Chem. Assoc. 1975, 58, 279-285

Transactions and Communications

Some aspects of spray applied water-borne paint binders*

By J. Bijleveld and H. Krak

Koninklijke Shell Plastics Laboratory, Netherlands

Summary

When electro-deposition was being developed as an application technique for water-borne systems, a great number of binders was developed merely to fulfil the specific requirements of that application method. Nowadays, there is increasing interest in aqueous systems for application by techniques other than electro-depostition and the present paper deals, therefore, with three different types of binder in paint systems intended for spray application.

Keywords

Types and classes of coatings and allied products

epoxy coating
spray finish
water base paint

Raw materials; binders (resins, etc)

acrylic resin
alkyd resin
epoxy resin
melamine resin
styrene resin

Quelques aspects des liants pour peintures à base d'eau et destinées à être appliquées par pistolage

Résumé

Lors de la mise au point de la technique d'électro-déposition pour l'application des systèmes, à base d'eau, un nombre important de liants a été perfectionné seulement en vue de répondre aux besoins specifiques de cette méthode d'application. Actuellement, il existe un intérêt croissant à l'égard des systèmes aqueux conçus pour être appliqués par des techniques autres que l'electrodéposition, et par conséquent l'article actuel traite de trois types différents de liants en systèmes de peintures destinées à être appliquées par pistolage.

Einige beim Spritzen wassergetragener Lackbindemittel zu beachtende Gesichtspunkte

Zusammenfassung

Zur Zeit der Entwicklung des Elektrotauchlackierens als Anstrichtechnik für wassergetragene Systeme wurden zahlreiche Bindemittel lediglich entwickelt, um die besonderen Erfordernisse dieser Anwendungsmethode zu erfüllen. Heutzutage besteht ein immer grösser werdendes Interesse daran, wassergetragene Systeme mit Hilfe anderer Methoden als die der Elektrotauchlackierung aufzutragen, und die vorliegende Abhandlung befasst sich deshalb mit drei verschiedenen Arten von Bindemitteln in für das Spritzverfahren bestimmten Anstrichsystemen.

Introduction

The advent of electro-deposition (E/D) as a new application technique for paint systems has caused a boom in the development of water-soluble binders. These binders have been developed mainly with the object of fulfilling the specific requirements for this method of application.

In conventional types of industrial paint applications, water-borne systems did not penetrate the market to any noticeable extent. The main reason for this was the fact that in order to arrive at films free from surface defects, special attention had to be paid to the "flash-off" of the wet films prior to stoving. This lengthened the total application process to an unacceptable level and at the time industry was hardly prepared to adapt the existing spraying or dipping procedure specially for aqueous systems.

This situation is about to change now. Firstly, the non-polluting aspect of aqueous systems becomes a more serious issue and in the second place availability and costs of solvents have caused some concern. It is, therefore, the aqueous binders, originally developed for E/D, which are now being considered for other applications as well.

This paper will deal with three types of binder, basically developed for E/D, which have been investigated in conventional spray applications. The three systems which will be discussed are (i) DX-28, a "Cardura" type of alkyd, (ii) DX-38, a styrene/acrylic-prepolymer modified "Epikote" ester and (iii) DX-40, a "VeoVa 10" based polymer type of binder†.

Preparation of binders

Cardura DX-28

The introduction of binder DX-28 for E/D application took place a few years ago. The success for this type of application however, has been hampered by a limited bath stability in E/D applications.

The binder, a water-soluble alkyd based on "Cardura E", is prepared according to a 2-stage, 1-kettle technique. The overall composition is given in Table 1.

†Cardura, Epikote and VeoVa are trade names of Shell Chemicals Limited.

*Presented at the fifth National Symposium of the South African Section held at Durban on 20 and 21 September 1974.

Table 1

Overall molar composition of DX-28

Composition (moles)	First stage (moles)	Second stage (moles)
Phthalic anhydride (1·00)	Phthalic anhydride (0·74)	Phthalic anhydride (0.26)
Cardura E (0·77)	Cardura E (0·77)	
Pentaerythritol (0·48)	Pentaerythritol (0·48)	
Adipic acid (0·33)	Adipic acid (0·33)	

In the first stage, phthalic anhydride (PA), Cardura E, adipic acid and pentaerythritol are reacted azeotropically at 230°C until an acid value of 4–8g KOH/kg is reached. Heating up to 120°C should be done cautiously since an exothermic reaction will start at about this temperature.

The second stage ingredient is added when the first-step material has been allowed to cool down to 150°C. This temperature is further maintained for two hours after all PA has been added.

The binder is thus made water-soluble by the addition of PA to the residual OH-groups to form phthalic acid half-esters. The PA is added in such a concentration as to give a final acid value of 35g KOH/kg on complete half-ester formation.

Finally, the binder is diluted at 100°C with ethylene glycol mono butyl ether to give an 80 per cent solids solution.

Epikote DX-38

Epikote DX-38 is another member of the series of water-soluble esters originally designed for application by E/D only.

In common with a number of other types of binder, DX-38 takes advantage of the well-known maleinisation technique of introducing hydrophilic centres into esters in order to impart water solubility and good hydrolytic stability.

DX-38 is prepared, in principle, by first reacting Epikote DX-20 with a methacrylic acid/styrene copolymer, followed by esterification with linseed oil fatty acids and subsequently reaction with maleic anhydride (MA). DX-38 thus represents a styrenated type of binder. For the incorporation of styrene, use is made of a special copolymer of styrene with a suitable monomeric acid (for example, methacrylic acid). Such a styrenation method offers a number of advantages over the more classical way of post-styrenation or the use of pre-styrenated fatty acids:

(a) the relatively complicated reaction with styrene is replaced by an easy-to-control esterification reaction.

(b) the conversion of the styrene/methacrylic acid polymerisation is better than that of the ester/styrene polymerisation; the molecular weight distribution, in addition, can be well controlled.

(c) styrenation via acidic polystyrene scarcely restricts or influences further reactions via double bonds.

(d) this method permits a much wider choice of fatty acids —even saturated acids can be used.

Before the styrene pre-polymer could be used, a series of experiments had to be carried out to develop sufficient "know-how" on the polymerisation variables in relation to the molecular weight characteristics of the resulting polymer.

Among the variables studied were temperature, addition and digestion time, acid concentration, type and concentration of the initiator, chain transfer agent and type of solvent. From this work a polymer was selected which showed a relatively narrow molecular weight distribution and a fairly low average molecular weight. Its composition is given in Table 2.

Table 2

Overall composition of the styrene/methacrylic acid pre-polymer

Composition	Weight per cent
Xylene	40.5
Styrene	55.1
Methacrylic acid	1.8
Azo-*iso*butyronitrile	1.3
Dodecane thiol	1.3

For the preparation of this pre-polymer, xylene is heated under nitrogen until reflux at about 130°C. Whilst reflux is maintained, a mixture of both monomers, initiator and chain transfer agent is drip-fed over a four-hour period into the stirred solution.

Finally the whole solution is heated for a further four hours at 140°C to obtain a conversion of 95 to 100 per cent. The characteristics of such a polymer are given in Table 3.

Table 3

Main properties of a styrene/methacrylic acid pre-polymer

Solvent	xylene
Solids, weight %	55–57
Viscosity at 23°C, N s m^2)	0.9–1.1
M_w	11 200
M_n	5 490
Q value (M_w/M_n	2.04
Acid value (solids), g KOH/kg	20–21

It should be realised that the introduction of acidic polystyrene theoretically could offer great difficulties from a functionality point of view. Such polymers are (at the most ideal composition) composed of a series of homologues, and consequently polyfunctional molecules are always present. This is demonstrated in Fig. 1.

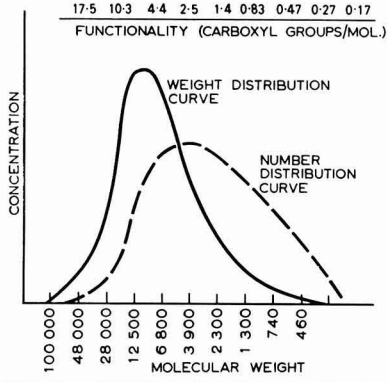


Fig. 1. Molecular weight distribution and functionality of a styrene/methacrylic acid copolymer

In Fig. 1 the molecular carboxylic group functionality of the selected pre-polymer is plotted against the molecular weight of the various species.

Practical trials, however, have shown that the carboxyl groups are not highly reactive in OH-esterification, hence these polymers are reacted in a first stage with the epoxide groups at moderate reaction temperatures. The binder, modified with such a pre-polymer, has an overall composition given in Table 4.

Table 4

Overall composition of Epikote DX-38

Epikote DX-20, equivalents	1.00
Linseed oil fatty acids, equivalents	1.081
Styrene/methacrylic acid copolymer, equivalents	0.035 (17% wt)
Maleic anhydride	for theoretical acid value = 80g KOH/kg
BDMA 0.25% on DX-20	
DX-256 1.0% on DX-20	
Monsanto P 1344 (1% solution in xylene) 0.1% on DX-20	

The actual preparation of DX-38, therefore, (excluding the preparation of the pre-polymer) is a three-stage process.

In the first stage, the Epikote DX-20 together with the pre-polymer solution are heated under nitrogen to a reflux temperature of 150-155°C, whilst benzyl dimethylamine (BDMA) is used to promote the epoxide-carboxylic group reaction. The temperature of 150-155°C is maintained for some 40 minutes. The acid value is then less than 0.5g KOH/kg.

In the second step, after the linseed oil fatty acids and DX-256 have been added, the temperature is raised to 240-245°C and the reaction water and xylene are distilled off—for which an increased nitrogen purge is needed. The reaction is allowed to proceed until the acid value has fallen below 14g KOH/kg.

After cooling the second-stage material down to 180-185°C, the required MA to achieve a theoretical acid value of 80g KOH/kg is added. The reaction is continued at 190-200°C for about one hour to give a viscosity of 35-60 N s m^{-2} (falling ball at 50°C). Subsequently the binder is cooled down to 100°C, at which temperature ethylene glycol mono butyl ether is added in order to obtain a 72.7 per cent solids solution.

VeoVa DX-40

When the technical requirements of polymers for use in E/D finishes were considered, it was found essential to use a system composed of at least three monomers, each contributing an essential property to the resulting polymer.

In order to obtain adequate water solubility, the polymer when neutralised should have a sufficient number of carboxylic groups attached to its chain. Experience has shown that the concentration should be such that the final acid value of the product is about 0.8-0.9 equivalents per kg. The polymer should also have the inherent capacity to be cross linked by stoving, in order to give the paint system good mechanical and chemical properties. As far as curing is concerned, a polymer consisting entirely of a carboxylic acid monomer and a functional monomer could theoretically be designed. In practice, however, for economic reasons, cheaper monomers have to be used as well. Such monomers should not upset the desired balance of flexibility and hardness. In the literature, it was indicated that curing of products containing carboxylic groups with special amino resins was feasible.

In the authors' tests with a VeoVa 10/vinyl acetate/acrylic acid terpolymer in conjunction with such amino resins, however, no proper cure was obtained under a variety of conditions; hence it was concluded that the presence of OH-groups was still indispensable for an adequate cure.

It was found necessary, therefore, to use four different types of monomer to produce a suitable polymer. In Table 5, a series of essential types of monomer is presented.

Table 5

Essential monomers for the preparation of a water-soluble polymer DX-40

–C00H	monomers	Acrylic acid, methacrylic acid
–0H	monomers	Hydroxy-ethyl-methacrylate (HEMA)
"hard"	monomers	Styrene, methyl-methacrylate
"soft"	monomers	VeoVa 10, acrylic esters, such as butylacrylate

A great number of exploratory experiments was carried out using VeoVa 10, acrylic acid, hydroxy ethyl methacrylate (HEMA), methyl methacrylate and styrene. Although the relative rate constants for radical initiated polymerisation of this set of monomers differ appreciably, polymeric solutions containing all these monomers were clear in appearance and stable. Two formulations prepared without styrene, however, showed rapid phase separation, probably caused by the polymer's inhomogeneity being too great.

The effect of the following variables was studied as well:

(a) type and concentration of the monomers in the initial reactor charge and of the monomers to be added.

(b) addition period or addition sequence of various monomers

(c) temperature

(d) type of solvents and initiators

(e) post-reaction conditions.

For an adequate cure, ten per cent HEMA, corresponding to 0.8 (–OH) equivalents per kg, is sufficient, whilst styrene monomer concentrations around 15 per cent offer no serious polymerisation problems. A final acidity of 0.9 equivalents per kg is a satisfactory compromise between good stability of the colloidal solution and good E/D characteristics, which means that the quantities of acrylic acid should be within the range four to seven per cent.

Variations in procedure were also relevant to the properties and of the resulting resin; pre-charging the reactor with all of the vinyl ester was always found to give good conversions. Certain solvents had a pronounced effect on the co-polymerisation. For example benzyl alcohol strongly affected polymerisation, causing the rate of vinyl conversion to be retarded appreciably. The summation of all these tests produced the polymer formulation given in Table 6.

The route for preparation of the polymer is schematically presented in Table 7.

Table 6
Overall composition of VeoVa DX-40

		Percentage
"VeoVa" 10		35
Acrylic acid	4.62	
Hydroxy ethyl methacrylate	7.21	23.8
Methyl methacrylate	11.97	
Styrene		11.2
Ethylene glycol monobuyl ether		30

The paint was spray applied at a solids content of 35 per cent on to bonderised steel panels (Bonder 97) and degreased, cold-rolled steel panels. The films were allowed to flash dry for 30 minutes at elevated temperature (approximately 40°C) before stoving at 150°C for 30 minutes. The mechanical properties of this system are given in Table 9, and the tests for chemical resistance are given in Table 10.

Epikote DX-38

For pigmentation, the authors used standard E/D pigments, such as the so-called "active" green and red, and "inactive"-red blends. The pigment compositions are given in Table 11.

Table 7
Reaction procedure for DX-40

	VeoVa 10	Acrylic monomers	Styrene	Solvent	t-BPB*
Initial charge	35	—	6.72	12	—
0–5 hrs. addition		23.8	4.48	18	0.875
$5\frac{1}{4}$–$5\frac{3}{4}$ final addition					0.117
$5\frac{3}{4}$–$6\frac{1}{4}$ final addition					0.117
$6\frac{1}{4}$–$6\frac{3}{4}$ final addition					0.117
	35	23.8	11.2		1.226
		70		30	

*Tertiary butyl benzoyl peroxide

The addition of the monomer/solvent/catalyst mixture is started at room temperature. Heating is begun simultaneously and it should take about 15 minutes for the temperature to increase from 23 to 80°C. Subsequently the heating is controlled in such a way as to raise the temperature to 140°C within one hour. This temperature is maintained throughout the whole procedure.

Solutions of ten per cent solids, although sometimes "milky" in appearance, showed very good stability. These solutions showed no change in physical and chemical properties after storage for one month at 40°C.

Preparation and performance of paints

Cardura DX-28

The pigment was dispersed in an aqueous binder DX-28 hexamethoxymethylmelamine (HMMM) solution for 24 hours by ball milling. The binder solution was prepared by complete neutralisation of Cardura DX-28 with dimethylamino-ethanol (DMEA) and subsequently thinned down with demineralised water to the desired solids content. A summary of the preparation and formulation details is given in Table 8.

Table 8
Preparation and formulation details of a DX-28 based aqueous paint

Paint preparation	
Binder DX-28	150
DMEA	6.7
Demineralised water	409
Cibamin M 100 (HMMM)	51.4
Pigment (Kronos RN-56)	96
Formulation details	
Pigment: binder ratio	0.56:1.0
Binder: MF ratio	70:30
Solids content in ball mill	37.5%

Table 9
Mechanical properties of an aqueous DX-28 based paint

Film appearance	good
Film thickness, μm	30-35
45°/45° gloss, %	95
Conical bend	no failure
Ford impact test (first failure), m/kg	
—direct	4.5
—reverse	4.5
Erichsen slow penetration, mm	>8

Table 10
Chemical properties of an aqueous DX-28 based paint

Resistance to 5% NaOH, 23°C	TLA* after 48hrs
Minutes to total softening in	
—xylene	1.5
—Methyl isobutyl ketone (MIBK)	2.0
—acetone	0.5
Salt spray, 120hrs (ASTM B 177-64) on:	
Bonder 97, polished	U*
tape test, mm	0†
Bonder 97, unpolished side	4D
tape test, mm	3-4
Bare steel	2D
tape test, mm	11-13
Salt spray, 240hrs	
Bonder 97, polished side	8F
tape test	0
Bonder 97, unpolished side	2D
tape test	6-7
Bare steel	1D
tape test	TLA

*U = unaffected; TLA = total loss of adhesion
†Blister ratings according to ASTM D 714-56

Table 11

Pigment compositions

Pigment	Red "inactive"	Red "active"	Green "active"
TiO_2, Kronos RN-59	35.0	31.8	—
TiO_2, Kronos RN-57	—	—	69.0
Kroma Red, RO 3097	60.0	54.6	—
Clay hydrite 10	5.0	4.5	9.8
Oncor M-50	—	9.1	—
Oncor F-31	—	—	9.8
Strontium chromate	—	—	9.8
Carbon black sterlings	—	—	0.5
Ben-a-gel	—	—	1.1

The pigments were dispersed in a 25 per cent aqueous binder solution for 24 hours by ball milling. The aqueous solution was prepared by neutralising the resin/ethylene glycol mono butyl ether solution (72.7 per cent solids) with triethylamine (TEA) and subsequently thinning down with demineralised water to the desired solids content. A 50 per cent degree of neutralisation was found to be sufficient to obtain good water solubility and to facilitate the pigment dispersion. A survey of the preparation and formulation details are given in Table 12.

The primer systems so obtained were applied at a solids content of about 50 per cent on to bonderised steel panels (Bonder 97). Immediately after spraying, without any flash-off period, the panels were stoved for 30 minutes at 180°C. In addition, another series of panels was allowed to flash off for 30 minutes at ambient temperature before stoving at the same schedule.

Table 12

Preparation and formulation details of an aqueous DX-38 based primer

DX-38	
Solids content	72.7% wt in ethylene glycol mono butyl ether
Acid value, theoretical	80g KOH/kg
Primer preparation	
Binder DX-38	69.0g
TEA	3.6g
Demineralised water	137.4g
Pigment	100.0g
Formulation details	
Pigment: binder ratio	2:1
Degree of neutralisation	0.5

For comparison, a conventional solvent-borne primer (a "D-4"/MF system), was prepared in the normal way with the "active" red pigment. The MF resin used was Maprenal NP (Hoechst Casella) at a D-4/MF ratio of 70:30. This system was applied and stoved in a similar manner to that used for the water-soluble system. The mechanical properties are given in Table 13.

The results obtained for chemical resistance are given in Table 14.

Table 13

Mechanical properties of an aqueous DX-38 based primer

	System: DX-38						D-4/MF	
	Pigmentation: green "active"		red "inactive"		red "active"		red "active"	
Flash off, mins	0	30	0	30	0	30	0	30
Film appearance	good	good	good	good	good	good	good	good
Film thickness, μm	27	25	20	25	25	25	30	30
Buchholz hardness	130	130	130	130	130	130	140	140
Conical mandrel	OK	OK	OK	OK	OK	OK	OK	OK
Impact, m/kg								
direct	2.81	3.375	2.25	2.25	3.375	3.94	1.125	1.125
—reverse	>1.125	>1.125	>1.125	>1.125	>1.125	>1.125	>1.125	>1.125
Slow penetration, mm	5	5	4	4	4	4	2	2

Table 14

Chemical properties of an aqueous DX-38 based primer

	System: DX-38						D-4MF	
	Pigmentation: green "active"		red "inactive"		red "active"		red "active"	
Flash off, mins	0	30	0	30	0	30	0	30
Resistance to 5% NaOH, 23°C	poor	poor	poor	poor	poor	poor	good	good
Mins to soften in								
—xylene	2.5	2.5	3	3	2	2	>5	>5
—MIBK	2.5	3	2	3	2	3	>5	>5
—Acetone	1	1	1	1	1	1	2.5	3
240hrs salt-spray;								
Bonder 97	U†	U	U	U	U	U	U	U
Tape test, mm	0	0	0	0	0	0	0	0
Bare steel	8MD	6MD	2D	2MD	3MD	2D	3MD	3MD
Tape test, mm	1-2	1-2	TLA	TLA	TLA	TLA	6-8	6-7

†ASTM B 117-64, U = unaffected, TLA = total loss of adhesion

VeoVa DX-40

The titanium dioxide ("Kronos RN-56") was dispersed in a 25 per cent binder solution by ball milling. The binder solution was prepared by blending 100 parts of a neutralised DX-40 polymer solution (70 per cent in ethylene glycol monobutyl ether) with 30 parts of curing resin "Cymel XM-1116". The remaining details of manufacture are detailed in Table 15.

Table 15

Preparation details of an aqueous DX-40 based paint

Pigment paste (24hrs ball mill):	Parts by weight
Kronos RN-56	25.7
25% binder solution in water	27.4
0,05% Tegopren (on total binder in paint)	
4-hours ball mill	
Binder mixture	23.4
Let-down	
Binder mixture	23.5

First trials with the paints further diluted to a normal spraying viscosity of say, 20 seconds (Ford-cup No. 4), resulted in paint films which suffered from an irregular flow pattern and bubbling defects.

The next trials were made with paints diluted with demineralised water to a solids content of about 30 per cent by weight. Because of consequently higher viscosity, the paint was then sprayed with a gun having a nozzle of 3.5 mm diameter, and with a slightly increased air pressure. The films obtained in this way showed a very good appearance, after a 40 minutes flash-off period and stoving at 175°C for 30 minutes; however, a slight tendency to pin-holing could be observed, although it was found that this could be remedied completely by adding a special flow control additive (Tegopren) at a 0.05 per cent concentration on total binder content in the paint. This material had to be added to the first ball-mill charge.

A third possibility for spraying the more viscous paint was to pre-heat both paint and spray-gun (with a nozzle of 1.8 mm diameter) to about 60°C. After a flash-off period of 15 minutes at ambient temperature followed by a further flash-off period of 15 minutes at 60°C, the films were stoved at 175°C for 30 minutes; they showed an excellent improvement as far as flow was concerned.

The films applied at a solids content of 30 per cent, containing Tegopren and sprayed with a gun having a nozzle of 2.5 mm diameter, were tested for mechanical and chemical properties, and the results are given in Tables 16 and 17.

Table 16

Mechanical properties of an aqueous DX-40 based paint

Pigment: binder ratio	6:10
Polymer: MF ratio	70:30
Film thickness, μm	35
45°/45° gloss, %	>100
Conical mandrel	no failure
Buchholz hardness	100
Ford impact, direct, first failure at m/kg	1.125
Erichsen slow penetration, mm	6

Table 17

Chemical properties of an aqueous DX-40 based paint

Pigment: binder ratio	6:10
Polymer: MF ratio	70:30
*240 hrs salt-spray, mm rust-creep ..	2
Immersion at 23°C:	
5% caustic soda: 2 days	U
7 days	very slight blistering

*Bonder 97, polished side

Conclusions

From the results given above, it will be clear that the Cardura DX-28 systems show excellent mechanical properties together with relatively good corrosion resistance. Epikote DX-38, certainly with the green "active" pigmentation, combines a good balance of mechanical properties with an excellent level of corrosion resistance, which is also noticeable for the VeoVa DX-40 system; in the latter case it is more remarkable, as here it concerns a more simple pigmentation system which does not include special corrosion inhibiting pigments. In addition, the mechanical properties of the DX-40 system are good.

As a whole, the above systems show a number of quite attractive features. Epikote DX-38 should be considered more specifically for primer end-use. The Cardura DX-28 and VeoVa DX-40 based systems are more suitable candidates for top-finish applications as here, by virtue of the incorporation of Cardura E and VeoVa 10, a good resistance to ultraviolet light and outdoor durability may be expected too.

In order to arrive at an attractive film appearance, DX-28 and DX-40 still require some attention especially with respect to "flash off". The excellent results obtained with the DX-38 based primer system without "flash-off", however, make this system look promising indeed, and further improvements to the present systems for finishing coats may also see the successful penetration of water-soluble binders into the market for coatings for non-E/D types of industrial application.

[*Received 25 November 1974*

Discussion

MR K. G. TURNER asked whether there were any weatherometer results for DX-28 and DX-40.

MR H. KRAK said that these two products were fairly recent developments. They were undergoing tests in Florida and initial results indicated that they behaved as expected, showing generally no significant reduction in gloss during the first one to two years. The period of the test, however, was at present too short to give a definitive answer.

MR K. R. MCDONALD asked what sort of resin was being used when replacing the coupling solvent with a melamime resin.

MR KRAK replied that this was hexamethoxymethylmelamine (HMMM).

MR SREEVES commented that in his experience, using partially methylated resins in combination with water-soluble epoxies and water-soluble alkyds resulted in very unstable resins. He had been assured by certain people in the paint industry that this was not the case, but nevertheless he had been able to obtain satisfactory stability only using HMMM.

MR KRAK said they had so far kept paints for two months at 40°C and at spray viscosity and there were no signs of instability.

MR K. E. PIGGOTT reminded those present that it was accepted that an ester-type linkage would break down in the presence of water and an amine, and he asked the speaker to give some idea of the suitability of the three types of system which had been mentioned.

MR KRAK agreed with Mr Piggott's first point; this was indeed the reason why he had investigated stability. A lot of information had been collected in the past on electro-deposition binders and particularly the bath stability at low solids content. There would normally be about 10 per cent binder in the final bath and this would, of course, be very worrying if large tanks were being used as, for example, in the automotive industry and the plant were shut down for any length of time.

J. Oil Col. Chem. Assoc. 1975, 58, 286-297

Rust-inhibiting chlorinated rubber paints based on active pigments, which are claimed to be non-toxic and non-polluting

By R. Lapasin, V. Longo and G. Torriano

Institute of Applied Chemistry, University of Trieste, Via A. Valerio, 34127 Trieste, Italy

Summary

The possibility is investigated of formulating rust-inhibiting chlorinated rubber paints, with low or zero toxicity and polluting action, by the use of new active pigments. Zinc phosphate, chromium phosphate, zinc and calcium molybdates and various organic pigments are taken into consideration. The evaluation of those formulations studied has been carried out by means of mechanical, chemical and cathodic tests. The results are compared with those for rust-inhibiting chlorinated rubber paints pigmented with red lead, zinc and strontium chromates, whose characteristics are well known. It is found that some of the new pigments are quite suitable for use in rust-inhibiting chlorinated rubber paints because the protective properties obtainable are competitive with those of the best anticorrosive primers based on the most effective traditional pigments.

Keywords

Types and classes of coatings and allied products

corrosion inhibiting coating
rust-inhibiting coating

Raw materials; binders (resins, etc)

chlorinated rubber

prime pigments and dyes

non-toxic pigment

chemically active pigments

calcium molybdate
calcium phosphate
red lead
strontium chromate
zinc chromate
zinc molybdate
zinc phosphate

Equipment primarily associated with analysis, measurement or testing

salt fog chamber

Processes and methods primarily associated with service or utility

electrolytic corrosion

Properties, characteristics and conditions primarily associated with dried or cured films

elasticity
scratch resistance
weather resistance

Les peintures anti rouille à caoutchouc chloré, basées sur des pigments réactifs, censées non toxiques et non polluantes

Résumé

On étudie la possibilité de formuler des peintures anti rouille à caoutchouc chloré n'ayant faible ou aucune action et toxique et polluante, à l'aide de nouveaux pigments réactifs. On donne une appréciation des phosphates de zinc et de chrome, des molybdates de zinc et de calcium, ainsi que de divers pigments organiques. L'évaluation des peintures qui font l'objet de cette étude a été effectuée au moyen des essais, mécaniques, chimiques et cathodiques. On fait une comparaison des résultats obtenus auprès de ceux rendus par les peintures anti rouille à caoutchouc chloré pigmentées au minium, aux chromates de zinc et de strontium dont les caractéristiques sont bien connues. On a trouvè que certains de ces nouveaux pigments sont aptes à être utilisés en peintures anti rouille à caoutchouc chloré puisque les caractéristiques protectrices sont compétitives à celles des meilleurs primaires anti corrosion à base des pigments traditionnels les plus efficaces.

Rostverhütende, aktive Pigmente enthaltende, angeblich ungiftige und nicht umweltverscmutzende Chlorkautschuklacke

Zusammenfassung

Eine Untersuchung der Möglichkeiten rostschützende Chlorkautschuklacke zu verarbeiten, welche dank der Verwendung neuer aktiver Pigmente fast oder gänzlich ungiftig sind und die Umwelt kaum oder garnicht verunreinigen. Zinkphosphat, Chromphosphat, Zink-und Kalzium-molybdat sowie verschiedene organische Pigmente werden in Betracht gezogen. Die Beurteilung dieser Versuchsvorschriften erfolgte mit Hilfe mechanischer, chemischer und kathodischer Prüfmethoden. Die Ergebnisse werden mit denen für rostverhindernde, mit Bleimennige, Zink- und Strontiumchromaten pigmentierten Chlorkautschuklacken, deren charakterischen Eigenschaften wohlbekannt sind, verglichen. Dabei wurde festgestellt, dass sich einige der neuen Pigmente für die Verwendung in rostschützenden Chlorkautschuklacken eignen, weil die erhältlichen schützenden Eigenschaften denen der besten antikorrosiven Primer, die auf den wirkungsvollsten, traditionellen Pigmenten basieren, gleichkommen.

Introduction

At present, chlorinated rubber paints are widely employed for the protection of iron and steel in the industrial, marine, building and road sectors on account of their excellent chemical, physical and mechanical properties.

Chlorinated rubber was one of the first synthetic polymers to be employed in the manufacture of paints; its use on an industrial scale dates back to around 1930. Recently, chlorinated rubber has been employed as a binder in high build protective coatings; hence, the possibility of its being employed in the formulation of anticorrosive coatings has greatly increased.

Protective chlorinated rubber paints can be divided into two main classes: 1. "Barrier" type coatings, containing inert pigments and extenders, for applications where a high chemical resistance is required. 2. Rust-inhibiting coatings, formulated with active pigments, for applications on the following surfaces: (a) where weathering is severe; (b) in conditions of high humidity or for immersion in sea and fresh water; (c) in industrial and marine environment.

The presence of active pigments leads to problems of toxicity and pollution, owing to the nature of the pigments. Recently, new active pigments have been proposed for rust-inhibiting purposes, which are claimed to have low or zero toxicity and polluting action: mention is made of zinc phosphate, chromium phosphate, zinc and calcium molybdates, and zinc-containing organic compounds; these pigments are suitable for formulating coatings which are not injurious to health during their manufacture and application, particularly in spraying operations, and they allow non-toxic films to be obtained.

This paper reports the results of an investigation carried out on the possibility of formulating high quality rust-inhibiting chlorinated rubber paints of low or zero toxicity, by employing the above mentioned active pigments.

The investigation is carried out by evaluating the protective power obtained for coatings with the new pigments studied, compared with the performance shown by a series of traditional active pigments of known rust-inhibiting properties.

Rust-inhibiting pigments

Refs. 1-4

A rust-inhibiting pigment is selected[1] on the basis of:

(a) its electrochemical properties;

(b) the prospect of its developing a chemical reaction (for example, soap formation) and consequently neutralising aggressive acid substances;

(c) its influence on the mechanical properties of the film, such as flexibility, adhesion, mar resistance, etc;

(d) its physiological properties.

Active rust-inhibiting pigments can be classified according to various criteria. Mayne[2] divides them into basic, soluble, and metallic; Nylén and Sunderland[3] divide them into anticorrosive pigments based upon tetravalent lead, chromate pigments, and metallic pigments.

The six classes proposed by Ruf[1,4] are given below:

1. Pigments acting in anodic and cathodic areas, practically insoluble, to be used at high concentration, such as red lead.
2. Pigments acting in anodic and cathodic areas, which supply passivating ions, for example chromates.
3. Pigments with a particular chemical action, which are able to give rise to complexes, such as phosphates and molybdates.
4. Basic pigments, with a high concentration of OH^- ions, for example, calcium plumbate.
5. Metallic dusts and flakes which are below Fe/Fe^{++} on the electrochemical scale (more negative) and offer primary cathodic protection, for example, zinc dust.
6. Organic substances with inhibiting groups, for example, organic chromates and basic nitrogen compounds (nitro-derivatives).

The above classification explains the nature and the protective mechanism of both the new pigments investigated and the traditional pigments used as criteria.

Experimental

New pigments

The following pigments were considered:

1. Zinc phosphate. Four commercial types were examined; they are designated zinc phosphate A, B, C, D.
2. Zinc and calcium molybdates, which are designated molybdates E, F, G.
3. Organic nitrogen compounds containing only zinc or zinc together with traces of lead, designated pigments S1, S2.

For the evaluation of the rust-inhibiting power of the above pigments, the following with known protective properties were chosen as reference materials: red lead (ASTM D 83-41), lead silicochromate, zinc chromate (TTP 465-I Pigment, Zinc Yellow (zinc chromate), dry), zinc tetroxy-chromate (BS 389-1963-III) and strontium chromate (ASTM D 1649-59-T). Chromium phosphate was also examined, since it is claimed to be physiologically acceptable because it contains trivalent chromium.

Formulation criteria

Refs. 5-14

Pigment

The criteria reported below were considered. Composition is on a volumetric basis.

Zinc phosphate paints. A high concentration of this active pigment is needed[5-8] in the final pigment mix. Accordingly, for a comparison of the four commercially available types A, B, C and D, paints 1, 2, 3 and 4 were formulated with a high zinc phosphate concentration (about 80 per cent) in the pigment. The effect of lowering the percentage of zinc phosphate in the pigment by substitution with zinc oxide was examined in paint 5, and the possibility of a synergistic action with molybdate F was studied with paint 6. In the literature[7], it is claimed that very good results can be obtained with the partial substitution of zinc phosphate with red lead; this substitution was not examined on account of the high toxicity of the latter pigment,

Paints based on pigments S1 and S2. Paints 7, 8, 9 and 10 were formulated according to the suggestions of the manufacturer; pigments S1 and S2 were tested at two different concentrations.

Paints based on molybdates E, F, G. Paints 11, 12, 13, 14, 15, 16, 17: for these materials, the formulation of the paint was selected according to the suggestions of the manufacturers of the pigments and according to information given by Robitaille[9]; two different concentrations of active pigments were tested, and for molybdate F, the effect of an addition of zinc oxide was also examined.

Paints containing traditional pigments. (Reference paints 18, 19, 20, 21, 22 and 23.) The pigment composition was according to the experience of the authors and information available in the literature[7,10–13].

The pigmentary compositions are given in Tables 1 and 2.

Table 1

Pigmentary volumetric composition: new pigments

Pigment	Composition (per cent)																
	Paint reference number																
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
Zinc phosphate A	79.6	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Zinc phosphate B	—	79.6	—	—	59.7	39.8	—	—	—	—	—	—	—	—	—	—	—
Zinc phosphate C	—	—	79.6	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Zinc phosphate D	—	—	—	79.6	—	—	—	—	—	—	—	—	—	—	—	—	—
Zinc oxide	—	—	—	—	19.9	—	—	—	—	—	—	—	1.4	—	—	—	—
Molybdate E	—	—	—	—	—	—	—	—	—	—	15.6	—	—	—	30.1	—	—
Molybdate F	—	—	—	—	—	39.8	—	—	—	—	—	15.6	15.6	30.1	—	—	—
Molybdate G	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	30.1	15.6
Pigment S1	—	—	—	—	—	—	3.9	7.9	—	—	—	—	—	—	—	—	—
Pigment S2	—	—	—	—	—	—	—	—	3.4	6.9	—	—	—	—	—	—	—
Titanium dioxide	16.2	16.2	16.2	16.2	16.2	16.2	29.0	29.0	29.0	29.0	29.0	29.0	29.0	22.3	22.3	22.3	22.3
Chromium oxide	1.5	1.5	1.5	1.5	1.5	1.5	—	—	—	—	—	—	—	—	—	—	—
Micronized talc	—	—	—	—	—	—	28.4	28.4	28.4	28.4	29.4	29.4	29.0	22.4	22.4	22.4	29.0
Blanc fix	—	—	—	—	—	—	36.0	32.0	35.5	33.0	23.3	23.3	22.3	22.5	22.5	22.5	30.4
Bentone	2.7	2.7	2.7	2.7	2.7	2.7	2.7	2.7	2.7	2.7	2.7	2.7	2.7	2.7	2.7	2.7	2.7
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0

Table 2

Pigmentary volumetric composition: reference pigments

Pigment	Composition (per cent)					
	Paint reference number					
	18	19	20	21	22	23
Lead silicochromate	39.6	—	—	—	—	—
Lead molybdate 3GL	9.9	—	—	—	—	—
Zinc oxide	—	19.4	10.9	19.4	—	—
Chromium oxide	—	—	5.4	—	2.0	—
Zinc chromate	—	48.5	—	—	—	—
Zinc tetroxichromate	—	—	—	48.5	—	—
Strontium chromate	—	—	—	—	39.6	—
Chromic phosphate	—	—	59.2	—	—	—
Red lead	—	—	—	—	—	87.6
Titanium dioxide	—	—	—	—	7.9	—
Micronized talc	28.9	14.7	—	14.7	28.9	9.7
Blanc fix	18.9	14.7	21.8	14.7	18.9	—
Bentone	2.7	2.7	2.7	2.7	2.7	2.7
Total	100.0	100.0	100.0	100.0	100.0	100.0

Binder

The binder consists of a low-viscosity chlorinated rubber, plasticised with chlorinated paraffins and modified by a 100 per cent phenolic wood oil varnish (spar varnish), containing approximately 35 weight per cent resin.

Volumetric composition

A pigment volume concentraction (PVC) of 35 was selected for all the formulations. The authors considered this to be particularly suitable[5–8, 12, 14].

Selection of the tests

On the basis of the properties of the binder and of the environmental conditions for which the paints were designed, the following tests were carried out:

Mechanical tests

Elasticity. Erichsen cupping test with an Erichsen N.229 apparatus, according to DIN 53156. Cupping tests were carried out one- and six months after film application.

Adhesion test. Cross-scratch test (grid test) according to DIN 53151. Tests were carried out six months after film application; the intermediate degrees 0-1, 1-2, 2-3, 3-4 were used in addition to the DIN 53151 scale 1, 2, 3, 4.

Chemical resistance tests

Accelerated tests. Exposure to: (a) an industrial atmosphere: Kesternich cabinet (DIN 50018, SO_2:0.2 1); (b) a marine atmosphere: salt fog cabinet (ASTM B 117-64); (c) immersion in fresh water.

Exterior exposure. Industrial marine environment (Trieste, industrial area); on-shore plate rack, 100m from the sea.

Cathodic tests

The following procedure was adopted: four-fifths of the length of an iron rod, with a diameter of 25mm and length 150mm, was protected with a 80μm thick layer of the paint to be tested. A 3 × 20mm rectangular area was left bare at a distance of about 40mm from the painted end; the rod was connected, by means of a conductive wire fixed to the unpainted end, to a magnesium rod of equal shape and dimensions. Both were immersed for two-thirds of their length in artificial sea water 40mm apart.

Steel plates of dimensions 100mm × 200mm × 1.5mm were used for the accelerated tests. Two coats of paint, each with a dry film thickness of 30 ± 5μm, were sprayed on the front of the plate; one coat, 30 ± 5μm thick, was sprayed on the reverse side. Film thickness was checked by means of a "Microtest" and samples with a thickness which deviated by more than 15 per cent from the mean value were discarded. The layout for exterior exposure tests is shown in Fig. 1.

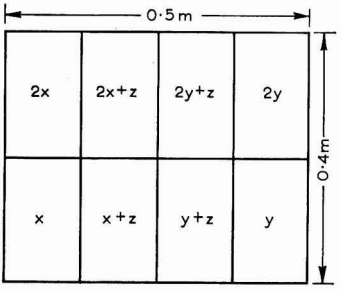


Fig. 1. Layout of panels for exterior exposure

On each plate two different types of paint, x and y, were applied. The symbols x (or 2x) and y (or 2y) indicate the

Table 3

Test results

Paint	Mechanical tests			Exterior exposure tests* (15 months)	
	Cupping tests		Grid tests		
	1 month	6 months	6 months	30μm	60μm
1	69	31	75	9–10	10
2	75	40	75	9–10	10
3	75	45	75	9–10	10
4	69	45	75	9–10	10
5	44	6	62	9–10	10
6	50	9	62	9–10	10
7	44	6	62	9	9–10
8	44	5	62	9	9–10
9	44	6	75	9	10
10	50	10	62	9	10
11	38	1	62	7	9
12	44	6	50	7–8	10
13	50	6	50	9–10	10
14	50	7	62	8	10
15	35	6	50	8–9	10
16	44	15	75	9–10	10
17	44	7	62	9–10	10
18	50	37	88	9–10	10
19	62	7	50	9	10
20	62	25	88	9–10	10
21	44	7	0	8– 9	9–10
22	56	29	75	9–10	10
23	50	5	0	9–10	10

*Evaluation according to ASTM D 610–43

surfaces protected with one (or two) coat(s) of paint x and y, respectively. The terms 2x + z, 2y + z, x + z, y + z indicate that the surfaces on which coat(s) of x or y were applied, were subsequently covered with a further coat of an alkyd gloss finish(z). The edges of the plates were sealed with epoxy resin.

On the films 60μm thick to be tested in the Kesternich chamber, a cross-scratch was drawn by means of a pointed instrument, under standardised conditions.

The exposure tests were commenced after 10 days of conditioning in a well ventilated room at about 20°C and relative humidity of 50 to 60 per cent.

The results of the mechanical tests, as well as the results of the tests of the exterior exposure, are shown in Table 3. As the results of the chemical and cathodic tests would be exceedingly complex in written form, they are quantified for the sake of clarity, and for ease of reading according to the criteria given. Further details appear in the Appendix, and the results are reported in diagramatic form in Figs. 2, 3, 4 and 5.

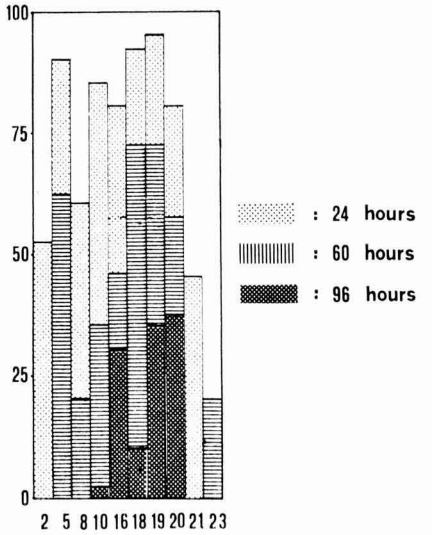


Fig. 2. Results of tests to show extent of cathodic protection

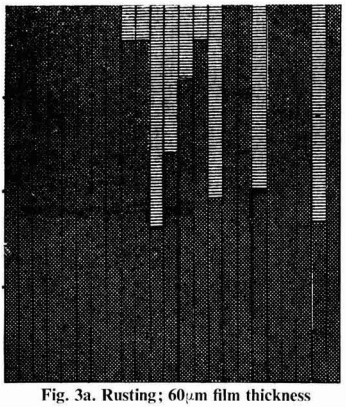


Fig. 3a. Rusting; 60μm film thickness

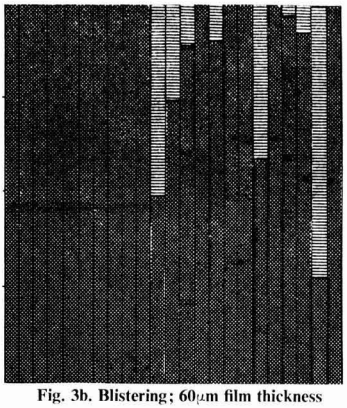


Fig. 3b. Blistering; 60μm film thickness

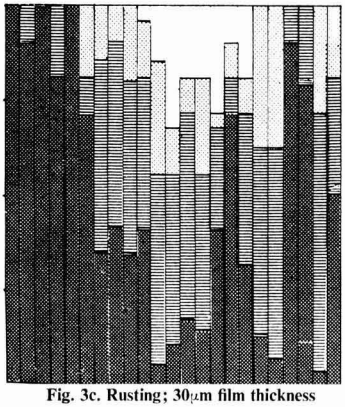


Fig. 3c. Rusting; 30μm film thickness

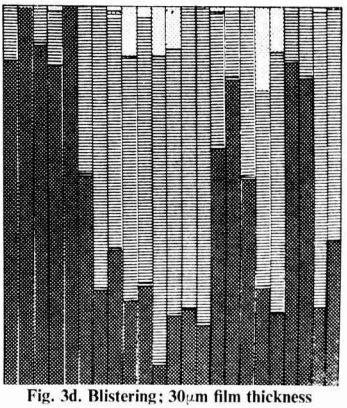


Fig. 3d. Blistering; 30μm film thickness

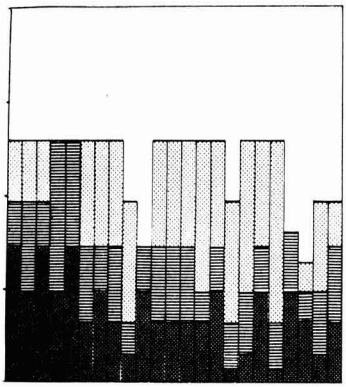


Fig. 3e. Cross-scratch rusting

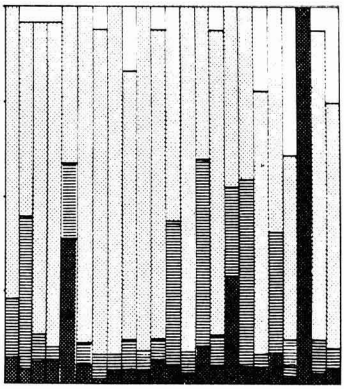


Fig. 3f. Cross-scratch blistering

10 cycles 40 cycles 80 cycles

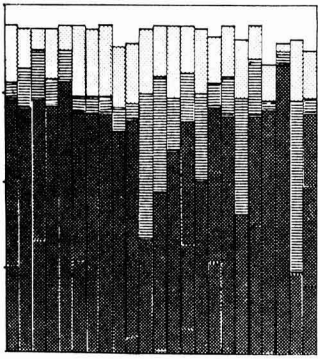


Fig. 3g. Total quantification; 60μm film thickness

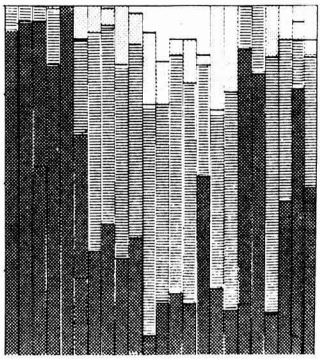


Fig. 3h. Total quantification; 30μm film thickness

10 cycles 40 cycles 80 cycles

Fig. 3. Industrial atmosphere: Kesternich cabinet tests*

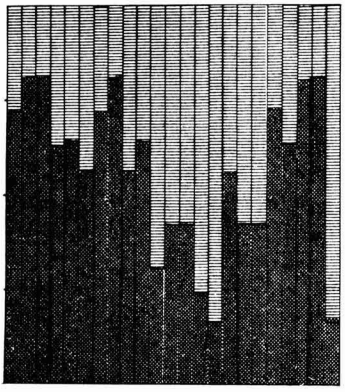


Fig. 4a. Rusting; 60μm film thickness

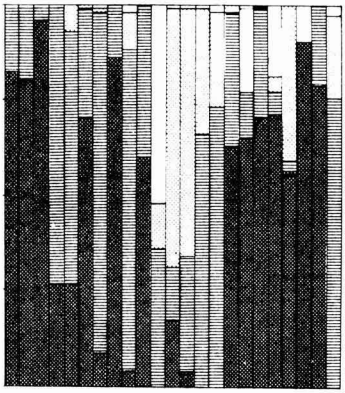


Fig. 4b. Blistering; 60μm film thickness

*In Figs. 3, 4 and 5, the following key applies to every histogram: the 23 columns are the results for each of the 23 test paints designated 1 (extreme left) to 23 (extreme right); the vertical axis represents a quantification of the results on a linear scale from zero (representing the worst condition) at the bottom, to 100 (representing the best condition) at the top. See Appendix for further details.

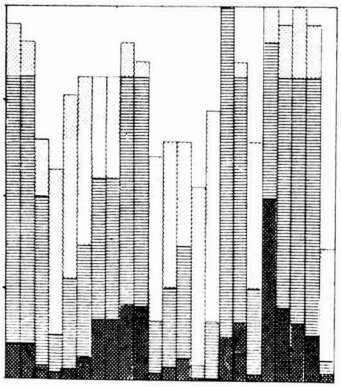


Fig. 4c. Rusting; 30μm film thickness

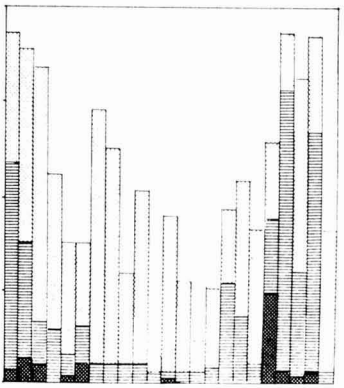


Fig. 4d. Blistering; 30μm film thickness

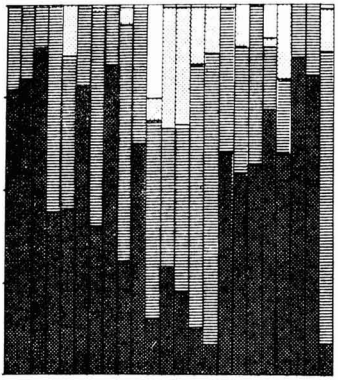


Fig. 4e. Total quantification; 60μm film thickness

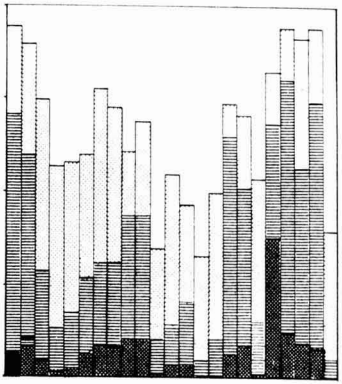


Fig. 4f. Total quantification; 30μm film thickness

Fig. 4. Salt fog exposure tests

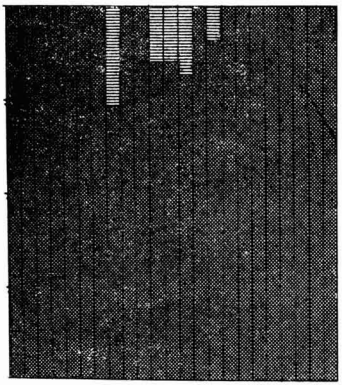


Fig. 5a. Rusting; 60μm film thickness

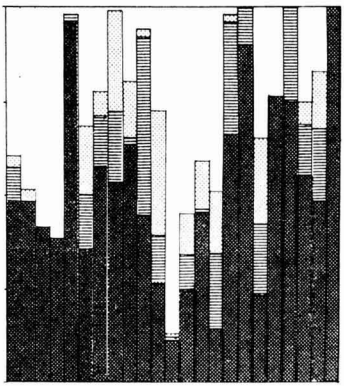


Fig. 5b. Blistering; 60μm film thickness

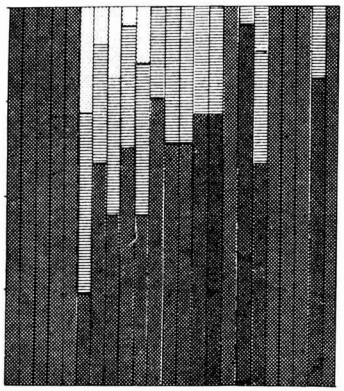


Fig. 5c. Rusting; 30μm film thickness

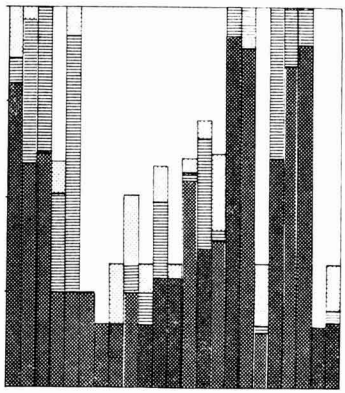


Fig. 5d. Blistering; 30μm film thickness

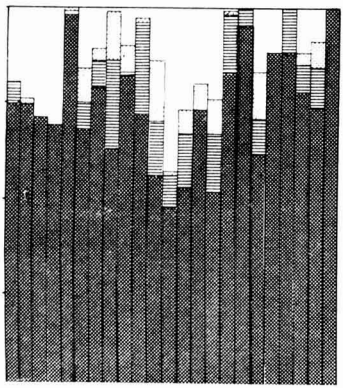


Fig. 5e. Total quantification; 60μm film thickness

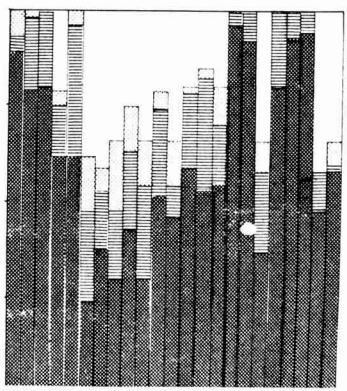


Fig. 5f. Total quantification; 30μm film thickness

30 days 60 days 150 days

Fig. 5. Water immersion tests

Results and discussion

General considerations

Ref. 15

From a general point of view, it is to be noted that there are great differences between the destructive effects of the chemical tests carried out: the effect of salt fog exposure is greater than that of a Kesternich cabinet (1 000 hours of salt fog exposure versus 80 cycles in a Kesternich cabinet), whereas immersion in fresh water shows only slight aggressiveness. The cathodic tests have a very destructive action, which is clearly associated with the chemical nature of the active pigments; in fact, suitably pigmented chlorinated rubber films exhibit a good resistance in these tests[15]. It must be pointed out, however, that the cathodic tests carried out by the authors were very severe; only films of outstanding adhesion to the substrate, high resistance both to pH variations and to the strong mechanical effect of gas evolution could withstand such cathodic action for more than 24 hours without appreciable degradation. Chlorinated rubber films pigmented with inert materials degraded slowly; after 96 hours, 70 to 80 per cent of the pigmented surface exposed was still unaffected; accordingly the resistance figures given by chromium phosphate pigmented paints must be regarded as excellent.

The effect of film thickness is evident; contradictory results, however, are sometimes encountered in the fresh water immersion tests. Whilst the role of the active pigment is clear, there is a sharp difference in the performance of the various pigments in some tests, such as salt fog exposure and cathodic tests. In other cases (Kesternich cabinet), these differences are much less marked, although, as in fresh water immersion tests, all the pigments behave satisfactorily.

Some pigments adversely affect the mechanical properties of the films, so that, for example, problems of embrittlement, particularly on ageing, will have to be tackled and formulation adjustments made.

Elasticity: tests-cupping

The paints examined were formulated at a constant PVC. No corrections were made for the different values for oil absorp-

tion of the various pigments; in fact, the aim of the present investigation was an evaluation of the rust-inhibiting power of a series of rust-inhibiting pigments and, accordingly, the presence of a given volume of active pigment in the film was considered necessary.

A rigorous discussion of cupping tests is, therefore, not possible. The influence of some pigments on film elasticity is so marked, however, that some qualitative considerations can be easily made.

Films of good and long-lasting elasticity can be obtained with zinc phosphate and chromic phosphate. As far as the zinc phosphate paints are concerned, paint 5, in which zinc oxide is also present, shows a certain amount of embrittlement on ageing. Such a deleterious effect has been found by the authors in various paint films when the zinc oxide content exceeds a given critical value, dependent on the system. Zinc phosphate and chromic phosphate give the best results amongst all the new pigments tested, and equal to, or even better than lead silico-chromate.

All the molybdates have a negative effect on film elasticity, especially on ageing. This is very evident in paint 6, where part of zinc phosphate is substituted by molybdate F.

Pigments S1 and S2 also seem to give the film unsatisfactory elastic properties. Nevertheless, the presence of large amounts of extender and inert pigment in formulations 7, 8, 9 and 10 does not allow a more precise evaluation of the two products to be made.

Among the chromate paints, the poor ageing properties of the types containing a considerable amount of zinc oxide is noticed (paints 19 and 21 versus paint 22).

The known bad effect of red lead is confirmed.

Adhesion tests—grid tests

Among the various new pigments examined, the best results were obtained with chromic phosphate which, in these tests, is equivalent to lead silico-chromate, a material known to impart excellent adhesion to chlorinated rubber films.

Zinc phosphate, when used alone, gave results only slightly inferior to chromic phosphate and still afforded good adhesion. In an order of decreasing film quality, the pigments are molybdate G, pigments S1 and S2, molybdates E and F.

The poor behaviour of red lead chlorinated rubber paints, similar to that of many red lead alkyd paints, is confirmed.

Industrial atmosphere—Kesternich cabinet tests

Ref. 1, 4

From an examination of the results, it is found that the new pigments can be grouped into three classes as regards the protective power of their films:

Zinc phosphate and molybdate G make up the class with the highest protective power. Zinc phosphate exhibits a good protective power also in thin films; three of the four pigments tested (types A, B and C) appear identical from the qualitative point of view. The effect of the favourable presence of zinc oxide[1] is pointed out. Thus, paint 5 is far superior to all the other paints formulated with the new pigments and displays a protective power similar to that of the best traditional paint (paint 21). Paint 5 shows its excellent protective power both in continuous film and along the edges of the scratch. Combining zinc phosphate with molybdate F, a lower protective power is obtained; this effect is easily explained by considering that molybdates in an acid environment tend to transform into polymolybdates with poor protective properties[4].

For very thick films, molybdate G has an outstanding protective power, which is even greater than that of the phosphates; nevertheless, it is lower for thin films, where the pronounced effect of pigment concentration is evident. Such behaviour, which is in sharp contrast to that of the other two molybdates, could not be forseen at the outset of the tests, since all the three pigments were received by the authors simply as "zinc and calcium molybdates" without any further information.

Pigments S1 and S2 belong to the second class, with a slightly lower protective power. For these pigments, the effect of film thickness is particularly evident, since they resemble zinc phosphate and red lead at 60μm but at 30μm the protective power is reduced and is found to be similar to that of lead silicochromate. No difference is noted between S1 and S2, in contrast to what occurred in all the other tests. The effect of the pigment concentration in the film is evident at 30μm.

Molybdates E and F constitute the third class, with rather poor protective power; this classification is in agreement with the general tendency to polymerization into compounds of low rust-inhibiting properties, as previously pointed out.

Special behaviour is displayed by chromic phosphate, which affords an excellent protective power where the film is continuous, whereas along a scratch, a deep and penetrating corrosion is encountered.

As far as the comparison with the traditional pigments is concerned, the pigments of the first class behave better than lead silicochromate and are equal to red lead, which are pigments universally known to be the most suitable for service in acid environments. It must be emphasised that both phosphates and molybdates have the great advantage over red lead and lead silicochromate of being lead-free materials.

Attention is drawn to the results given by the chromates, which range from excellent (paint 21) to rather poor (paint 22). A comparative evaluation of the single pigments cannot be made because of the presence of zinc oxide in paints 19 and 21. Zinc oxide is likely to play an important role, as noted in the case of combination with phosphates (paint 5) and molybdate (paint 13).

Salt fog exposure tests

As with the Kesternich cabinet tests, three classes of different protective power for the new pigments can be deduced for these series of tests.

Zinc phosphate with its excellent protective power, is placed in the first class; three commercial types, A, B and C, are found to have the same degree of quality; type D is slightly inferior. Substitution of part of the zinc phosphate with zinc oxide or molybdate F decreases the protective power; in this case, the effect of the presence of zinc oxide impairs the protective power in contrast to what occurs in the Kesternich cabinet tests.

Pigments S1 and S2 can be included in the second class, with a slightly inferior protective power; no difference is detectable

between S1 and S2, whereas the effect of the pigment concentration in the film is great. Some embrittlement of the film is noticed; accordingly, formulations must be modified.

Molybdates E and F display poor protective properties; no effect of pigment concentration and zinc oxide modification is found, as was observed in the Kesternich cabinet tests. Molybdates E and F form the third class of pigments, of mediocre efficiency.

Molybdate G requires a separate detailed discussion. After 1 000 hours the protective power of its films is fair, similar to that of pigments S1 and S2. Considerable degradation of the film is noticed, and the film itself appears very brittle. On the other hand, after 500 hours the protective power is outstanding, and no embrittlement occurs at this stage. This pigment, therefore, requires a modification to be made to the paint composition. The same observation is applicable to chromic phosphate.

So far, for an evaluation of the new pigments compared with the traditional standard pigments, the pigments of the first class (zinc phosphate) can be associated with zinc chromate, the pigments of the second class (S1 and S2) with silicochromate, and the molybdates (E, F) of the third class with red lead. Molybdate G and chromic phosphate can hardly be evaluated since it seems that they have not been correctly employed, but it is probable that they would give excellent results in a suitable formulation (always supposing a suitable composition could be developed). As far as traditional pigments are concerned, it is interesting to note that in chlorinated rubber binders, chromates are far superior to red lead. Within the chromate family, the effect of pigment solubility is marked, as chlorinated rubber is a hydrophobic binder: solubility decreases from zinc tetroxychromate to strontium chromate and to zinc chromate. Zinc chromate displays a higher rust-inhibiting power than zinc tetroxychromate. In this study, however, a strict comparison of the chromates cannot be made because of the different pigmentary composition of the three chromate-containing paints.

Fresh water immersion tests

As has been observed under "general considerations", 150 days' immersion generally causes a less pronounced degradation than with the other tests. At the end of the test, many films were still quite unaffected; this was the case for red lead at high film thickness (paint 23) and for molybdate A, also at high film thickness and in sufficient concentration (paint 17). In addition, the resistance of chromic phosphate is excellent (paint 20).

For these tests too, a division of the new pigments is possible; whereas the test results suggested the same grouping for both salt fog exposure and the Kesternich cabinet, however, in the case of fresh water immersion, the new pigments have been grouped in a slightly different way.

1. The best results are given by molybdate G and chromic phosphate, which closely resemble red lead, the best traditional pigment for service in fresh water. They constitute the first class of pigments, with the highest protective properties.

2. The second class comprises zinc phosphates, and pigments S1 and S2 with a slightly lower protective power than class one; these pigments resemble the traditional chromates. With regard to the different commercial types of zinc phosphates, type D displays (as in all other tests) poorer properties. In general, with zinc phosphate, a diffuse blistering takes place; the presence of zinc oxide enhances the protective power by reducing blistering, whilst molybdate F has the opposite effect. As far as pigments S1 and S2 are concerned, the strange conclusion which must be drawn is that they give better results at lower concentrations in the film.

3. Molybdates E and F are less effective than lead silicochromate and can be placed into a third class of mediocre protective power.

Exterior exposure tests

Exposure tests were commenced on 15 September 1973 on-shore by Trieste harbour about 100m from the sea.

First inspection: 15 March 1974. No degradation could be detected, but it must be noted that the aggressive action exerted during this time period was rather slight because of the shortness of the exposure time, the climate of the region at that time of the year (when low solar radiation is encountered), and a lot of rain, which washed away sea salt and corrosive dusts deposited on the samples from neighbouring industries.

Second inspection: 15 December 1974. Due to the excellent properties of the binder, degradation was generally slight, with non-blistering rusting. Degradation was marked only for molybdate E; it was less intense for molybdate F; for both, an effect of pigment concentration was evident, as well as the beneficial action of zinc oxide. A still less pronounced attack was found with zinc tetroxychromate and pigments S1 and S2; pigment S2, however, gave results clearly superior to S1. All the remaining types were almost unaffected, showing excellent rust-inhibiting and protective power.

Cathodic tests

New pigments: Outstanding results were obtained with chromic phosphate and very good results with molybdate G. All the other pigments reduce to a greater or lesser extent the excellent resistance of chlorinated rubber films; this is due to the reactivity of the pigments and, in this particular test, to their sensitivity to pH variations. This adverse effect is particularly evident with zinc phosphate, molybdates E and F and pigment S1; zinc phosphate can be improved if it is partially substituted by zinc oxide (paint 5 versus paint 2).

Reference pigments: It will be recalled that good results are usually obtained with lead silicochromate and combinations of chromates and zinc oxide. Nevertheless, coatings containing these pigments are much less resistant than paints formulated with inert materials. Red lead and zinc tetroxychromate exhibit a very poor behaviour. The present tests confirm what is stated above. So far, two different classes of pigments are distinguished: lead silicochromate, which gives good results; and red lead, which displays low resistance. The poor resistance of chlorinated rubber films pigmented with red lead and, in general, of red lead pigmented films in the presence of a cathodic protection is well known. In fact, coatings containing red lead have not been employed for the protection of ships' bottoms since cathodic protection started to be applied on a large scale to ships during fitting out and, subsequently, in service.

For the purpose of comparison, only chromic phosphate amongst the new pigments can be assigned to the first class of high resistance. It is superior to the reference pigments and,

moreover, it closely resembles silicates and inert pigments, such as some oxides, which permit the formulation of chlorinated rubber films of very good resistance because of the pigment's low reactivity. Molybdate G occupies an intermediate position with rather good properties; S2 is fair, whereas zinc phosphate can be associated with red lead and zinc tetroxychromate in the second class. Zinc phosphate, however, can be vastly improved if it is modified with zinc oxide.

Conclusion

With the new pigments, claimed to have low or zero toxicity and polluting action, rust-inhibiting chlorinated rubber paints can be formulated with a protective power equal to or even greater than that given by chlorinated rubber paints pigmented with red lead and chromates.

It has been found possible to divide the new pigments into different classes according to protective power, which can be closely correlated with analogous classes for traditional pigments.

As with the traditional pigments, the new ones also exhibit, in some cases, high specific resistance in certain aggressive environments; accordingly, emphasis is placed on the usefulness of formulating an all-purpose primer and also specialised primers for particular environmental conditions.

Zinc phosphate seems to be particularly suitable for general purpose heavy-duty protective coatings. For less severe environmental conditions, if a very low content of heavy metals is required, pigment S2 offers interesting prospects.

Molybdates must be sharply divided into two classes of very different protective power: molybdate G shows outstanding rust-inhibiting properties; however, further work needs to be carried out to perfect the formulation of the paints containing this pigment, in order to improve the mechanical properties of the film.

Finally, attention must be drawn to chromic phosphate, because this pigment can be used for the formulation of films which exhibit excellent resistance to immersion in fresh water, provide cathodic protection and have excellent mechanical properties.

Acknowledgment

The authors are indebted to the Veneziani Zonca Vernici Spa of Trieste for supplying all the materials needed for the present study, and to Mr C. Bernich for the preparation of the primers and the varnished panels.

[*Received 22 January 1975*

References

1. Ruf, J., *Werkstoffe u. Korrosion*, **20**, 1969, 861.
2. Mayne, J. E. O., *Anticorrosion*, **20** (10), 1973, 3.
3. Nylén, P., and Sunderland, E., "Modern Surface Coatings", Interscience Publ., New York, 1965.
4. Ruf, J., *Farbe u. Lack*, **79**, 1973, 22.
5. Clay, H. F., and Cox, J. H., *JOCCA*, **56**, 1973, 13.
6. Pepin, B., Proc. XI FATIPEC Congr., 1972, 171.
7. Rendu, M., *Paint, Oil and Colour J.*, **158**, 1970, 3751.
8. (Anonymous), *Paint Technology*, **34** (7), 1970, 30.
9. Robitaille, D. R., "Protective Coatings Containing Molybdates". Climax Molybdenum Co., Michigan, 1969.
10. Ruf, J., Proc. XI FATIPEC Congr. 1972, 395.
11. (Anonymous), Techn. Bulletin Pierrefitte.
12. Bates, R. P., *JOCCA*, **54**, 1971, 945.
13. Louvigny, A., *Pitture e Vernici*, **48**, 1972, 311.
14. Birkenhead, T. F., *JOCCA*, **52**, 1969, 383.
15. Lapasin, R., Torriano, G., and Volpe, S., *Ind. Vernice, in press.*

Appendix

Key to the quantification of the results

A general criterion of quality is followed; accordingly, 100 is taken as the value for the best conditions (no blistering, no rust, etc) and 0 for the worst. The following is a more detailed account:

Mechanical tests

Cupping test. The quantification is made by dividing the cupping arrow expressed in m $\times 10^{-4}$ by 0.8, since at values of the arrow higher than 0.8-0.9 the plate usually breaks.

Cross-hatch grid test. The quantification of the data obtained according to the modified DIN 53151 scale (see under adhesion tests) is made according to the following criteria:

Modified scale DIN 53151	Quantification
0	100
0–1	88
1	75
1–2	62
2	50
2–3	38
3	25
3–4	12
4	0

Chemical resistance tests

Industrial atmosphere exposure. (Kesternich chamber—DIN 50018, SO_2 0.2 l.) The quantification is made for the results after 10, 40 and 80 cycles. Blisters on either face of the sample tested are quantified according to the following formula:

$$B_f = A \times I \times D + 100\,(1—A)$$

where A is the percentage of area involved in the degradation, I an index of blistering density according to the following scale:

no blister = 10
VF = 9
F = 8
FM = 7
M = 6
MD = 4
D = 2
destroyed = 0

and D is the dimension of the blisters according to ASTM D 714-56. Rusting is quantified by multiplying together the rust values determined on the two plates according to ASTM D 610-43. Blisters around the cross-scratch are quantified according to the following formula:

$$B_s = (n\,(P \times I \times D) + 400n)/4$$

where n is the number of branches of the cross-scratch which are involved in the degradation, I is the index of blistering density reported above, D the dimension of the blisters according to ASTM

D 714-56 and P is an index of blistering penetration into the paint as a result of the cross-scratch, as reported below:

Penetration (mm)	Index P
0	10
1	9
2	8
3	7
4	6
5	5
6	4
7	3
8	2
9	1

The rust at the scratch is evaluated by multiplying together the rusting indices obtained for the two plates; these rusting indices are determined on the basis of an empirical 5-degree scale, as reported below:

no rust	10
dots of rust	8
spots of rust	6
rust	4
diffused rust	2

For a total quantification of the results obtained in the industrial atmosphere resistance tests, the following formulae are employed;

$(B_f + R_f)/2$	for the 30μm film
$(B_f + R_f + (B_s + R_s)/2)/3$	for the 60μm film

where B_f and R_f are the mean blistering and rusting indices relative to the faces of the samples tested, and B_s and R_s the mean blistering and rusting indices relative to the cross-scratch.

Salt fog resistance. (ASTM B 117-64). The quantification is made for the results after 250, 500 and 1 000 hours exposure. Blisters and rust on either face of the sample tested are quantified as described above for exposure to industrial atmosphere. For a total quantification of the results of the salt fog resistance tests, the following formula is employed:

$$(B_f + R_f)/2$$

where B_f and R_f are the mean blistering and rusting indices relative to the faces of the samples tested.

Fresh water immersion. The quantification is made for the results after 30, 60 and 150 days. Blisters and rust on either face of the sample tested are quantified as for the industrial atmosphere exposures. For a total quantification of the results of the fresh water immersion tests, the following formula is employed

$$(B_f + R_f)/2$$

where B_f and R_f are the mean blistering and rusting indices relative to the faces of the samples tested.

Cathodic tests

The quantification is made for the results after 24, 60 and 96 hours. The cathodic resistance index is assumed to be equal to the percentage area which remains entirely unaffected and adherent to the rod.

J. Oil Col. Chem. Assoc. 1975, **58**, 298-302

Economic aspects of protection by paint films against corrosion*

By R. Hermelin

Kronos Export Department, Kronos Titan GmbH, P.O. Box 100 720, Leverkusen, West Germany

Summary

The importance of the economic aspects of protection against corrosion is stressed, and an analysis is made of the various factors which influence economics, such as surface preparation, raw material and application costs, and the period of effective life of the coating.

Some general comparisons are made between various paint systems.

The protection of a bridge over the river Waal in Holland is taken as a practical example, and various "cost factors" are added together to demonstrate the total cost of protection. In order to calculate the annual cost of protection, some assumptions are made concerning the useful life of the paint system, and various alternatives are compared.

Keywords

Types and classes of coatings and allied products

corrosion inhibiting coating

Miscellaneous terms

investment cost
labour cost
operation cost
raw material cost

Properties, characteristics and conditions primarily associated with dried or cured films

durability

Les aspects économiques de l'emploi des peintures pour assurer la protection anti corrosion

Résumé

On souligne les aspects économiques de la protection anti corrosion, et l'on fait une analyse des divers facteurs qui exercent une influence sur les considérations économiques, tels que la préparation de la surface, les prix de revient des matières premières et de l'application, ainsi que la durée de la vie utile du revêtement.

On fait certaines comparaisons de nature générale entre de divers systèmes de peintures. On considère, en tant qu'exemple pratique, la protection d'un pont sur le Waal en Hollande, et l'on fait une totalisation des divers éléments du prix de revient en vue de démontrer le prix de revient global de protection. Afin de calculer le prix de revient annuel de protection, on fait certaines suppositions à l'égard de la vie utile du système de peintures, et l'on fait une comparaison des diverses alternatives eventuelles.

Wirtschaftliche Gesichtspunkte des Rostschutzes durch Anstrichfilme

Zusammenfassung

Die Wichtigkeit wirtschaftlicher Gesichtspunkte beim Rostschutz wird betont, und die verschiedenen, die Wirtschaftlichkeit beeinflussenden Faktoren wie Vorbereitung der Oberfläche, Rohstoff und Verarbeitungskosten, sowie wirksame Lebensdauer des Anstrichs werden analysiert.

Einige Anstrichsysteme werden ganz allgemein verglichen. Als Beispiel wird der Schutz einer Brücke über den Waal Fluss in Holland gewählt. Verschiedene "Kostenfaktoren" werden addiert, um die Gesamtkosten des Schutzes aufzuzeigen. Um die Kosten des Schutzes pro Jahr berechnen zu können, werden einige Annahmen hinsichtlich der brauchbaren Lebensdauer des Anstrichsystems gemacht; auch werden verschiedene Methoden verglichen.

Introduction

Recent months have been a very turbulent period as far as prices are concerned. The prices of base metals, on which anticorrosive pigments are based, have been jumping wildly, breaking all past records. In addition labour has become more costly because of world-wide inflation. Nevertheless, costing and comparisons have to be made, even in an unstable period. In fact, paint producers, designers, engineers and owners of facilities to be protected have been more and more concerned with the cost of protection.

Cost factors

Ref. 1

The main cost factors influencing the total protection cost can be broken down into:

Surface preparation
Material (paint)
Labour (painting)
Durability

It is clear that for a detailed calculation, other cost elements should be considered, like scaffolding, idle time (drying), etc. These have been left out of the considerations since, in general, they represent only a small part of the original investment, and in any case they differ widely from one project to another.

The prices in Germany early in 1974 have been taken as a basis for the cost calculations, but naturally these can be considered only as rough guidelines. According to a study published in Germany at the beginning of 1974[1], the breakdown between the various cost factors for a 25 000m² steel construction (25m² per tonne of steel) was as follows:

	Percentage of total cost		
	1960	1970	1974 (Author's estimate†)
Surface preparation ..	40	45	35
Paints cost*	20	15	30
Labour cost (4-coat system)	40	40	35

*1st and 2nd coat—red lead/linseed oil
3rd and 4th coat—iron oxide
†Based on a more sophisticated paint system

*Presented at the fifth National Symposium of the South African Section held at Durban on 20 and 21 September 1974.

The impact of these various cost factors on the development of practices for protection against corrosion may be analysed.

Surface preparation

This cost factor retains its relatively high proportion of the total cost because of salary rises and increased costs of equipment and material. To reduce this cost factor, the following methods have been applied:

1. Preparation of the steel sheets and profiles by automatic cleaning and spraying booths (shop primer).

2. The use of more durable paint systems (to delay re-painting as long as possible).

3. The trend towards paint systems less sensitive to the degree of surface preparation (re-painting).

Material (paint)

Paint users and paint producers realised in the course of time that it pays to invest more in the paint system itself. Provided this brings a longer life, it is economical. If the share of the paint in the total cost is in the order of 30 per cent, an increase of 50 per cent in its price will mean a general cost increase of $0.3 \times 0.5 = 15$ per cent only. Consequently, if the sophisticated paint system being 50 per cent more expensive can increase life by at least 15 per cent, then the extra cost is justified. This is probably the main reason why in the last decade new and more efficient paint systems, based on better pigments and binders, conquered the market, increasingly replacing the conventional systems. This trend reached a degree of stagnation, owing to the fact that the prices of raw materials rose faster than the labour costs.

Table 1 shows how the various systems compare on a cost basis.

Labour (painting)

The ever increasing cost of labour has induced the industry to find ways to economise on this important cost factor. Where painting has to be done in the open air (top coats, re-painting jobs), the cost of painting is rocketing. One counter-measure has been mentioned already, namely "shop primers". There has also been progress in developing painting techniques (spraying, airless spray, etc.). The object has again been to increase the life of a system, in order to postpone re-painting for as long as possible. One of the most important developments, however, is in the field of the high-build coat. The basic idea is that more can be saved by eliminating a manual job than by improving its technique. Consequently, the paint industry has been supplying for several years greater amounts of high-build coatings. The direct result was that the average number of coats went down. For several reasons (which will be discussed later), there is also a minimum number of coats which are required.

Durability

The increased use of better pigments has already been mentioned. With regard to the structure of the painting system, there are, in fact, three basic methods:

Conventional	Primer (two)	40—50 μm	
	Intermediate coat, Top coat	50—60 μm	
High-build	Primer	above 100 μm	
	Top coat	above 100 μm	
"*Defence-in-depth*" *system*	Primer	40—50 μm	each containing an anticorrosive pigment
	Intermediate coat, Top coat	50—60 μm each	

Table 1

Material cost for high-build primers and those of normal film thickness

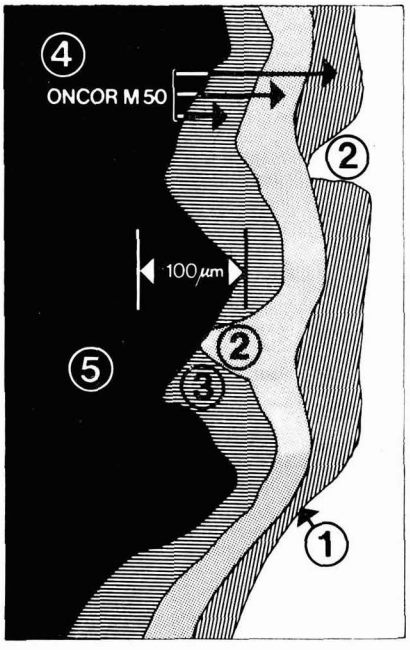
Material	Usual dry film thickness (μm)	Solids volume ($cm^3\ kg^{-1}$)	Theoretical spreading rate ($m^2\ kg^{-1}$)	Less 30 per cent for usual losses	Price in spring 1974 (DM kg^{-1})	Price (DM kg^{-1})
1. Alkyd resin/lead silicochromate ..	80	320	4	3.2	5.00	1.55
2. Zinc powder. Single component	80	185	2.3	1.5	5.10	3.40
3. Zinc powder. Two-component	80	220	2.7	2.0	6.30	3.15
4. Zinc chromate/alkyd resin	80	320	4.0	3.0	4.80	1.60
5. Zinc chromate/chlorinated rubber ..	80	260	3.2	2.4	4.40	1.83
6. Red lead in oil	45	280	6.2*	4.0	3.50	0.88
7. Alkyd resin/red lead	40	240	6.0*	3.9	3.40	0.87
8. Chlorinated rubber/red lead	35	200	5.7*	3.7	3.70	1.00

*Because of the high specific weight, losses due to settlement and residues are comparatively higher than with the other materials. Thirty-five per cent was therefore deducted in these cases.

The first two systems are well known (the high-build system will be discussed further, but first the "defence-in-depth" system will be considered).

In this system, an active anticorrosive pigment is incorporated in all coats including the top coat. Experience has shown that this system provides exceptionally good and long lasting protection against corrosion. The outstanding properties of a "defence-in depth" system are explained by the fact that all irregularities of the metal surface are covered by paint containing active anticorrosive pigment. This means that whatever the roughness of the surface, it is actively protected.

In the "defence-in-depth" system, anticorrosive pigments other than "Oncor M50" (Kronos Titan GmbH), such as red lead and zinc chromate, cannot be included on account of their much higher tinting strengths.



1. Where the paint film is thin over tiny surface projections and sharp structural edges, the rust-inhibitive pigment content in all coats provides extra protection.
2. Inevitable "holidays" in film do not destroy protection. Again, all coats provide both rust inhibition and weather resistance.

Fig. 1. Protection over an irregular substrate from the "defence-in-depth" system

Paints containing "Oncor" pigments can offer a complete solution to the cost problem because:

1. They are not sensitive to surface preparation.
2. They improve considerably the life of a system, which can be shown by means of various examples.
3. They can be easily applied, brushed, rolled, and sprayed, especially airless spraying. Thick coats with various binders can be produced.

A practical example indicates the economics of protection against corrosion.

Practical example

A big bridge in Holland was protected against corrosion by a paint system and this example will be used to demonstrate the cost of protection against corrosion. Reference will be made to the type of surface preparation, the paint and the painting operation.

Details of the bridge are as follows:

Location:	Holland, across the river Waal near Nijmegen
Structure:	Steel mounted on concrete piers
Design:	Rijkswaterstaat
Length:	approximately 1 050m, largest span 270m
Width:	37.5m

Total weight of steel structure: approximately 15 000 tons

Paint supplier: Sikkens Smits, Holland

Paint system: Primer on "Oncor M50" basis, 120μm. Top coat, micaceous iron oxide grey, 170μm. The binder is an epoxy/isocyanate combination. The carriageways will be protected by a bituminous primer having also anticorrosive properties. On top of that, the road bed will be laid.

Total surface to be protected: 305 000m^2 as follows:

Inner surface of hollow parts: 140 000m^2

Outer surface: 70 000m^2

Remainder will be paved and for use by traffic.

Total paint thickness: 290μm

Total paint quantity: 120 tonnes

Application: Primer in workshop, by airless spray. Top coat on the assembled bridge, by airless spray.

Scheduled completion date: April 1976.

Construction of phases

In the workshop the steel sub-sections are corundum blasted to give an Sa-3 finish and then sprayed with the primer leaving the edges free for welding. They are then transported to the big storage yard at the river side. A crane brings the sub-sections to an assembly shed where they are welded together to form sections of 15m length and 37.5m width. In total, there are 70 sections, each weighing 200 tonnes. From the shed, they are transported to the site for assembly on an undercarriage having 112 wheels. Cranes lower the sections, which are then kept in place by means of hydraulic jacks during hand welding using carbon dioxide/argon apparatus.

Economics*

Cost of application—labour

The cost of labour including social charges and fringe benefits

*One Guilder approximately equal to 18.3p

has been calculated at 20 Guilders per hour. The following performances have been estimated:

Sand blasting	4m²/hour	average
Application of primer (indoors)	11m²/hour	inner and
Application of top coat (outdoors)	9.5m²/hour	outer surfaces

This gives the following costs:

Sand blasting	6.50 Guilders/m²
Painting primer	1.80 Guilders/m²
Painting top coat	2.10 Guilders/m²
	10.40 Guilders/m²

The cost for sand blasting includes the preparatory work and the abrasive material.

Material—paint

The following has been estimated:

Primer cost	6 Guilders/kg
Primer yield	2.5m²/kg
Top coat	6 Guilders/kg
Yield top coat	2m/kg

This will give the following costs for the paint:

Primer	2.40 Guilders/m²
Top coat	3.00 Guilders/m²
	5.40 Guilders/m²

Total cost of painting:

Labour	10.40 Guilders/m²
Material (paint)	5.40 Guilders/m²
	15.80 Guilders/m²

Paint cost as a percentage of total costs for protection:

$$5.40/15.80 \times 100 = 34 \text{ per cent}$$

"Oncor" pigmented paint as a percentage of total costs for protection:

$$2.40/15.80 \times 100 = 15 \text{ per cent}$$

For the sake of simplicity, extra costs for preparation and protection of the seams and for any repair work necessary have been disregarded.

Durability

Whereas the cost of the application of the paint can be more or less precisely calculated, this is not the case with durability. In fact, no comparison will be complete if the life of the paint is not taken into account. Cost per square metre can, therefore, serve as criterion only if the various systems provide the same duration of protection, which is very unlikely. Thus, a calculation of the annual cost of protection is possible only if the lapse of time before re-painting is estimated. This can be done, for example, by considering other objects which have been protected with the same pigment system. The quality of surface preparation, the application and the differences in climate will influence the durability of a paint system, however, so that only rough estimates based on past experience can be made.

If the above-mentioned system is assumed to give 15 years' protection to the bridge, which is not too exaggerated according to the author's experience in this field, then the annual cost of protection would be

$$15.80/15 = 1.05 \text{ Guilders/m}^2\text{/year}$$

Since a high-build system is being considered, it is not thought that a further increase of the thickness, or obtaining the same primer thickness by two coats instead of one, would increase the life of the bridge's protective system. These possibilities should be considered when the thickness of the coats is much less. The so-called "defence-in-depth" system, where "Oncor" pigmented paints are extensively used, should be applied for normal coats (30—40μm thick) and for re-painting, where the roughness of the metal surface is much more pronounced than on new steel.

Conclusions

High-build coats give a saving in labour, compared with a normal system where coats are 40 to 50μm thick.

A "defence-in-depth" system is recommended when the coat thickness is normal (40—50μm), or where the surface roughness is over 60—70μm (re-painting).

Beyond a certain limit, a further increase of the thickness does not bring longer life.

A good anticorrosive pigment, even if more expensive, is still economic. This because it increases the life without increasing excessively the cost of the protection, of which the paint cost represents only one-third.

A good pigment with the right system ensures a long life for the structure to be protected, and offers an optimal economical solution.

[*Received 25 November 1974*

Reference

1. Winkler, H., "Dickschichtanstriche fur den Korrosionsshutz vohn Stahl", Industrie-Lackier-Betrieb 42, 1974 (2), Jahrgany.

Discussion

MR D. J. HOUSE asked whether the atmospheric conditions around bridges in England would be similar to those around the bridge referred to by Mr Hermelin.

MR D. J. PIENAAR considered the conditions to be similar with respect to latitude.

MR HERMELIN also considered the conditions to be similar: both were places where there was a heavy rainfall, both were very near to surface water and not far from industrial areas where there was pollution.

MR A. BURNS asked how sections to be welded were treated. He also enquired whether the use of a lead-based pigment over zinc was an accepted practice overseas.

MR HERMELIN said that with regard to the first question, sections to be welded were masked with a 15cm wide tape on each side. The area to be welded was cleaned by hand using a steel brush.

With regard to the second point this procedure was not accepted practice. It was done not to illustrate an anti-corrosive system, but merely to show what was meant by the influences on anti-corrosive protection of differences between peaks and valleys in a metal surface.

MR D. J. PIENAAR asked the author to explain further the use of protective tape; he had not come across this before.

MR HERMELIN explained that a black Sellotape was used. The sections were firstly sand blasted and then the worker went round all edges which had to be welded and sealed these with tape. This had good adhesion to the metal surface and served to keep the sand blasted area clean and the metal surface free from atmospheric attack. It was then sprayed and the area was then welded and primed on both sides.

MR PIENAAR said that the weld had to be blasted to give a clean surface, but he asked what was the point of blasting the adjacent areas when these would be welded and so make a mess.

MR HERMELIN said heat from the welding operation would crack the priming coat and this was an advantage when priming the weld.

Next month's issue

The Honorary Editor has accepted the following papers for publication, and they are expected to appear in the September issue of the *Journal*.

Testing of surface coatings by the customer *by D. A. Bayliss*

Flocculation—its measurement and effect on opacity in systems containing titanium dioxide pigments *by J. G. Balfour and M. J. Hird*

Jordan Award paper—*See page 314*

Why did it fail? *by A. N. McKelvie and A. F. Sherwood*

Correspondence

Trends in petrochemical raw materials

SIR—Waddams in his survey of trends in petrochemical raw materials (*JOCCA*, 1975, **58**, 125) is scathing about the possibility of fermentation as a route to tonnage organic chemicals, in particular ethylene. After touching on the use of potato peelings as a fermentation substrate—on which I do not comment—he goes on to state that *to produce perhaps 3 per cent of the world's 1980 ethylene requirement in this way would require a mountain of 50 million tonnes of fermentable material.*

From this, we may calculate that the world ethylene requirement in 1980 is estimated to be about 500 000 000 tonnes, which is certainly going to require quite a large lake of oil, and a non-renewable lake at that.

We may note, however, than the *annual* world production of cellulose is around 100 000 million tonnes, that is, about 150 pounds of cellulose per day for every man, woman and child on the earth. This can be turned without undue trouble into fermentable sugars; it so happens that we have just completed an elaborate and detailed study of the production of sugars from cellulose wastes, and perhaps the most surprising thing that has emerged is the economic attractiveness of even the original Scholler process at present price levels. It is not generally known that some two dozen plants are operating in Russia at the present day producing sugars from wood wastes; the largest has an output of around 100 000 tonnes per year of sugars; most are producing fodder yeast, but the original plants were planned to produce ethanol for ethylene.

But that 500 000 000 tonnes of ethylene in 1980 worries me, especially as Waddams gives the present UK usage as 1 500 000 tonnes per year. Is the rate of growth really so rapid? Or does Waddams not realise that to produce one tonne of ethylene requires no more than four tonnes of fermentable material?

Yours faithfully,
M. H. M. ARNOLD

Arnold Services,
106 Runcorn Road,
Moore, Warrington WA4 6UB
9 April 1975

Mr. Waddams replies . . .

SIR—I should like to thank Mr Arnold for drawing my attention to the incongruous figures given on page 126 of the April 1975 issue of *JOCCA*. His worry about 3 per cent derives partly from the fact that the correct figure—and the one used in the original calculations—is 10 per cent, which makes quite a considerable difference.

I must nevertheless disagree with certain elements in his calculation. He would suggest that 50 million tonnes of

fermentable material will make 15 million tonnes of ethylene. I assumed that fermentable feedstock would vary in requirement from around four up to about ten tonnes of material per tonne of ethanol produced, with an average of between six and seven. Something like eight million tonnes of ethanol would be needed to produce five million tonnes of ethylene by dehydration. This would represent something like 10 per cent of the world demand by 1980.

The main point of difference is Mr Arnold's assumption that all of this fermentable material is going to be a high grade material, whereas I am assuming that we shall rapidly run out of such material and we shall be using a variety of relatively unsatisfactory waste products. Even the use of molasses would require something over four tonnes of material per tonne of alcohol or well over six tonnes per tonne of ethylene. I remain unconvinced, therefore, by Mr Arnold's final sentence.

Yours faithfully,

A. L. WADDAMS

BP Chemicals International Limited,
Devonshire House,
Mayfair Place,
Piccadilly,
London W1X 6AY
27 May 1975

Obituary

E. A. Bullions

Ted Bullions died on 18 March and with him goes a little corner of the paint industry which was unique and quite irreplaceable.

He was born in Boston, Massachusetts, and despite spending his early life in Canada and the rest of it in Scotland, he kept his accent virtually intact, so that there was never any real doubt as to his origin. He studied chemistry at what was then the Royal Technical College, Glasgow—now Strathclyde University—leaving shortly before the beginning of the war. Just as he was to do throughout his life, he made an impression at College. So it was that the name of Bullions was known to staff and students alike, well beyond the august confines of the Department of Applied Chemistry. It was inevitable that he should play an important part in student affairs, particularly in the Union, the SRC and the Andersonian Chemical Society.

During the war, he served as a captain with the now legendary Highland Light Infantry. Whatever incongruity may be conjured up by the unlikely union of a Boston accent with an HLI kilt, no one who knew the man and the traditions of the regiment could ever doubt the singular appropriateness of the one to the other.

He left the Army to join Montgomerie Stobo & Co. Ltd., the Glasgow paint manufacturers, as Chief Chemist. His impact on the paint industry was immediate and positive and it was during this period that he did much of his work on ball-milling techniques, on which he was something of an authority.

In 1957 he left to join William Sim and Sons (Paints) Ltd., of Leith, where he became Technical Director. Sims were eventually to merge with Croda Paints Ltd., and, at the time of his retirement, Ted was Director in charge of the Leith paint factory and Research Manager of Croda Paints.

Employees at Sims quickly became familiar with the accent and came to experience an enthusiasum and, at the same time, an army type of discipline which they had never encountered before. Laboratory staff and others, accustomed to starting work at a leisurely 9.00 or 9.15 a.m. quickly found that it was 8.00 a.m. sharp, or else! Nor did he spare himself. For long, his own starting hour was a mystery; those who arrived at 7.30 a.m., 7.00 a.m. or even 6.45 a.m. found Ted already there! He made a substantial contribution to the modernisation of the plant at Leith and also did the buying.

He had not enjoyed the best of health for several years and, indeed, it was failing eyesight to the point of virtual blindness which forced his premature retirement at the end of December 1974. He bore all his afflictions with the greatest of courage. Beyond his immediate family, it is doubtful if, latterly, anyone knew how seriously ill he really was. He was always appreciative of enquiries for his health; but usually skilfully deflected these so that the truth of how he actually felt was never revealed.

His impact on the Scottish Section of OCCA was tremendous. He served, successively, as a member of Committee, Honorary Secretary, Vice-Chairman and, finally, as Chairman of the Section. He was a member of Council for several years and became a Vice-President of the Association.

It could well be said that he left his own memorial in the shape of the Student Group and the Eastern Branch of the Scottish Section. There was vision in these two ideas; but only conviction, determination and hard work brought them into being and established them on a firm footing. No chief chemist or technical director of these early days could readily forget the round of telephone calls he made every month, urging that all student members be "encouraged" to attend the lecture on the following Saturday morning. Even managing directors were not sacrosanct.

When, on moving to Edinburgh, he suggested to the Committee that an Eastern Branch of the Scottish Section be founded, nobody thought for a moment that the idea was possible. But Ted Bullions did and, very quickly, another impossibility became a fact, as one of his Edinburgh associates recalls.

It was Ted's inspiration that brought about the formation of the Eastern Branch in 1963 and through his initiative that the Steering Committee was set up. He accepted the Chair in the first two difficult years, although he had only recently completed a term of office as Chairman of the Section. Such was his enthusiasm, and it certainly spread to his associates on the Committee.

His involvement in OCCA right through the ensuing years when failing health and other commitments necessitated his taking a rather less active part at Committee level, had wider implications than purely Association matters. He was a great believer in education and training of young technicians and factory personnel and always emphasised that they should be guided and encouraged to take on more responsibility.

When a body was set up by CAPITB in Scotland to look at training needs of the Scottish surface coatings industries, Ted's wisdom and knowledge were invaluable and the writer recalls the efforts he made to get informal training sessions organised. All this at a time when the state of his health might have indicated he should have been taking things more easily. This was the courage and spirit of the man.

He was intolerant of too much bureaucracy and red tape and, when the occasion demanded, he could be extremely provocative but always constructive and intensely practical. Scottish OCCA is the poorer for the loss of wisdom and guidance of a good friend and colleague but richer for the many contributions he made to its progress.

Ted Bullions was a character fashioned solidly and unmistakably in three dimensions. He was a very real person and one of the real personalities of the paint industry. His approach to everything was positive and, when he felt it necessary, uncomprising. He utterly despised anything which savoured of hypocrisy, pretentiousness or inefficiency and his re-action, when he encountered any of these was apt to be devastating. He had something of a way with representatives who called on him and it was not unknown for him to strike terror into the heart of even the most experienced. His many characteristics were never more apparent than in his personal relationships and no one could possibly have had a firmer or more dependable friend. He will be very much missed and long remembered by those who knew him best.

In the last year or so, only the faithful attention of his wife, Chris, made it possible for Ted to carry on many of his activities. The strain, although not perhaps immediately apparent, must have been considerable. Tragically and suddenly, she died exactly two weeks after Ted.

A.McL.
G.H.H.
W.S.S.

Annual Report of the Council for 1974

Adopted at the Thirteenth Annual General Meeting of the Incorporated Association held at the Grand Hotel, Scarborough, at 2.15 p.m. on 20 June 1975.

General

It was recognised in the report for 1973 that at least one problem with which the Association would have to contend in 1974 arose out of the raw material shortage and its possible effect upon participation by some companies in the annual Technical Exhibition. There have, however, been many other difficulties for the Association to face during 1974; including the effects on printing of the three-day working week in Great Britain early in the year, combined with staff shortages throughout the year at the Association's new offices and the possibility of power cuts during the construction period immediately before the Exhibition. In addition, like all other organisations, the Association found that costs continued to rise dramatically. Naturally, all these factors have had an effect upon the Association. Indeed, the Association is particularly vulnerable in a rapidly changing economic climate since, for example, its complex system for altering the annual membership subscription rates leads to delay and the Association has to arrange its charges for items such as Exhibitions, Conferences, subscriptions and advertisements in the *Journal* many months in advance; it takes some considerable time, therefore, to make the necessary changes.

Bearing in mind the problems which have arisen, the Association has surmounted the difficulties which beset it at the start of the year with great success; and its financial position was strengthened in the latter half of the year by the decisions made at the February and April Council meetings. Council was much heartened to learn from the Exhibition Committee that, following the technical success of the OCCA-26 Exhibition, which overcame all the problems encountered, the decision to ask exhibitors at the 1975 Exhibition to remit their first instalments with their application forms, far from discouraging organisations from exhibiting, perhaps reminded them of the true value of the Association's annual forum for technical display and discussion in the surface coatings industries.

The *Journal* continued to affirm its position as a leading scientific publication. Moreover, its attractive presentation of Section proceedings, news of the industry and other items further enhanced its reputation and Council feels that this is one more advantage, in addition to those mentioned in the Report for 1973, of the changeover to A4 format.

The Twenty-Sixth Technical Exhibition took place at the Empire Hall, Olympia, London, on 23-26 April: a report appears later under the Exhibition Committee's Report and a review of the Exhibition appeared in the June issue of the *Journal*.

The Association's Biennial Dinner/Dance was held at the Savoy Hotel, London, on 31 May when the Association's guests were the President of the Federation of Societies for Paint Technology, Mr Michael Malaga and Mrs Malaga, Mr T. L. Houghton, President of the Institute of Metal Finishing, Mr H. G. Cole, President of the Institution of Corrosion Technology and Mrs Cole and Mr P. A. Sturge, President of the Paint Research Association and Mrs Sturge. A full report appeared in the July issue of the *Journal*.

The Twelfth Annual General Meeting of the Incorporated Association took place at the University College, London, on 26 June, when Mr A. T. S. Rudram was elected President Designate. The following Vice-Presidents were elected:

Mr W. F. McDonnell
Mr A. S. Gay
Mr A. G. Holt
Mr F. D. Robinson
Mr F. D. H. Sharp
Mr T. W. Slinn
Mr L. F. Saunders

The Honorary Officers were elected as follows:

Honorary Secretary	Mr D. J. Morris
Honorary Treasurer	Mr F. Cooper
Honorary Editor	Mr S. R. Finn
Honorary Research and Development Officer	Mr A. R. H. Tawn

The report of the Auditors on the scrutiny of the postal votes was received and it was announced that the following members had been elected to the Council for the years 1974-76:

Mr J. R. Taylor
Mr N. H. Seymour
Mr A. A. Duell

Votes of thanks to the Retiring President, retiring Council Members, the Honorary Officers and the Director & Secretary were carried with acclamation.

A new venture, that of a joint Symposium with the Paintmakers' Association, was successfully accomplished during the year. The event was originally scheduled for the day of the Annual General Meeting but, owing to unforeseen problems, it was necessary to postpone it until 17 September at University College, London, under the title "The optimum use of resources for the surface coatings industries". It was felt that further such ventures will be organised in non-Conference years. A report appeared in the November issue of the *Journal*.

On the evening of 16 October the Council Reunion Dinner held at the Cafe Royal was once again extended to include any members who had previously served on the Council. On this occasion, the only guests of the Association were six

Past Presidents and four Past Association Honorary Officers. The function was a most successful venture, allowing many old friendships to be renewed.

During the year, Council authorised the introduction of a new Association tie, having the Association's insignia as a single motif on a maroon background. The ties were available in the autumn and Section Committees agreed to arrange sales to members. These ties, as well as those with the blue background, were also available from the Association's offices.

The Association was able to present papers at the conferences held by its sister associations. In May, Dr J. Dunderdale gave one of the lectures at the Congres at Garmisch Partenkirschen of the Federation d'Associations de Techniciens des Industries des Peintures, Vernis, Emaux et Encres d'Imprimerie de l'Europe Continentale and in November, Mr J. H. W. Turner was one of the lecturers at the Convention at Atlanta of the Federation of Societies for Paint Technology.

The Sections continued to play their full part in furthering the aim of the Association and Council noted with pleasure that the Transvaal Branch for the first time took over the organisation of the South African Section. By the end of the year, the London Section had taken the first steps towards encouraging the growth of Association activity in Canada. Overseas also, the Eleventh New Zealand Convention was held at Wairakei Hotel from 2 to 4 August under the title "Environment and the surface coatings industry". The 5th National Convention of the South African Section took place on 20 and 21 September at the Holiday Inn, Durban with the theme "Modern trends in coatings and their applications."

Symposia were also arranged by Sections in the United Kingdom. On 20 March, the Midlands Section held a successful function at Edgbaston, Birmingham on "Atmospheric pollution—will the paint user overcome this problem?" The London Section organised a weekend meeting on "Colour" at the Queen's Hotel, Hastings, 23-24 February which was attended by representatives of the French Association (Association Francaise des Techniciens des Peintures, Vernis, Encres d'imprimerie, Colles et Adhesifs). This Section also held a half day Symposium on 12 March at the Polytechnic of the South Bank on "Additives" and a Colloquium with the Institution of Corrosion Technology on 20 November at the Thames Polytechnic, Woolwich on "Coatings for immersed conditions." A highlight of the year has been the visits abroad of the President and Mrs Silver. Not only did they attend the Convention of the Federation d'Associations de Techniciens des Industries des Peintures, Vernis, Emaux et Encres d'Imprimerie de l'Europe Continentale at Garmisch Partenkirschen in May but also the Convention of the New Zealand Sections in August and the South African Section in September. To the evident delight of the Sections abroad, the President delivered a lecture to their Conventions and it is clear from the many and genuine tributes received by Council since their visit that both the President and Mrs Silver did a great deal to foster the good relations which have so long existed between the Council and the Sections. In congratulating warmly both the President and Mrs Silver on the excellent way in which they had acted as ambassadors for the Association, the Council paid tribute to the immense amount of hard work and planning with which these visits involved them and recorded a vote of appreciation to them.

On his return journey from the New Zealand Convention, the President was able to meet members of the Federal Committee of the Oil and Colour Chemists' Association Australia in Sydney and, once again, was able to discuss matters of common interest with them.

In August, the Council was greatly saddened to learn of the death of the Immediate Past President, Arthur Blenkinsop, who had not been in the best of health during his Presidency but had always done his utmost for the Association. A tribute by Mr George Weatherston (a Past Chairman of the Newcastle Section) appeared in the October issue of the *Journal*. Council also learnt with sorrow of the death of two other members who had contributed much to the welfare of the Association, Mr H. F. Clay (a past Chairman of the Manchester Section) and Mr W. J. Arnot (the first Chairman of the Thames Valley Branch (now Section) and, at the time of his death, its Honorary Secretary.)

Since the removal of the offices from the City of London to Middlesex, it has not been so convenient for overseas visitors to call at the offices but the Director & Secretary has been pleased to welcome members both from the United Kingdom and overseas. In the Report for 1973 the Council recorded its thanks for the great burden carried by the Director & Secretary during that year, since none of the staff trained for so many years in the City offices were able to travel to the new location. It has proved very difficult to recruit staff during the past year, particularly in view of the very heavy pressure on the Association's financial resources. Consequently, the Director & Secretary has been organising the Association's work with a severely depleted staff, most of whom work on a part time basis. Nevertheless, the standard of the Association's organisation has continued at its very high level and Council feels that members will appreciate that this could only be accomplished by extremely hard work by all the staff and considerable sacrifice of leisure time and holidays by both the Director & Secretary and the Assistant Editor, Mr C. A. Tayler. The Council records, therefore, its thanks and those of the Members to the Director & Secretary, Robert Hamblin, and his staff for their constant efforts throughout one of the most difficult years encountered by the Association.

Membership of the Association

There has been a small decrease in the total membership during the year, particularly amongst Registered Students. Council asks all senior members of the Association to draw the attention of junior technical staff to the advantages of registration as Students and to encourage them wherever possible to prepare for admission to the optional Professional Grade as Licentiates. The figures given below at 31 December 1974 relate only to those members whose 1974 subscriptions have been received; the names of those in arrears with subscriptions have been removed:

Section	*Ordinary*	*Associate*	*Honorary*	*Student*	*Total*
Bristol	63	13	—	2	78
Hull	70	7	—	5	82
Irish	45	16	—	1	62
London	591	67	4	7	669
Manchester	355	37	2	10	404
Midlands (including Trent Valley Branch)	184	21	1	2	208
Newcastle	128	12	—	11	151
Scottish (including Eastern Branch)	96	23	—	12	131
Thames Valley	112	13	—	4	129
West Riding	64	14	—	5	83
Auckland	73	32	—	2	107
Wellington	59	23	—	2	84
South African	208	49	1	9	267
General Overseas	366	24	2	—	392
Total 1974	2,414	351	10	72	2,847
Total 1973	2,489	389	9	112	2,999
Net increase/decrease during 1974	−75	−38	+ 1	−40	−152

The Council

During the calendar year the Council has met four times, the average attendance being 28. All meetings were held in London.

Committees of the Council

The Committees of Council met as set forth below:

Exhibition Committee	2
Finance Committee	3
President's Advisory Committee	5
Professional Grade Committee	3
Publications Committee	1

Exhibition Committee

Chairman: The Honorary Treasurer, Mr F. Cooper

The Twenty-Sixth Technical Exhibition was held at the Empire Hall, Olympia, London, from 23 to 26 April 1974 against a background which could hardly have been more discouraging. The acute shortages in raw materials which had afflicted the industries during the autumn of 1973 inevitably affected the number of exhibitors, but nevertheless these were drawn from 13 overseas countries and the Exhibition attracted visitors from more than 50 overseas countries. It was felt that many visitors had come to the Exhibition specifically to discuss the problems arising from the raw material shortage with suppliers and exhibitors reported that they had a most successful and busy Exhibition.

Prior to the Exhibition the industry in the United Kingdom had had to contend with a three-day working week and restrictions on electricity supply, which had led to considerable delays in printing so that it was not possible to despatch the *Official Guide* as early as in previous years. The Committee pointed out, however, that several other exhibitions were cancelled or severely curtailed, whereas the Association's Exhibition opened on time and afforded an ideal opportunity to the many new exhibitors to introduce their products. Amongst those visiting the Exhibition for the first time was a delegation of Japanese scientists and technologists—the forerunner of several overseas visits which are being arranged for the 1975 Exhibition.

On the opening evening, the Association held a Dinner at the Savoy Hotel when a congratulatory scroll was presented to Dr S. H. Bell OBE (President 1965-7), who had been recognised in the New Year's Honours List.

The theme of the Technical Education Stand was "Powder Coatings" and the Committee was again indebted to members of the London Technical Colleges who provided the staff for the stand, to Mr S. R. Finn who wrote the leaflet and to Mr G. H. Hutchinson who acted as lecturer for the school parties.

A review of the Exhibition appeared in the July issue of the *Journal* and the Exhibition Committee recorded its thanks to the Honorary Editor, Mr S. R. Finn, who prepared the report.

Finance Committee

Chairman: The Honorary Treasurer, Mr F. Cooper

As stated in the report for 1973 the financial situation facing the Association was the most difficult with which it had to contend since 1951. The measures which the Finance Committee proposed to Council in 1974, and which were accepted by them, inevitably took time to come into full effect, due to the nature of the Association's activities.

Although by the end of the year, the steps taken were having a beneficial effect, the Finance Committee emphasises that deficits have been incurred for three successive years and it is of paramount importance to plan for regular future annual surpluses, not only to restore the position to that of 1971 but also to provide for further development.

Members will be well aware of the very severe decrease in the value of investments generally during 1974 and, although it was fortunately not necessary to realise any investments in the year, the value of the equities held by the Association at the end of 1974 stood at £10,121 below their purchase price, compared with £4,319 above their purchase price at the end of 1973 and the Government holdings stood at £3,049 below their purchase price compared with £2,149 at the end of 1973.

Jordan Award Committee

Chairman: The Honorary Research and Development Officer, Mr A. R. H. Tawn

The Committee did not meet during 1974 since the Award is a biennial one, but applications for the next Award were received by the closing date 27 December and the Committee will be considering these in the early part of 1975.

Liaison Committee

Chairman: The President

As stated in the General Section of the Report, the President has made several visits abroad to other societies, to the Sections of the Association in New Zealand and South Africa and to OCCA Australia. On all these occasions he took the opportunity of discussing informally closer liaison with other societies, particularly with the Presidents of Federation d'Associations de Techniciens des Industries des Peintures, Vernis, Euraux et Eucres d'Imprimerie de l'Europe Continentale, the Scandinaviska Lackteknikers Forbund and the Federation of Societies for Paint Technology.

The President of the Federation of Societies for Paint Technology, Mr M. Malaga, also visited the United Kingdom in May and had informal talks with both the President and the Director & Secretary; he was also able to present the Scroll of Honorary Membership to the Association's latest Honorary Member, Mr R. W. Matlack (formerly Executive Vice-President of the Federation), at the Federation Convention in November.

President's Advisory Committee

Chairman: The President

For the 1974/75 session Mr L. H. Silver invited the Chairmen of the Bristol Section (Mr F. E. Ruddick), the London Section (Mr R. H. E. Munn) and the Newcastle Section (Mr C. N. Finlay), all of whom are in their second year of office, to serve on the Committee together with the Honorary Officers of the Association.

Professional Grade Committee

Chairman: The President

During the year the Committee recommended to Council that there should be slight amendments to the regulations, which had first been introduced in the autumn of 1971.

	Applications received	*Applications transferred between grades*	*Successful*	*Awaiting fulfilment of regulations*	*Not accepted*	*Resignations and deaths*	*As shown in December 1974 Journal*
Fellowship	190	*Less* 42 *Add* 3	145	3	3	5	140
Associateship	237	*Less* 14 *Add* 42	235	12	18	1	234
Licentiateship	26	*Add* 11	9	20	8	—	9
	453*		389	35	29	6	383

*In December the applications of a further two Fellows, five Associates and two Licentiates were approved by the Committee.

in particular, to those regulations relating to the period of service as an Ordinary Member before entry could be granted into the Fellowship and Associateship Grades. Council agreed to accept the recommendation that this period should be reduced to two years in all cases, whilst retaining the one year period for the Licentiateship.

The regulations were published in full in the July issue of the *Journal* and were also featured on the Information Centre at the Exhibition.

Details of the applications which had been dealt with by the Committee prior to its meeting in December 1974 are set out above and are shown in the full list of members admitted to the various grades in the December 1974 issue of the *Journal*.

Technical Committee

Chairman: The Honorary Research and Development Officer, Mr A. R. H. Tawn

As stated in the Report for 1973 the Technical Committee had prepared the format for the Joint Symposium with the Paintmakers' Association and concerned itself with the forward planning of the Conference in June 1975.

A successful Joint Symposium was held in September 1974 and the full list of lecturers and papers for the Scarborough Conference appear in the January and February 1975 issues of the *Journal*.

Technical Education Committee

Chairman: The President

Liaison has been maintained with various technical colleges and three of these are now guiding their students in the preparation of dissertations for the Licentiate Grade. It is gratifying to learn that many of these students are from overseas.

The Committee has also taken note of the effect of the work of the Technician Education Council and hopes that it will be asked to provide representatives on some of the Committees of this Council in 1975. At the end of the year the Scottish Technician Education Council asked the Association to appoint a representative to one of its Committees and Mr R. F. Hill has acted in this capacity.

Publications Committee

Chairman: The Honorary Editor, Mr S. R. Finn

The use of the A4 page size was, of course, continued during 1974 and the advantages it gave in the reproduction of diagrams and large tables was increasingly evident. No adverse comments had been received since the few which were reported last year.

The year 1974 was a particularly difficult one, firstly because the three-day working week imposed upon industry at the beginning of the year affected the production of the *Journal* and, secondly, on account of the great inflation of costs and the difficult financial position of the Association. These conditions caused the abandonment of the square back spline carrying the month and number of each issue, in favour of a rounded saddle-stitched back upon which the details could not be printed. This binding method could be done at the Association's printer's works and avoided transferring the journals to another factory for binding. However, this action also eliminated the occasional complaint that pages became loose and gave a very appreciable saving in production costs.

During the three-day period it was necessary to reduce the number of papers per issue to an average of about three and since the restoration of a full working week, the very high cost of production did not allow the resumption of publishing four papers in each issue.

The number of pages in the *Journal* occupied by *Transactions and Communications* amounted to 277 out of a total of 432, or 64 per cent compared to 402 pages in 1972, which was 68 per cent of the total. Nineteen books were reviewed, but it was disappointing that only two *Letters to the Editor* were received. Perhaps the most remarkable feature of the papers published was their geographical distribution, 27 papers being received from 14 overseas sources, namely: Australia (6), Egypt (3), Switzerland (3), two each from India, Germany, USA and Argentina, and one from each of Poland, South Africa, Jugoslavia, Finland, Holland, New Zealand and Czechoslovakia. As the total number of papers published was 43, this amounts to 62.5 per cent from overseas sources, which must surely indicate the increasing international role of the Association.

The Publications Committee met once during the year when various matters were discussed. It was agreed that under the circumstances the saddlestitching adopted in an emergency would be continued. The Association's translator for the summaries in Russian had been seriously ill and it had not been practicable to insert a Russian version of the summaries for a number of months. The Committee decided that, in view of the very high cost of typesetting in Russian characters and the uncertain utility of summaries in that language, this feature of the *Journal* should be discontinued for the present.

The remaining stocks of the *Introduction to Paint Technology* had reached the level at which a decision on reprinting or revising it must be made. Mr J. R. Taylor kindly agreed to assess the present text in order that the Committee should be able to advise Council that either a new chapter should be written to bring the information up to date, or that such extensive additions were required that the whole book should be revised.

Apart from Part VII of the Paint Technology Manuals, which was bound from reprints of Student Reviews which

appeared in the *Journal*, only about 100 copies of Part III remained available for sale at the end of the year. Correspondence had taken place with Messrs Chapman and Hall regarding the publication of further editions of the Manuals but it had not been possible to reach agreement. Mr C. W. Collier, the Collator of Parts IV and V, kindly attended the meeting to advise on the current position of their revision. He stated that only three chapters of Part IV remained to be revised and here there had been some difficulty in finding suitable authors; a number of possible authors were suggested by members of the Committee. It was decided to complete the revision of Part IV as quickly as possible.

It was also decided to construct the 1975 Exhibition Report by the same means as used in 1973 and 1974, which experience had shown to be the most convenient way of preparing it in time for the June number of the *Journal*.

The Honorary Editor wishes to thank the Honorary Publications Secretaries for their accounts of *Section Proceedings* during the year and all those who have contributed to book reviews.

Survey of published papers. An analysis of the papers published during 1974 in comparison with 1972 and 1973 is as follows:

Papers originating from Section symposia and lectures	1972	1973	1974
Bristol	—	—	—
Hull	—	1	—
Irish	1	—	1
London	4	4	1
Manchester	—	13	4
Midlands	2	—	6
Newcastle	—	—	1
New Zealand (Auckland)	—	—	1
Scottish	—	—	—
South African	5	—	—
Thames Valley	1	—	—
West Riding	—	—	1
	13	18	15
Papers submitted directly			
United Kingdom	10	12	2
Overseas	18	10	26
Conference	—	16	—
	28	38	28
Total	41	56	43

The smaller number of papers in 1972 was due to the publication of 12 *Student Reviews*, which subsequently became Part VII of the Paint Technology Manuals.

Representation on other organisations

The Association was represented on other organisations as follows:

Technical Training Board for the Printing Ink and Roller Making Industry: Mr A. R. H. Tawn and Mr H. C. Worsdall.

Paint Apprenticeship Council: Dr H. W. Keenan.

The Parliamentary and Scientific Committee: The President and the Director & Secretary.

The British National Committee for Chemistry: Mr A. R. H. Tawn.

City and Guilds Advisory Committee for the Chemical Technicians Certificate: Dr J. G. Gillan.

East Ham Technical College Consultative Committee for the Science Department: Mr R. M. W. W. Wilson.

Association of Exhibition Organisers: The Director & Secretary.

Programme Liaison Committee: The Honorary Programmes Officer of the London Section and the Director & Secretary.

The Paintmakers' Association Training and Technical Education Committee: The Honorary Secretary and the Director & Secretary.

The Society of Dyers and Colourists Terms and Definitions Committee: Dr J. Toole and Mr J. T. Hurst.

The Society of Dyers and Colourists "Review of Coloration Progress" Committee: Mr H. D. Brearley.

The Colour Group (Great Britain): Mr R. Smith until December 1974.

Institution of Corrosion Technology Education Committee: Dr J. B. Harrison and Mr D. S. Newton.

Institute of Metal Finishing Technical Education Committee: Mr A. R. H. Tawn.

Scottish Technician Education Council Sub Committee: Mr R. F. Hill.

British Standards Institution:

PVC Pigments, Paints and Varnishes Industry Committee: *Dr J. B. Harrison*

PVC/1 Pigments: *Mr A. S. Lewis* until October, *Mr H. G. Cook* since October

PVC/1/9 Carbon Black: *Mr J. S. Marsh* until October, *Mr V. G. Heffer* since October

PVC/1/11 Extenders: *Mr S. A. Ray*

PVC/1/18 Zinc Dust Pigments: *Mr D. S. Newton*

PVC/3 Oils, Varnishes, Putty etc.: *Mr G. H. Hutchinson*

PVC/3/5 Test Methods for Paint Media: *Dr L. A. O'Neill*

PVC/4 and PVC/4/1 Lac: *Dr B. S. Gidvani*

PVC/6 Cement Paints: *Mr W. O. Nutt*

PVC/8 Plastic Wood: *Mr V. P. Gellay*

PVC/10 Test Methods for Paints: *Mr A. N. McKelvie*

PVC/11 Revision of the Glossary of Paint Terms: *Mr S. A. Ray*

PVC/14 Colours for Paints: *Mr A. B. Lock*

PVC/15 Water Paints and Distempers: *Mr T. W. Wilkinson*

PVC/16 Ready Mixed Paints: *Mr G. A. Newell* until October, *Mr A. T. S. Rudram* since October.

PVC/19 Bituminous Paints: *Mr J. Rogers*

PVC/20 Calcium Plumbate Priming Paints: *Mr A. G. Walker*

PVC/23 Zinc Rich Paints: *Dr D. Atherton*

PVC/24 Water Thinned Priming Paints: *Mr J. H. Sparrow*

PVC/25 Organic Finishes for Aluminium Windows: *Dr J. B. Ley*

LGE/9 Artificial Daylight for Colour Matching: *Miss O. Rawland* until October

C/17 Viscosity: *Mr A. N. McKelvie*

C/17/2 Revision of BS 188 (Drafting): *Mr A. N. McKelvie*

CHE/43 Test Sieves: *Mr M. J. F. Meason*

CHE/50 Test Methods for Powder Properties: *Mr D. S. Newton*

CIC/4 Solvents and Allied Products: *Mr A. R. H. Tawn*

CIC/6 Glycerol: *Mr W. A. Ledger*

OFFA/7 Sampling Oilseeds, Oils and Fats: *Mr N. F. Lythgoe*

OFFA/12 Vegetable Oils: *Mr N. F. Lythgoe*

OFFA/24 Analysis of Oilseeds, Oils and Fats: *Mr N. F. Lythgoe*

ELE/16/53/6 Varnishes: *Mr N. H. Seymour*

ACE/44 Aircraft Finishes: *Mr J. B. G. Lewin*

BLCP/18 Code of Practice—Painting: *Mr J. E. Mitchell*

M/26 Artists' Materials: *Mr J. A. L. Hawkey*

RDE/25 Road Marking Compounds: *Mr T. R. Bullett*

OC/20/4/12 Chemistry and Chemical Technology: *Mr J. Orpwood*

Reports submitted by representatives may be seen by members at the Association's offices.

The Association was also represented on overseas organisations as follows:

South Africa

SABS Specification—Two-Pack Epoxy Chemical Resisting Finishes . . . Mr H. I. Bosman.

Witwatersrand College for Advanced Technical Education, Advisory Committee on Paint Science . . . Mr P. A. J. Gate and Mr A. Vlotman.

Natal College for Advanced Technical Education, Science and Education Advisory Committee . . . Mr K. R. McDonald and Mr K. M. Engelbert.

Council of the National Association of Scientific and Technical Societies . . . Mr L. F. Saunders.

Wellington

Standards Association of New Zealand—Paints and Coatings Sectional Committee . . . Mr T. W. Slinn.

Appendix

Report of the Council in accordance with the Companies Act 1967

1. The Council presents herewith the audited accounts of the Association for the year ended 31 December 1974.

2. *Results*

The results for the year and the appropriation thereof are set out in the Income and Expenditure Account on page 9.

3. *Principal activities of the Association*

The Association has continued in its work of furthering the development of the science and technology of the oil and colour industries.

4. *Changes in fixed assets*

The movement in fixed assets during the year is set out in the table on page 10.

5. *The Council*

The following were members of Council at 31 December 1974:

L. H. Silver
D. J. Morris *elected 26 June 1974*
F. Cooper, BSc
S. R. Finn, BSc, FRIC, FTSC
A. R. H. Tawn, FRIC, FInstPet, FIMF, FTSC
A. G. Holt, FTSC *elected 26 June 1974*
W. F. McDonnell, FRIC, AMBIM *elected 26 June 1974*
L. F. Saunders, FTSC *elected 26 June 1974*
A. T. S. Rudram, FTSC
T. W. Slinn, BSc, FTSC
D. E. Eddowes, BSc
L. J. Brooke, ATSC
H. G. Clayton
N. Cochrane
H. R. Hamburg, PhD
F. E. Ruddick
F. D. Robinson, BSc, ATSC
E. Armstrong AMBIM, ATSC
J. R. Taylor, BSc, FRIC, FTSC *elected 26 June 1974*
N. H. Seymour, FTSC *elected 26 June 1974*
A. A. Duell, ARIC, FTSC *elected 26 June 1974*
G. R. Duchett *elected 26 April 1974*
T. W. Wilkinson, AMCT, FTSC *elected 16 April 1974*
D. P. Power *elected 19 April 1974*
R. McD. Barrett, BSc, MSc(Tech), AIWM *elected 19 April 1974*
F. D. H. Sharp *elected 26 June 1974*
D. J. Pienaar, MSc *elected 6 April 1974*
Miss P. Magee
R. H. E. Munn, LRIC, FTSC
J. T. Tooke-Kirby
J. E. Mitchell, BSc, FRIC, FTSC
A. S. Gay, ATSC
D. E. Hopper, ACT (Birm), ATSC
C. N. Finlay, ATSC
K. V. Hodgson, FTSC *elected 4 April 1974*
A. McLean, BSc, ARCST, FRIC, FTSC
W. H. Tatton, ARIC, FIMF, FTSC
J. L. Inshaw, ARIC, ACTC, FTSC
J. D. W. Davidson, FIPE, FIWM, MBIM *elected 1 August 1974*
D. Morris, ATSC
R. P. Bartrum
P. F. Sharp, BSc, ATSC
F. Sowerbutts, BSc(Tech), FTSC
F. Schollick, BSc, FRIC
M. D. Taylor, FTSC
G. Willison, FRIC
M. J. Leahy (Co-opted as President of the Oil and Colour Chemists' Association Australia)
L. Valentine, BSc, PhD (co-opted as Representative of the Oil and Colour Chemists' Association Australia)

In addition, the following were members of Council at 1 January 1974 and served during the year; the date shown after each name denotes when during 1974 service on Council terminated:
A. W. Blenkinsop, FTSC (*26 June*)
D. S. Newton, AMCT, CGIA, FInst.CorrT, FIMF, FTSC
R. G. Gardiner (*26 June*)
A. B. Lock (*26 June*)
K. R. McDonald, BSc, ATSC (*26 June*)
R. N. Wheeler, BA, ARIC (*26 June*)
H. W. Keenan, PhD, FRIC, FTSC (*26 June*)
H. C. Worsdall (*26 June*)
P. L. Gollop, ARIC, FTSC (*26 April*)
F. W. Stoyle, BSc, FIOP, PhD, FRIC, FTSC (*19 April*)
S. Duckworth, ARIC, FTSC (*5 April*)
K. F. Baxter (*4 April*)
E. M. Burns (*5 April*)
R. A. Eglington (*6 April*)

From *5 April 1974* until *1 August 1974* Mr L. Hopwood served as Scottish Section representative until transferred by his company to Bristol.

6. *Auditors*

The auditors, Coopers & Lybrand, will continue in office in accordance with Section 159(2) of the Companies Act 1948.

By Order of the Council

ROBERT HAMBLIN
Director & Secretary

2 January 1975

OIL AND COLOUR CHEMISTS' ASSOCIATION

BALANCE SHEET as at 31 December 1974

1973 £	£		£	1974 £	*1973* £	£		£	1974 £
		ACCUMULATED FUND —					FIXED ASSETS—		
	43,097	Balance at 1 January 1974 ..	32,438				Furniture, Fittings, Office Machines and Motor Car at		
	10,659	*Less* Deficit for the year ..	11,633			*9,123*	cost	10,408	
32,438				20,805		*7,815*	*Less* Accumulated Depreciation	6,072	
		CURRENT LIABILITIES—			*1,308*				4,336
	398	Provision for Paint Technology Manuals	398			*8,128*	Leasehold Property on short lease at cost	8,128	
	21,068	Receipts in advance	100,924			*452*	*Less* Accumulated Amortisation	904	
	8,909	Creditors & Accrued liabilities	14,238		7,676				7,224
30,375				115,560			QUOTED INVESTMENTS—		
						11,708	British Government Securities at cost	11,708	
							(Market Value £8,659) *Market Value 1973 £9,559*		
						26,897	Other Investments at cost ..	26,897	
							(Market Value £16,775) *Market Value 1973 £31,216*		
					38,605				38,605
	L. H. SILVER *President*						CURRENT ASSETS—		
						550	Stock of unsold publications at cost	468	
	F. COOPER *Hon. Treasurer*					*856*	Paper Stock in hand	3,893	
						11,688	Debtors & Payments in Advance	17,347	
	R. H. HAMBLIN *Director and Secretary*					*2,130*	Balance at Bankers and Cash in Hand in United Kingdom and Overseas Sections ..	64,426	
						—	Stock of ties	66	
					15,224				86,200
£62,813				£136,365	*£62,813*				£136,365

REPORT OF THE AUDITORS TO THE MEMBERS

The Annual Accounts of the United Kingdom and Overseas Sections have been incorporated in these accounts on the basis of returns submitted to us by the Hon. Auditors of these Sections. We have not verified the net assets of the Sections at 31 December 1974 which amounted to £6,257 or at 31 December 1973 which amounted to £5,465 nor have we verified the change in net assets of the Sections between these two dates. With this reservation, in our opinion, the accounts set out on pages 8 to 11 give a true and fair view of the Association's affairs at 31 December 1974 and of its results for the year on that date and comply with the Companies Acts 1948 and 1967.

COOPERS & LYBRAND

London, 31 March 1975

Chartered Accountants

Note: *The page references given in the paragraph above are equivalent to pages 310 to 313 in this* Journal.

OIL AND COLOUR CHEMISTS' ASSOCIATION

INCOME & EXPENDITURE ACCOUNT FOR THE YEAR ENDED 31 DECEMBER 1974

£	1973 £			£	1974 £	£
			INCOME			
			MEMBERSHIP AND GENERAL INCOME—			
		14,914	Subscriptions	21,057		
		142	Professional Grade Certification Fees	190		
		127	Entrance Fees	254		
		2,111	Sundry Publications	1,041		
		13	Sundry Income	1,205		
		—	Profit on sale of equipment	760		
		942	Section Surplus	—		
		827	Conference	—		
		3,636	Investment Income	3,864		
	22,712				28,371	
			JOURNAL RECEIPTS—			
		11,819	Advertising	15,139		
		14,927	Sales	16,796		
		2,598	Capitation Fees (OCCA Australia)	2,601		
		661	Reprints	2,001		
	30,005				36,537	
	62,225		EXHIBITION RECEIPTS		38,011	
114,942						102,919
			EXPENDITURE			
			MEMBERSHIP AND GENERAL EXPENSES—			
		10,595	Administration Expenses (Note 4)	9,621		
		12,487	Journal	11,869		
		6,676	Postage, printing and stationery	5,997		
		1,482	Publications	694		
		—	Section Expenditure (Note 5)	1,350		
		89	Council Reunion Dinner	71		
		2,894	General Expenses, including Accountancy	2,677		
	34,223				32,279	
			JOURNAL EXPENSES—			
		10,595	Administration Expenses (Note 4)	9,621		
		15,263	Printing and Publication	14,507		
		882	Reprints	1,285		
		2,827	Postage and Stationery	2,416		
		1,099	General Expenses	980		
	30,666				28,809	
			EXHIBITION EXPENSES—			
		48,896	Direct Expenses	42,907		
		10,596	Administration Expenses (Note 4)	9,622		
		1,099	General Expenses	980		
	60,591				53,509	
125,480						114,597
£(10,538)						£(11,678)
(121)			Profit on Exchange			45
£(10,659)			(Deficit) For the Year			£(11,633)

NOTES ON THE ACCOUNTS

1. *Fixed Assets*

	Furniture, Fittings, Office Machines and Motor Car		*Leasehold Property*	
Cost	£	£	£	£
At 1 January 1974	9,123		8,128	
Additions	3,441		—	
Disposals	(2,156)		—	
		10,408		8,128
Depreciation				
At 1 January 1974	7,815		452	
Disposals	(2,156)		—	
Charged to Income and Expenditure Account.. ..	413		452	
		6,072		904
Net book value at 31 December 1974		£4,336		£7,224

Depreciation and amortisation of fixed assets is based on the estimated useful lives of the relevant assets.

2. *Foreign Currencies*

Overseas Section income, expenditure, assets and liabilities have been converted to Sterling at the following rates:

New Zealand	$1.78
South Africa	R1.62

3. *The Ethel Behrens Fund and Jordan Award Fund*

The Ethel Behrens Fund and the Jordan Award Fund have not been incorporated in the Association Income and Expenditure Account and Balance Sheet but have been shown as separate accounts.

4. *Administrative Expenses*

Administrative expenses have been equally apportioned between the three main headings of expenditure in the Income and Expenditure Account on the basis of staff time involved. These expenses are:

1973 £		1974 £
19,455	Salaries	16,673
4,671	Temporary staff	4,420
407	Welfare	346
5,328	Rent, rates, lighting and telephone ..	6,050
375	Audit fee	510
100	Provision for dilapidations	—
998	Furniture, fittings depreciation	413
452	Leasehold property amortisation	452
£31,786		£28,864
	The charge to each heading is therefore:	
10,595	Membership	9,621
10,595	Journal	9,621
10,596	Exhibition	9,622
£31,786		£28,864

5. *Section Expenditure*

The section expenditure is as follows:

1973 £		1974 £
12	Bristol	150
111	Hull	51
353	Irish	113
(1,515)	London	250
(671)	Manchester	770
249	Midlands	12
29	(Trent Valley Branch)	61
3	*Newcastle	159
(317)	Scottish	(309)
(76)	†(Eastern Branch)	50
184	*Thames Valley	195
163	West Riding	(32)
361	Auckland	239
202	*Wellington	66
225	*South Africa	(425)
(687)		1,350
(255)	Adjustment for previous year	—
£(942)		£1,350

NOTE:

*unaudited return incorporated into the accounts 21.3.75

†estimated return incorporated into the accounts 21.3.75

ETHEL BEHRENS FUND

INCOME & EXPENDITURE ACCOUNT FOR THE YEAR ENDED 31 DECEMBER 1974

1973 £	Expenditure	1974 £
46	Income Tax on Investment	52
89	Surplus	82
£135		£134

1973 £	Income	1974 £
135	Interest on investment (Gross) ..	134
£135		£134

BALANCE SHEET as at 31 December 1974

1973 £	Liabilities	1974 £
2,435	Accumulated Fund at 1 January ..	2,524
89	Add surplus . ..	82
£2,524		£2,606

1973 £	Assets	1974 £
2,442	Local Government Securities at cost (Market Value £2,299)	2,442
82	Balance at Bank	164
£2,524		£2,606

JORDAN AWARD FUND

INCOME & EXPENDITURE ACCOUNT FOR THE YEAR ENDED 31 DECEMBER 1974

1973 £	Expenditure	1974 £	1973 £	Income	1974 £
100	Award	—	*66*	Interest on investment (Gross) ..	65
4	Printing	—	*38*	Deficit	—
—	Surplus	65			
£104		£65	*£104*		£65

BALANCE SHEET as at 31 December 1974

1973 £	Liabilities	1974 £	1973 £	Assets	1974 £
1,160	Accumulated Fund at 1 January ..	1,122	*1,000*	British Government Securities at cost (Market Value £928)	1,000
38	*Less* Deficit	—			
—	*Add* Surplus	65	*122*	Balance at Bank	187
£1,122		£1,187	*£1,122*		£1,187

Proceedings of the Annual General Meeting

The Thirteenth Annual General Meeting of the Incorporated Association was held on 20 June 1975 at 2.15 p.m. at the Grand Hotel, Scarborough, Yorkshire, with the President (Mr L. H. Silver) in the Chair.

There were 58 Members present. Mr S. L. Davidson (a Past President of the Federation of Societies for Coatings Technology) was present by invitation.

The notice convening the meeting was read.

Apologies

Apologies for absence were received from Mr I. Moll, Mr D. J. Silsby, Mr L. J. Brooke, Mr J. L. Inshaw, Mr K. A. Safe, Mr D. J. Morris (Hon. Secretary) who was recovering from a road accident, Dr S. H. Bell (Past President) and Mr F. Sowerbutts (Past President).

A telegram from Dr Bell congratulating the outgoing President and extending good wishes to the incoming President was read. The Director & Secretary reported that Mr Sowerbutts was convalescing from a major operation and it was unanimously agreed to send the best wishes of the Members at the Meeting to him.

Minutes

The President asked the Meeting to take as read the Minutes of the Twelfth Annual General Meeting held on 26 June 1974, as printed and circulated in *JOCCA* pp. 285-286 inclusive, August 1974. There being no comments, the adoption of the Minutes was put to the Meeting and carried unanimously.

Report of the Auditors to the Members

The Report of the Auditors to the Members was read, it being pointed out that the date of the report was 31 March 1975.

Annual Report of the Council for 1974

In the absence of Mr D. J. Morris (Honorary Secretary) who was recovering from a recent motor accident, the adoption of the Annual Report of the Council and the Statement of Accounts for 1974 was moved by Mr F. Cooper (Honorary Treasurer) and seconded by Mr S. R. Finn (Honorary Editor). There being no comments or questions on the Annual Report of the Council and the Statement of Accounts for 1974, these were formally adopted by the meeting.

Mr S. L. Davidson asked permission to speak to the Annual General Meeting and extended not only the best wishes of his Federation to the Association but also to express their great pleasure at the Honorary Membership of the Association bestowed in 1974 upon the Federation's retiring Executive Vice-President, Robert Matlack, as mentioned in the Annual Report.

Election of President (1975-77)

Mr Silver stated that, as indicated on the Agenda, Mr Arthur Rudram had been nominated by the Council as President of the Association and he now asked the Annual General Meeting to accept the nomination.

This was carried unanimously with acclamation. Mr Rudram thanked the meeting for the high honour bestowed upon him and stated that he would at all times do his best to uphold the high dignity of the office and to follow the example of good work carried out by former Presidents of the Association.

Election of Vice-Presidents of the Association

The President read the nominations of the Council and asked the meeting to accept them *en bloc*. This was agreed

and the following were then elected as Vice-Presidents:

(*i*) Mr W. F. McDonnell
(*ii*) Mr A. S. Gay
(*iii*) Mr A. G. Holt
(*iv*) Mr F. D. Robinson
(*v*) Mr F. D. H. Sharp
(*vi*) Mr L. F. Saunders
(*vii*) Mr J. Beachen

Election of the Honorary Officers of the Association

It was unanimously agreed to elect the Honorary Officers as follows:

Honorary Secretary	Mr D. J. Morris
Honorary Treasurer	Mr F. Cooper
Honorary Editor	Mr S. R. Finn
Honorary Research and Development Officer	Mr C. N. Finlay

Presentation of the Jordan Award

The President indicated that he now had the pleasant duty of presenting certificates and cheques of £50 each to the joint winners of the 1974 Jordan Award.

He explained that the Jordan Award was instituted in 1967 by Mrs Marjorie Jordan, in memory of her late husband, Dr L. A. Jordan, who was President of the Association from 1947-49 and became an Honorary Member in 1955. Mrs Jordan, who had since died, wished the Award of £100 to be made for the best contribution to the science or technology of surface coating by a member, under the age of 35, of any nationality, working in either the academic or industrial field.

Announcement of election of three Elective Members to Council 1975-77

The President read the following report which had been received from the Auditors:

We have scrutinised and counted the voting papers received from the members of the Association in the United Kingdom and Overseas, and certify that the votes cast, including those notified by telex from the South African Section, show that the following obtained the largest number of votes:

M. J. Heavers H. C. Worsdall C. Butler

Six voting papers were rejected as not being in order.

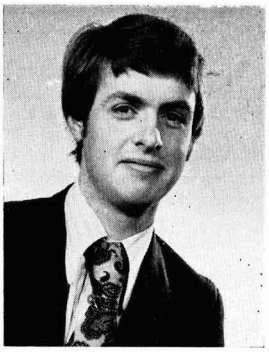
London,
11 June 1975

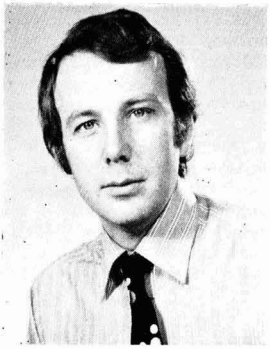
COOPERS & LYBRAND
Chartered Accountants

Chairmen of Sections for the coming session

The names of the Section Chairmen for the coming year were given as follows:

Auckland	Mr R. F. Meek
Bristol	Mr G. R. Duckett
Hull	Mr E. Armstrong
Irish	Mr D. Power
London	Mr J. Tooke-Kirby
Manchester	Mr H. G. Clayton
Midlands	Mr D. E. Hopper
Newcastle	Mr K. V. Hodgson
Scottish	Mr A. McLean
South African	Mr D. J. Pienaar
Thames Valley	Mr J. L. Inshaw
Wellington	Mr O. W. A. Brett
West Riding	Mr R. P. Bartrum





Mr J. G. Balfour (left) and Dr M. J. Hird, who were the joint recipients of the 1974 Jordan Award at this year's AGM

On this occasion the Jordan Award Committee had decided to make the Award jointly to Mr J. G. Balfour and Dr M. J. Hird for their paper "Flocculation—its measurement and effect on opacity in systems containing titanium dioxide pigments", which had been presented to this Conference, and which would be published later in the *Journal*.

The President then presented the certificates and cheques to Mr Balfour and Dr Hird.

Membership subscription rates

The Honorary Treasurer proposed that, in accordance with Article 11, the following resolution having been passed by the Council at two successive Council Meetings on 16 October 1974 and 25 February 1975 be confirmed by the Annual General Meeting:

That, with effect from 1 January 1976 the annual membership

subscription rates in the various categories of membership shall be as follows:

Ordinary or Associate Member	*£12.00 per annum*
Registered Student under 21 years of age	*£3.00 per annum*
Registered Student between 21 and 25 years of age	*£6.00 per annum*
Retired Member	*£1.50 per annum*

By resolution of the Council, Value Added Tax will be applicable to membership subscriptions paid by members resident in the United Kingdom.

Mr F. D. H. Sharp seconded the motion and it was unanimously agreed without comment.

Reappointment of Auditors and fixing the remuneration thereof

It was proposed by Dr J. B. Harrison that Coopers and Lybrand (Chartered Accountants) be reappointed Auditors of the Association and that their fee for 1975 be £450. This was seconded by Mr G. Hutchinson and carried unanimously.

Vote of Thanks to retiring President

In proposing the vote of thanks to the retiring President, Mr P. J. Gay (President 1959-61) acknowledged the very great contribution which Mr Silver had made to the Association at a most difficult time in its history. All organisations meet crises at some time in their history and the President had to face many difficulties but the turning point in the Association's fortunes seemed to have been reached and this was due in no small measure to Mr Silver's efforts. He then formally moved the vote of thanks, which was carried unanimously and with acclamation. The President thanked Mr Gay for the kind way in which he had proposed the vote of thanks and the members for the way in which they had received it.

Vote of Thanks to retiring Council Members

The President called upon Mr K. R. W. Chitty to propose a vote of thanks to those members retiring from Council and not serving in another capacity in the forthcoming session. On behalf of the members Mr Chitty proposed a vote of thanks to all those members, both at home and overseas, who had given so willingly of their service. He wished to make a special mention of the retiring Honorary Research & Development Officer, Mr A. R. H. Tawn, who had served for six years, had thus organised the technical sessions for three Conferences and had previously served as Honorary Editor. He wished also to bring particular attention to the work of the retiring Vice-President, Mr T. W. Slinn, in furthering the aims of the Association in New Zealand and Miss P. Magee, who had served as the Irish Section's Representative and it was hoped that she would soon return to Council as the second lady member to be elected to the Chair of a Section.

The vote of thanks was then carried with acclamation.

Vote of Thanks to Honorary Officers of the Association

Mr D. E. Hopper, in proposing a vote of thanks to the Honorary Officers of the Association, wished to associate himself with the remarks made by Mr Chitty in respect of the work carried out by the retiring Honorary Research & Development Officer, Mr A. R. H. Tawn. He also felt that members would wish to show their appreciation of the excellent work carried out for the past six years by the Honorary Editor, Mr S. R. Finn and the Honorary Treasurer, Mr F. Cooper, who had served for five years during a difficult period for the Association's finances. The Honorary Secretary, Mr D. J. Morris, had now completed his first year of office and members would not only wish to thank him for his work on their behalf but also to wish him a speedy recovery from the anxiety caused him by his recent car accident.

The vote of thanks was carried with acclamation.

Vote of Thanks to the Director and Secretary

The President stated that, although the item did not appear on the agenda, the members would wish him to thank the Director & Secretary and his depleted staff for their strenuous efforts in keeping the Association in the forefront of the scientific and technological societies during the most adverse conditions. The vote of thanks was carried with acclamation.

Any other competent business

Mr R. L. J. Morris, whilst appreciating that membership subscriptions were bound to increase in a period of inflation, asked if consideration could be given to grading these according to age not only for Registered Students as at present but for the group who had completed the time as Registered Students to the age of possibly 33. The President thanked Mr Morris for his suggestion and promised that it would be examined by the relevant committee. There being no other competent business, the President thanked members for their attendance and declared the meeting closed at 2.42 p.m.

Review

Plastics Materials

By J. A. Brydson

London: Newnes-Butterworths, 1975, 3rd Edition. Pp. 731. Price £13.75

This welcomed third edition of the textbook of plastics materials by Brydson has now been published. The subject has been brought well up to date and the original editions have required appreciable extension owing to the wide advances in this field. The chemistry and physics of the materials are first considered and, to a limited extent, processing. The main chapters of the work are devoted to the various polymer types including those of recent development. Original and bibliographical references are given at the end of each chapter. This is an essential reference work for any polymer laboratory.

L. A. O'NEILL

Information Received

Cathodic protection

A corrosion protection study of North Sea steel structure is now under way at the Sintef corrosion centre, Trondheim, Norway. The three-year project, started in January 1975, has been initiated and planned by Sintef and is being supported by the Occidental Group, Elf-Norge, Norsk Hydro, Statoil, Scanpet and Kvaerner Engineering; part of the study will involve co-operation with the Corrosion and Protection Centre at the University of Manchester Institute of Science and Technology.

New BASF plant to produce component for wire coating lacquers

Construction has begun at BASF Antwerp on a new plant for the production of tris-(2-hydroxyethyl)-isocyanurate (THEIC), an important component for wire coating lacquers, which has exceptional heat resisting properties. The plant will have an annual capacity of 3 000 tonnes and is scheduled to go on stream in mid-1976. It operates using a BASF process which has already been proved in a pilot plant at Ludwigshafen.

Scado to build second factory in Schoonebeek

Scado BV is soon to start building a plant on its Schoonebeek site for the production of resins for powder coating systems and water dispersible resins. Part of the plant will be operational in 1976 and it is expected that the entire unit will be complete by the end of 1977. This will give an increase in capacity of 10 000 tonnes and it is expected that the new plant will employ 35 to 40 people.

William Boulton Group opens Brussels office

The William Boulton Group, manufacturer of plant and machinery for the ceramic, chemical, food and process industries, has announced the opening of its European Marketing Office at 497 Avenue Louise, Brussels, Belgium—a few minutes walk from the headquarters of the European Economic Community. Whilst the William Boulton Group had been a successful exporter to both Western and Eastern Europe for many years, it was hoped that the opening of the office in Brussels would serve further to promote sales in Europe and assist and co-ordinate the group's European activities.

New products

Aluminium paste pigments

Micro Particles Limited, Newbury, Berks is currently offering eight grades of aluminium paste pigments. These pigments all conform to the British Standard 388:1972, as well as ISO/R/1246. In particular, the company is able to produce pastes based 100 per cent on aromatic solvent.

New range of water dispersible paint resins from SRL

As part of a continuous development programme to produce resins for paint manufacture which exhibit high flash points, Synthetic Resins Limited, Speke, Liverpool, has introduced a new range of water dispersible resins.

To be known under the brand name o "Uradil", the new range at present consists of six resins: two alkyds, two acrylics and two oil-free polyesters.

These resins enable manufacturers to produce paints with flash points in excess of 32°C thus complying with 1973 "Flammable Liquid Regulations".

New Tioxide pigment for plastics

Tioxide International has announced a new hihgly dispersible durable pigment for plastics "Tioxide R-MC". The "MC" stands for medium crystal, in contrast to the established R-FC grade which is a fine crystal pigment.

R-MC is described in BTP report 184 and the main fields of application are expected to be in rigid PVCl window frames, exterior cladding and other building products.

Styrenated shellac polymer from BCPC

British Chemical Products and Colours Limited is now able to offer a further styrenated shellac polymer "J-PRYL P-200" on behalf of Ionac Chemical Company, New Jersey. J-PRYL P-200 is a carboxylated styrene polymer formulated in a fine particle size specifically for aqueous flexographic ink and coating systems. In conjunction with this range of styrenated shellac polymers, there is also available J-PRYL W-10 a high density polyethylene emulsion at 30 per cent solids. Full technical literature and samples together with suggested starting point formulations for inks and coatings is available from British Chemical Products and Colours Limited, Buckingham Street, London.

Technical advances in ethyl zinc silicates for the structural, marine and offshore industries

Metalife International has announced the launching of "Metalife 2ZS" a new formulation which has advantages over conventional ethyl silicates, the most important being that the microfine zinc powders are incorporated in the specially balanced solvent blend at the manufacturing stage. This new technique, based on over 20 years' experience of suspending zinc powders in both organic and non-organic media at the Metalife Research and Development Centre, has produced a simpler, more positive and effective product. (Patents pending.)

The system "Spectrum 3", a joint development between Serck Controls and Hatra, which facilitates colour quality control and repetitive colour production. Differences between a standard colour and colour samples can be readily measured and past/fail decisions within customer's prescribed limits printed out in permanent record form

Literature

Beetle isobutylated amino coating resins

The Chemicals Division of British Industrial Plastics has published a new twelve-page report presenting the latest information on its extensive range of "Beetle" isobutylated coating resins. The information provided will facilitate replacement of n-butylated urea and melamine resins by their more economical isobutylated counterparts. In addition the information allows properties, such as solids/viscosity relationships and reactivity, to be accurately predicted.

Between press and paper

Kunstharsfabriek Synthese BV has issued a loose-leaf publication entitled "Between press and paper". Topics covered include the distinction between liquid and fatty inks, their specific areas of application and the influence of the printing ink resin on the quality of the graphic industry's output. The company states that this is a unique reference book and wishes to supply it to all those involved in ink making.

RCL technical service reports

In order to make all customers aware of the work being carried out in its technical services department, the Resinous Chemicals Division of Berger Chemicals will be issuing from time to time technical service reports describing programmes of evaluation and product developments. The reports will be known as "Solutions" and will be issued as and when the company feels it has interesting information to pass to its customers. The first publication of "Solutions" is Technical Service Report No. 1 and deals with "New developments in low flammable quick drying coatings". Copies are available from RCL, Portland Road, Newcastle upon Tyne NE2 1BL.

UK chemical industry statistics

The seventh revised edition of the Chemical Industries Association Limited handbook "UK Chemical Industry Statistics Handbook 1975" is now available.

Courses, symposia etc.

Instrumental colorant formulation

The Inter-Society Color Council is organising a special technical conference entitled "Instrumental colour formulations—1976" to be held at Williamsburg, Virginia, USA, from 25 to 28 January 1976.

Paint selection, application and inspection

A two-day course specifically designed to appeal to the non-specialist and particularly to those who in the course of their work have to deal with paint selection and paint specifications and painting contractors, is being organised by the Midland Branch of the Institution of Corrosion Science and Technology. The course is being held on 14 and 15 October 1975 and further information may be obtained from Mr D. Norman, the Institution of Corrosion Science and Technology, c/o The British Gas Corporation, Hinckley Operational Centre, Hinckley, Leicestershire.

New developments in impact testing

The Polymer Properties Group of the Plastics and Rubber Institute is organising a meeting entitled "New developments in impact testing" to be held at the Scientific Societies Lecture Theatre, Fortress House, 23 Saville Row, London on Tuesday 2 December 1975. There will be two sessions: one will examine developments in machinery used in impact testing; the other will consider advances made in material evaluation.

Process plant operation

The Advisory Committee for Chemical Plant Operation of the City and Guilds of London Institute are developing a scheme for courses and examinations to replace that of 060—Chemical Plant Operation. The new scheme, for which the Part I Examination will first be offered in 1976, is designed as an introduction to the process industries in general and to plant operation in particular and is intended to range over a wider field than the chemical industry, to which the previous scheme was restricted.

Printing machines and ink transference

The Technical Training Board of the British Printing Ink and Roller Making Industries has announced that its annual lecture will be presented by Mr P. Ogden on Monday 6 October at 6.15 p.m. at the Royal Institution, Albermarle Street, London. Entrance is by ticket available from the Society of British Printing Ink Manufacturers, Alembic House, 93 Albert Embankment, London SE1 7TU.

Solid state physics and polymer science

The Department of Physics at Sir John Cass School of Science and Technology, City of London Polytechnic, is running two part-time MSc degree courses "Optical and dielectric polymer science" and "Solid state physics with special reference to surfaces and thin films", which may be attended for degree courses or purely for interest's sake without registering for the degree.

Section Proceedings

Wellington

Fatty acids and their use in surface coatings

Dr G. Bermingham, Sales Director of Victor Wolf Limited, spoke to 32 members at ICI House on 10 April about the utilisation of fatty acids in the modern surface coatings industry.

The distilled fatty acids first used industrially in the 1930s for soap making were shown to be superior in some respects to oil. No real headway had been made with surface coatings, however, until the outbreak of war made glycerol (normally lost from oils) a valuable raw material. As a result of this, the need arose to produce alkyd resins from fatty acids rather than oils.

In the 1950s castor oil had been investigated and it was shown that dehydrated castor oil containing up to 66 per cent conjugated linoleic acid could be produced and was an excellent base material for alkyd resins. Because of a shortage of tall oil, which contained major proportions of linoleic acid, a similar investigation to the above was carried out using instead of castor oil, soya bean oil, and some excellent linoleic and rich materials were now available. The stearic acid must be removed and there were available fatty acid fractions containing as little as 5 per cent of the stearic component. This was still considered by some, however, to be the main disadvantage of soya bean fatty acids.

Dr Bermingham pointed out some of the advantages of using fatty acid, which included:

1. More flexible formulation, much more predictable chemistry and quality. A wider range of polyols can be used.
2. "Water white" non-yellowing alkyds result.
3. No glycerol present to affect film properties. If any glycerol is needed, then the exact amount can be added.
4. Drying time improved, harder films formed and hence better gloss.
5. Shorter process times.
6. Copolymer formation through the Diels Alder reaction to yield water soluble resins.

From the above the main applications for fatty acids were shown to be:

1. High quality industrial alkyd finishes.
2. Epoxy esters for high chemical resistance.
3. Water reducible epoxy esters for dip or electrocoat primers.

The lecture was followed by many questions and these were very ably answered by Dr Bermingham. The meeting closed at 8.45 p.m. after a vote of thanks from Mr O. W. Brett.

L.H.O.

Thames Valley

Protection of off-shore oil rigs

It has been brought to the attention of the editor that a mistake has occurred on page 184 of the May 1975 issue where Mr Dunkley is described as Technical Director of the British Inspection Engineering Company. Mr Dunkley is, in fact, Technical Director of BIE (Anti-Corrosion) Limited, a member company of the British Inspecting Engineers Group. We apologise for any inconvenience caused.

OCCA-28 Exhibition

Alexandra Palace, London. 23-26 March 1976

The target for 1976!

The international forum for technical display and discussion in the surface coating industries

New arrangements for OCCA-28

The Exhibition Committee has decided that the Twenty-eighth Annual Exhibition of raw materials, plant and equipment for the paint, printing ink, colour and allied industries organised by the Association will take place at Alexandra Palace, London N22 from 23 to 26 March 1976.

Alexandra Palace was the venue for the Exhibitions held by the Association from 1965 to 1969 and has many attractive features as the venue for this unique Exhibition. Alexandra Palace occupies a commanding position high on the North London hills and is less than two miles from the North Circular Road. Since the Association's last Exhibition at Alexandra Palace, travel arrangements have been improved by the addition of the Victoria Line to the Underground system, which now links Victoria Station to the Piccadilly Line at Finsbury Park. The building of the extension of the Piccadilly Line from Hounslow to the Airport terminal at Heathrow is now well advanced and when this is completed in due course it will give a direct link with Turnpike Lane Station on the Piccadilly Line. In the meantime, a bus service operates from Heathrow Airport to Houslow West Station, at present the terminal station on the Piccadilly Line. Those travelling by the Piccadilly line should alight at Turnpike Lane Station and the Association will be running a bus shuttle service from this station to and from Alexandra Palace. The journey from central London to Turnpike Lane takes approximately 18 minutes.

Visitors who prefer to travel from Heathrow to the West London Air Terminal in order to leave their luggage at Hotels before travelling to Alexandra Palace can board Piccadilly Line trains at Gloucester Road Station. A map will be included in the *Official Guide* showing the connections between the main line stations and the Piccadilly Line and also showing the link with the North Circular Road.

For those travelling by car from the Midlands or the North, the motorway system now links with the North Circular Road, from which Alexandra Palace is easily accessible; there will be ample free car parking space available at Alexandra Palace. The Exhibition will be open on four days commencing on the Tuesday morning at 09.30 a.m. and closing on the Friday at 16.00. There are two restaurants with full dining facilities together with a cafeteria and several bars.

Motif of the Exhibition

The motif for 1976, designed by Robert Hamblin, continues the theme of the last two Exhibitions—in which attention was drawn to the heavy participation by exhibitors and visitors from overseas—by showing the target for 1976 as London, where all the previous Association annual Exhibitions have been held. The colours of the motif this year are those associated with an archery target and these colours will be carried throughout the publicity leading to the Exhibition. Two of them will be incorporated on the facias of the stands—the blue colour from North to South and the yellow colour from East to West. As in previous years, this will give the Exhibition both an entity in design and will afford pleasing differences in colour as visitors move from corridor to corridor.

Invitation to Exhibit

Copies of the Invitation to Exhibit have been despatched to companies and organisations in the United Kingdom and overseas which have shown at previous OCCA Exhibitions or have requested information for the first time for the 1976 Exhibition. Completed application forms for stand space must be returned to the Director & Secretary of the Association not later than **Wednesday 1 October 1975.**

Since it was the overwhelming decision of the British people (in a Referendum held in June 1975) that the UK should remain a member of the European Economic Community, it is expected that even more European based firms will participate in this Exhibition, but any organisation in any part of the world wishing to exhibit should write immediately for details to the Director & Secretary of the Association since exhibitors and visitors alike are welcomed from all countries.

Any organisation which has not previously exhibited and wishes to obtain an Invitation to Exhibit should contact the Association's offices immediately.

International forum

At OCCA-XXVII in April 1975 there were direct exhibits from 15 countries. Listed in the *Official Guide* were over 150 companies, many of whom were overseas companies showing through British associates. The full review of this important Exhibition appeared in the June issue of this *Journal* and the Committee emphasises that the Exhibition affords a splendid opportunity annually for the technical display of information and a unique forum for informal discussion between suppliers and manufacturers.

Technical education stand

In continuance of its interest in the educational field, the Association will once more provide a stand devoted to technical education, at which details of courses at technical colleges will be available as well as information on the optional Professional Grade for Ordinary Members, introduced in September 1971, which has attracted widespread interest and support.

Information in foreign languages

As in previous years, the Association will be circulating information leaflets in six languages, which will contain application forms for those wishing to purchase copies of the *Official Guide* and season admission tickets before the Exhibition.

"Official Guide"

This unique publication will contain descriptions of all exhibits and advertising space is available both to exhibitors and those organisations not able to show at the 1976 Exhibition. As in previous years, the *Official Guide* will be published several weeks in advance of the Exhibition so that intending visitors can obtain copies and plan their itineraries.

For the 1975 Exhibition, it was decided that a small charge should be made both for the *Official Guide* and for season admission tickets to the Exhibition. This policy undoubtedly prevented casual visitors who might otherwise be attracted to exhibitions for which no admission charge was made and who gathered quantities of technical literature from the stands. The innovation was welcomed by many exhibitors and in no way acted as a deterrent to visitors to this Exhibition. It is envisaged that a similar charge will be made for the *Official Guide* to OCCA-28.

Each Member of the Association, at home and abroad, will be sent a copy of the "Official Guide" and free season admission ticket.

As for the 1976 Exhibition, copies of the *Official Guide* and season admission tickets will be available several weeks in advance of the Exhibition (*pre-payment only*) from the Association's office and they will also be available for purchase at the entrance to the Exhibition Hall.

Full details of advertising in this publication, the basic rates for which are the same as for the *Journal*, can be obtained from the Association's offices.

OCCA Conference Diary

The Association returned to Scarborough this year to hold its Biennial Conference from 17 to 21 June at the Grand Hotel, which was the headquarters for the Conference, the other hotel used for accommodation being the St. Nicholas Hotel. The occasion was a truly international one with delegates attending from the UK and eleven overseas countries.

There were seventeen papers presented in five technical sessions. The topics proved to be of great interest and lively discussions followed every presentation; in fact such was the enthusiasm generated that every session Chairman found it necessary to curtail the discussions prematurely to fit all the papers into the time allowed. There were sessions in both the mornings and afternoons of the first two days and in the morning of the third day; all of these were very well attended. Following the AGM, there were three workshop sessions in the afternoon on the final day and these also proved to be of great interest.

The comprehensive social arrangements made for delegates and their ladies has always been a feature of OCCA Conferences and the coach tours to the surrounding area, social functions and other events proved once again to be very popular. These social activities, the interest generated by lecturers and others during the technical sessions, and fine weather and true Yorkshire hospitality throughout the week ensured that everyone was kept happily occupied and made this one of the most successful Conferences which the Association has organised.

Tuesday 17 June

The first function of the Conference was the reception held by the President together with the Honorary Officers and the Director & Secretary for overseas members and visitors before dinner.

Delegates from Denmark, France, Finland, Germany, Japan, Netherlands, Norway, Sweden, Switzerland, USA and Yugoslavia had registered for the Conference and the Association was pleased to have present at the overseas reception representatives from the other three Societies of the international alliance: Mr J. C. Leslie (President of FSCT), Mr L. O. Portin (President of SLF) and Mr J. Roire (President of FATIPEC). After dinner the Honorary Research and Development Officer, Mr A. R. H. Tawn, gathered together the lecturers and Chairmen of sessions and convenors of workshop sessions to discuss the way in which the technical part of the Conference should be conducted.

Meetings were also held to organise the golf, tennis and table tennis tournaments and thanks are due to Mr A. A. Duell (golf) Mr D. E. Hopper (table tennis) and Mr A. Laws (tennis), whose hard work made these events both successful and enjoyable.

Wednesday 18 June

At 9.30 a.m. the President declared the Conference open and handed over to the Honorary Research and Development Officer (who had arranged the papers for the Conference) and acted as Chairman of the first technical session.

Papers from the Conference, together with the ensuing discussions, will be published in the *Journal* later this year and no attempt at reportage will be made here. It must be noted, however, that the discussions following the papers were both lively and long, reflecting the interest aroused by the speakers. Compliments are due both to the contributors to the discussions and to the Chairmen who encouraged, controlled and in many cases closed the discussions in a prudent and tactful manner.

After the first technical session, the President and Mrs Silver welcomed all those attending the Conference at an informal reception before lunch.

In the afternoon, the ladies toured the neighbouring villages of Malton, Hovingham and Helmsley and also visited Rievaulx Abbey, Kirby Moorside and Brompton. Three papers were presented at the second technical session held that afternoon chaired by Mr G. H. Hutchinson, a former Chairman of the Eastern Branch of the Scottish Section.

In the evening the Mayor of Scarborough, Councillor A. Harvard Baker, FRCS and the Mayoress welcomed delegates at a Civic Reception, which was followed by dancing until midnight.

Lecturers, Session Chairmen and Chairmen of Workshop Sessions are shown above grouped around Mr A. R. H. Tawn (Honorary Research & Development Officer) and Mr L. H. Silver (President). On Mr Tawn's right is Mr S. R. Finn (Hon. Editor), and on Mr Silver's left is Mr A. T. S. Rudram (President Designate)

Thursday 19 June

Dr G. de W. Anderson, Director of the Paint Research Association, chaired the technical session on Thursday morning, when four papers were presented.

For the ladies there was a coach trip to Ayton, Thornton-le-Dale and Pickering, travelling by the North Yorkshire Moors Railway to Grosmont and returning via Ryswarp and Robin Hoods Bay. In the afternoon a further technical session was held chaired by Mr A. G. Holt, a Vice-President of the Association, when three papers were presented.

After dinner delegates who wished were able to join a party visiting the Futurist Theatre for its Variety show starring Danny La Rue.

Friday 20 June

The final technical session of the Conference was chaired by Mr A. T. S. Rudram, President Designate. Three papers were presented and the Chairman then invited delegates to join in a general forum discussion to deal at greater length with any of the points which had arisen during the week. Once again a lively discussion followed and this eventually had to be cut short to keep within the schedule and allow delegates to lunch before the Annual General Meeting of the Association in the afternoon.

The Association would like to thank Mr S. R. Finn who helped at all technical sessions by distributing the microphone and question forms for the discussions.

The Annual General Meeting was held at 2.15 p.m. and a full report appears elsewhere in this issue.

The three workshop sessions—"How can we control over specification?" (convenor: Mr K. J. Day) "What is the reality of toxic hazards for the surface coatings manufacturer?" (convenor: Mr H. G. Cook) and "The impact of non-impression processes on the printing ink industry" (convenor: Mr P. Fink-Jensen)—were held after the Annual General Meeting. The Association's policy not to record the proceedings in order to foster a freer interchange of ideas was proved successful once again and Council thanks each convenor for his help.

The evening saw the final event of the Conference, the Association's Dinner and Dance, held at the Grand Hotel. Prior to the Dinner, the guests were received by the President (Mr L. H. Silver) and Mrs Silver, together with the Mayor and Mayoress of Scarborough. The Federation's President, Mr J. C. Leslie and his lady having had to return to America earlier in the Conference to attend the wedding of their first daughter the following Saturday, Mr S. L. Davidson (a Past President) represented the Federation of Societies for Coatings Technology. After the dinner, and following the Loyal Toast by the President, the Toast to the Association was proposed by Mr L. O. Portin, President of SLF, who drew attention to the close relations between the four societies: OCCA, the FSCT, FATIPEC and the Scandinavian Society. OCCA was to be congratulated not only for its splendid Conferences, but also the annual technical

Representatives from the four member societies of the international alliance. From left to right: Mr L. O. Portin (President, SLF), Mrs Portin, Mr J. Roire (President, FATIPEC), Mrs Silver, Mr L. H. Silver (President, OCCA) Mrs Leslie, Mr J. C. Leslie (President, FSCT), Mrs Rudram, Mr A. T. S. Rudram (President Designate, OCCA)

The President, Mr Silver, the Mayor of Scarborough, Councillor A. Harvard Baker, Mrs Silver, and the Mayoress

Exhibition and monthly Journal, both of which attracted world-wide interest and which were a credit to the paint industry and to British enterprise. He extended his best wishes for these in the future and also extended an invitation to those present to attend the SLF Conference in Helsinki 29 September-1 October 1976.

The President replying on behalf of the Association thanked Mr Portin for his congratulatory remarks. He welcomed delegates, lecturers and Chairmen of sessions and thanked them for their work in running the Conference and also the retiring Honorary Research and Development Officer, Mr A. R. H. Tawn. He welcomed the Mayor and Mayoress, and thanked the Borough for the Civic reception which it had provided on the Wednesday of the Conference.He extended a welcome to the ladies, who added grace and charm to the occasion and then proposed a toast to the Mayor and Mayoress and to the Association's other guests.

In his reply Councillor A. Harvard Baker, Mayor of Scarborough, extended

the thanks of all the guests and ladies for the hospitality shown by the Association at the Dinner. He was impressed by the large number of overseas guests, there being eleven overseas countries represented, and this was a tribute to the high standing of the Association. As the President had remarked on an earlier occasion, it was also particularly relevant since this was "International Week" in Scarborough.

Following Councillor Baker's speech the presentation of the Presidential Insignia to Mr A. T. S. Rudram, who had been elected President of the Association at its Annual General Meeting that afternoon, took place. Mr Silver, investing Mr Rudram, used the traditional form of words:

Arthur Thomas Stephen Rudram, in accordance with the resolution passed at the Annual General Meeting this afternoon, it is now my duty to invest you with the insignia as President of this Association and I charge you to guard well the interests of our Association at all times and to uphold the dignity of our high office.

Mr Rudram then presented Mr Silver with his Past President's medallion engraved with his years of office and paid tribute to the fine way in which he had carried out his duties during his time as President. In this, of course, he had been ably supported by Mrs Silver. Mr Rudram thanked Mrs Silver for her work as President's Lady particularly in her visits to the various functions of the Sections of the Association, both in this country and overseas, where she had charmed everyone.

Mr Rudram explained that, in recognition of the considerable part which she had played in helping the President during his term of office, a hostess trolley—the gift of her choice—had earlier been presented to Mrs Silver on behalf of the Association.

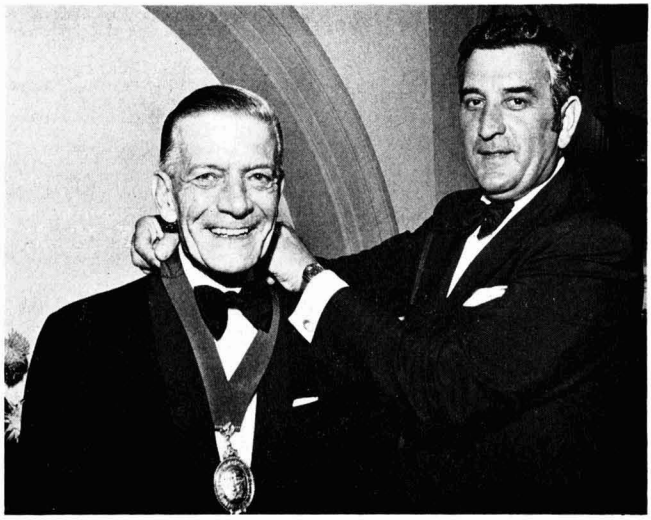
Mrs Silver thanked Mr Rudram and members of the Association for their kindness in making this presentation. She had very much enjoyed visiting the Sections of the Association and meeting so many members and their ladies and would treasure the gift in the years to come as a happy momento of this time.

Following the speeches the top table party left the dining room and the assembled company made their way to the ballroom for the dance.

Later that evening the new President's Lady presented the prizes for the various tournaments and thanked the three members who had organised the tournaments—Mr Duell, Mr Hopper and Mr Laws. The winners were—*Golf:* Mr Arthur Duell (The Sam Sharp Golf trophy, replica and sweep). *Men's tennis:* Mr Alan Laws. *Men's table-tennis:* Mr Cyril Williams. *Ladies' table-tennis:* Dr Marianne Ellinger.

Saturday 21 June

Saturday saw the dispersal of delegates. Once again the verdict was that an enjoyable and successful Conference had been held.



Mr Silver presents Mr Rudram with the Presidential Insignia of Office . . .

. . . and receives his Past-President's medallion

Reunion Dinner for past and present members of Council

Following the successful innovation in 1973 of a Reunion Dinner for those members who have served on Council at any time, Council has decided to hold a similar event this year. The Dinner will take place on Wednesday 15 October 1975 at the Rugby Club, 49 Hallam Street, Portland Place, London W1N 5LJ, at 6.30 for 7.00 p.m., and informal dress will be worn.

The price of the ticket, for the dinner and wine, will be £7.00 (inclusive of VAT), and a cash bar will be provided at the reception and after the dinner. Past Presidents, Past Honorary Officers, Honorary Members and Founder Member have been invited as guests of the Association. All other past and present Members of Council must send the necessary remittance with their completed application form. Any member with service on Council who has not received an application form and wishes to do so should write to the Director & Secretary at the Association's offices.

Section Programmes for 1975-76 Session

Main Association Events

1975

Wednesday 15 October Reunion Dinner for past and present members of Council. The Rugby Club, Hallam Street, London W1. 6.30 for 7.00 p.m. Informal dress.

1976

Tuesday 23—Friday 26 March

OCCA-28 Technical Exhibition, to be held at Alexandra Palace, London N22

Friday 14 May Dinner and Dance at the Savoy Hotel, London.

Friday 25 June Annual General Meeting. 3.00 p.m. at the Crown Hotel, Harrogate, Yorks.

Bristol

Unless otherwise stated, all meetings will be held at the Royal Hotel, Bristol, at 7.15 p.m.

1975

Friday 26 September "English Silver" by Miss E. C. Witt of the Bristol City Museum and Art Gallery. *Ladies' Evening.*

Friday 31 October "Gloss paints: water thinned or solvent thinned?" by Mr D. G. Dowling of Berger Paints.

Friday 21 November "The Health and Safety at Work Act" by Mr J. F. Alcock, H.M. District Inspector of Factories.

1976

Friday 30 January "Modern techniques of wood preservation and protection" by Mr R. E. Hambling of Cuprinol Ltd.

Friday 27 February *Lecture to be arranged.*

Friday 26 March "The bulk handling of pigments" by Mr D. Read of Laporte Industries Ltd.

Friday 2 April Annual Dinner Dance at the Mayfair Suite, New Bristol Centre.

Friday 30 April Annual General Meeting.

Hull

Unless otherwise stated, the meetings will be held at the George Hotel, Land of Green Ginger, Hull, at 6.30 p.m.

1975

Friday 3 October Annual Dinner/Dance to be held at the Willerby Manor Hotel, Willerby, Nr. Hull.

Monday 6 October "Polyesters for boat building, tank storage and chemical engineering" by a speaker from Scott Bader Ltd. Joint meeting with the Institution of Chemical Engineers at the Haven Inn, Barrow Haven, Lincs.

Monday 3 November "The factory inspector and industry: partnership is preferable to imposition" by R. V. Souter of HM Factory Inspectorate.

Monday 1 December "Paint exports" by Mr L. H. Silver, Silver Paint and Lacquer Group.

1976

Monday 5 January "High solids, water reducible aminoplast cross-linkers for modern coating systems" by M. M. Donnez, Monsanto, Europe.

Monday 2 February "Water thinned gloss paints" by Dr K. Sellars, Harlow Chemical Co. Ltd.

Monday 16 February "The use of microvoids as pigments" by a speaker from Tioxide International. *Venue to be announced.*

Monday 1 March "Lapidary" by Mr J. Hale of Kingston Lapidary Society. *Ladies' Evening.*

Irish

All meetings at the Clarence Hotel, Dublin at 8.00 p.m. unless otherwise stated.

1975

Friday 19 September "Management lecture" by Mr P. Rock, Irish Management Institute.

Friday 17 October "Fuel economy" by Mr S. W. Carroll, Institute for Industrial Research and Standards.

Friday 21 November Annual Dinner Dance, Clarence Hotel at 8.30 p.m.

Friday 5 December "Car coatings" by Mr A. C. Patrick, Fords of Cork.

1976

Friday 16 January Ladies' Night, Fashion film—Cheese & wine tasting.

Friday 20 February "High solids material" by Mr D. Faulkner, Rohm & Haas (UK) Ltd.

Friday 19 March "Adhesives" by Mr J. E. Reid, Evode Industries Ltd.

Friday 16 April Annual General Meeting.

London

Unless otherwise stated, all meetings will be held at the Imperial College of Science & Technology, Prince Consort Road, Kensington SW7, at 7.00 p.m.

1975

Thursday 25 September "North sea oil and gas—its effect on industry." *Chairman's Evening.*

Thursday 16 October "The coatings industry in a changing world" by Dr H. Wittcoff, Prof. of Chemistry, University of Minnesota and Special Adviser to General Mills Chemical Inc. *Afternoon Meeting: lecture commencing at 2.30 p.m.*

Friday 24 October Ladies' Evening at the Piccadilly Hotel, London W1.

Wednesday 19 November "Decoration of plastics"' One-day joint symposium with the Kent Sub-Section of the Plastics and Rubber Institute, to be held at and in association with Thames Polytechnic, Woolwich, commencing at 9.30 a.m.

1976

Monday 19 January "Applications for cellulose ethers in paint manufacture" by Dr V. Knittell, of Kalle Wiesbaden, W. Germany, at East Ham College of Technology, High Street, London E6, commencing at 7.00 p.m.

Wednesday 18 February "Health and safety". One-day symposium to be held at and in association with Thames Polytechnic, Woolwich, commencing at 9.30 a.m.

Wednesday 12 March "Printing ink and paper." One-day symposium at Surrey University, Guildford, commencing at 9.30 a.m.

Thursday 22 April Annual General Meeting, to be followed by a talk on "The restoration of Elizabethan buildings" by Dr R. J. Ceresa of the South Bank Polytechnic.

Manchester

Unless otherwise stated, all meetings will be held at Manchester Literary and Philosophical Society, George Street, Manchester, at 6.30 p.m.

1975

Friday 10 October "Handling of powders and pigments in bulk" by Dr N. Harnby, School of Chemical Engineering, University of Bradford.

Friday 24 October 50th Anniversary Dinner/Dance, Piccadilly Hotel, Manchester.

Thursday 6 November 50th Anniversary Foundation Dinner, Midland Hotel, Manchester.

Thursday 3 November Ladies' Evening with Beauty Lecture at Last Drop, Bolton.

Monday 1 December "The highly flammable liquids regulations" by Mr D. V. Offord, HM Factory Inspectorate, Woodcourt Hotel, Brooklands Road, Sale, at 6.30 p.m.

1976

Friday 9 January "Masonry coatings" by Mr P. Whiteley, Building Research Establishment.

Wednesday 28 January "The formulation and manufacture of emulsions for the paint industry" by Mr K. R. Geddes, Crown Decorative Products Ltd. to be held at Manchester Literary & Philosophical Society at 4.30 p.m. *Student lecture.*

Friday 6 February "Smoke emission from polymer and paint films" by Mr K. A. Safe, Technical Service Manager, Paint and Building Industries, Vinyl Products Ltd., Woodcourt Hotel, Brooklands Road, Sale, at 6.30 p.m.

Wednesday 11 February "Acrylic emulsions in decorative and industrial coatings" by Mr J. H. Sparrow, Rohm & Haas (UK) Ltd. at Manchester Literary & Philosophical Society at 4.30 p.m. *Student lecture.*

Monday 1 March "Paper in relation to printing processes" by Mr A. Swan, Reed Engineering and Development Services Ltd., Woodcourt Hotel, Brooklands Road, Sale, at 6.30 p.m. Joint lecture with Institute of Printing.

6 and 7 April Symposium at UMIST. *Details to be announced.*

Friday 9 April Annual General Meeting. *Venue to be announced.*

Midlands

Unless otherwise stated, all meetings will be held at the Apollo Motel, Hagley Road, Edgbaston, B15, at 6.30 p.m.

1975

Friday 19 September Ladies' Night to be held at Botanical Gardens, Edgbaston B15, at 7.00 p.m. for 7.30 p.m.

Friday 26 September "The elements of product coating" by Mr B. Mickie of Carrs Paints.

Friday 17 October "The coatings industry in a changing world" by Dr H. Witcoff of General Mills*.

Friday 21 November "The outworker" by Mr D. E. Hopper of Ludford Enamelling. *Student lecture.*

1976

Friday 16 January "Corrosion—the supplier's problems" by Mr A. Claxton of Inmont and "The user's problems" by Mr F. Timmins of British Rail to be held at Birmingham Chamber of Commerce and Industry, Harborne Road, Edgbaston B15, at 6.30 for 7.00 p.m. *Dinner lecture.*

Thursday 19 February "Titanium pigments developments". *Details to be announced.*

Friday 19 March "Newton-Friend" Lecture—Ladies' invitation. Halesowen College of Catering. *Speaker and time to be announced.*

Friday 23 April Annual General Meeting. *Venue and time to be announced.*

Trent Valley Branch

Unless otherwise stated, all meetings will be held at 7.00 p.m. at the Crest Hotel, Pastures Hill, Littleover, Derby.

1975

Thursday 9 October "Lead chromes, their present uses and future trends with particular emphasis on recent regulations" by R. M. W. W. Wilson of SCC Colours, London.

Friday 30 October Halloween Dance at Cross Keys Inn, Turnditch, at 7.30 p.m.

Thursday 13 November Joint Meeting with Society of Dyers and Colourists. *Subject and venue to be arranged.*

1976

Friday 16 January *See* Midlands Section programme.

Thursday 12 February "Non-toxic replacement for mercury in fungicidals". *Speaker to be announced.*

Thursday 11 March "Powder coatings" by Mr S. T. Harris of Midland Speciality Coatings Ltd., Bilston, Staffs.

Friday 9 **April** Annual General Meeting, followed by Buffet Dance at Cross Keys Inn, Turnditch, at 7.30 p.m.

Newcastle

All meetings, with the exception of the Annual General Meeting, will take place at the Royal Turks Head Hotel, Newcastle upon Tyne, at 6.30 p.m.

1975

Thursday 2 October "Recent developments in organic pigments" by Dr E. R. Inman, Ciba-Geigy (UK) Limited.

Thursday 6 November "Industrial applications of organic titanates" by Dr P. D. Kay, Titanium Intermediates Ltd.

Thursday 4 December "High solids, water reducible aminoplast cross-linkers for modern coating systems" by Dr M. Donnez, Monsanto, Europe.

1976

Thursday 8 January "Biodeterioration of paints" by Mr C. N. Finlay, Nuodex Ltd.

Thursday 5 February "Planning" by Mr J. A. Willey, Berger, Jenson & Nicholson Ltd.

Thursday 4 March "New developments in antifoulings" by Dr Christie, International Paint Co. Ltd.

Thursday 2 April Annual General Meeting.

Scottish

Unless otherwise stated, all meetings will be held at the Beacons Hotel, 7 Park Terrace, Glasgow, at 6.00 p.m.

1975

Thursday 16 October "The Health and Safety at Work Act" by Mr F. Hyland, HM Factory Inspectorate.

November Joint Meeting with Society of Dyers and Colourists. *Details to be announced.*

Thursday 11 December "Dispersion and flocculation of titanium dioxide" by Mr J. Rackham and Mr J. G. Balfour, Tioxide International Ltd.

1976

Friday 9 January Annual Dinner/Dance.

Thursday 15 January "Gloss emulsions" and "High performance decorative acrylic emulsions" by Mr G. Keith and Mr D. H. Kerrison, Rohm & Haas Ltd.

Thursday 12 February "Advances in water-based coatings for the printing and packaging industries" by Mr G. H. Hutchinson, Croda Inks, to be held at 7.30 p.m. in the Carlton Hotel, Edinburgh.

Thursday 11 March "The coatings technologist in a changing world" by Mr A. T. S. Rudram, Donald MacPherson Group Ltd.

Eastern Branch

Unless otherwise stated, all lectures will take place in the Carlton Hotel, North Bridge, Edinburgh, at 7.30 p.m.

1975

Saturday 4 October Joint meeting with the Scottish Student Group. *Subject to be announced.* The meeting will start at 10.30 a.m. in the Lady Nairn Hotel, Willowbrae Road, Edinburgh, followed by lunch and the annual skittles match.

Thursday 20 November "Dispersion machinery" by Mr R. Webster of J. C. Forbes Ltd.

Thursday 18 December "Antiquities" by Mr R. Snowdon. *Time and venue to be arranged.*

1976

Thursday 12 February Joint meeting with the Scottish Section. "Water-based inks" by Mr G. H. Hutchinson, Croda Inks Ltd.

Thursday 18 March Annual General Meeting followed by a film show, 7.00 p.m.

Student Group

Unless otherwise stated, meetings will be held at the Ciba-Geigy Site, Hawkhead Road, Paisley.

1975

Saturday 4 October Joint meeting with Eastern Branch and skittles match in Edinburgh.

Tuesday 11 November "Physical measurements of pigments" by Mr G. Murdoch of Ciba-Geigy.

Tuesday 9 December "Manufacture of explosives" by lecturer from the Royal Ordnance Factory, Bishopton.

1976

January Works visit to Tennent's Brewery.

Tuesday 10 February "Organic pigments" by lecturer from ICI.

Tuesday 9 March "Safety in the laboratory and factory". *Speaker to be announced.*

Thames Valley

Unless otherwise stated, all meetings will be held at the Beaconsfield Crest Motel (White Hart), Aylesbury End, Beaconsfield, Bucks at 6.30 p.m. for 7.00 p.m.

1975

Thursday 2 October "Safety: recent acts" by Mr R. E. L. Everett, Safety Officer, ICI Paints.

Thursday 6 November "Treatment and disposal of hazardous industrial wastes" by a speaker from Re-Chem International Ltd.

Thursday 4 December "A new approach to large batch milling" by Mr J. Jarvis and Mr R. Ward of Torrance Machinery Ltd.

***A summary of this lecture and short biography of the speaker will be published in the September issue.**

Section Programmes for 1975-76 Session—*Continued*

1976

Thursday 29 January "Packaging testing for hazardous goods" by Mr C. Swinbank, Packaging Co-ordinator, ICI Ltd.

Friday 6 February Buffet Dance at Great Fosters, Egham.

Thursday 26 February "Ink/paper relationships" by Dr A. A. Gamble, Fishburn Printing Inks.

Thursday 25 March "Waxes, etc" by a speaker from Johnsons Wax.

Thursday 8 April Annual General Meeting and talk (*to be announced*).

West Riding

Unless otherwise stated, all meetings will be held at The Griffin Hotel, Boar Lane, Leeds, commencing at 7.30 p.m.

1975

Thursday 4 September The OCCA Golf Tournament at the Pannal Golf Course, Harrogate.

Tuesday 9 September "Aspects of titanium dioxide durability and accelerated weathering techniques" by a speaker from Laporte Limited.

Tuesday 14 October "Gloss emulsion paints" by Dr Faulkner of Rohm & Haas (UK) Limited.

Tuesday 11 November "Prospects for surface coating resins in the European Market" by Mr C. Martin of Amoco Chemicals Europe.

Friday 28 November Dinner and Dance at the Crown Hotel, Harrogate.

Tuesday 9 December "Aluminium co-ordination complexes" by Mr J. H. W. Turner of Manchem Limited.

1976

Tuesday 13 January "Water based adhesives" by Dr K. Sellars of Harlow Chemical Company Ltd.

Tuesday 10 February "The role of pigment preparations in the surface coating industry" by Mr M. Cotton of Sandoz Products Limited.

Tuesday 9 March "Trade effluent control" by Mr D. A. Bailey of the Yorkshire Water Authority.

Tuesday 13 April Annual General Meeting.

May Luncheon Lecture; *date and venue to be announced.*

London Section

Annual General Meeting

The 37th Annual General Meeting of the Section was held on Friday 18 April 1975, at The Great Northern Hotel, Kings Cross.

Before the meeting proceeded, Members stood in silence for one minute, as a tribute to Mr L. O. Kekwick, a past Chairman and Treasurer of the Section, who died recently after a long illness.

In proposing the adoption of the annual report, Mr H. C. Worsdall, the Section Honorary Secretary, made reference to the problems of finding suitable meeting places in London for technical meetings. He reported that the Southern Branch of the Section had been closed due to lack of support. However, an Ontario Branch of the London Section had been formed and a Steering Committee formed to run this Branch. The report was seconded by Mr M. Hess and adopted unanimously.

Dr H. Hamburg presented the financial report and this was seconded by Mr Newnham and adopted unanimously.

The election of Chairman and Officers then took place. Mr R. H. E. Munn, the retiring Chairman, proposed Mr J. Tooke-Kirby as Section Chairman. This was seconded by Mr H. A. Hipwood and unanimously accepted. Mr J. Tooke-Kirby made a short speech of thanks and thanked Mr Munn for all his work and efforts for the Section over the past two years as Chairman and for five years as Secretary. He also thanked Dr Hamburg who was retiring as Treasurer after seven years. Mr Tooke-Kirby presented both gentlemen with a small token from fellow committee members. Officers and Committee Members were elected (listed at the front of this issue).

Following the AGM, a buffet meal and film show were provided for members and their ladies. Three films were shown all dealing with Canada: Sheridan Park, Hello Toronto and Ontario Today.

Professional Grade

Admission

The following Ordinary Member was admitted as a Licentiate in the Professional Grade on 10 July:

Kofi Ohene-Kwadade (*General Overseas Section—Ghana.*)

Mr Ohene-Kwadade studied at the Polytechnic of the South Bank and obtained his Certificate in Surface Coatings Technology, following which he submitted a dissertation to the Professional Grade on "To study the suitability of some local raw materials as paint components".

Mr Ohene-Kwadade has now returned to Ghana where he will be taking up an appointment.

Courses

As well as the Polytechnic of the South Bank, various other colleges of further education are willing to help Registered Students and Ordinary Members of the Association with courses and the preparation of dissertations for submission in respect of Licentiate ship in the Technology of Surface Coatings (LTSC) and these include:

East Ham College of Technology, High Street South, East Ham, London E6 4ER.

Slough College of Technology, William Street, Slough, Bucks.

John Dalton Faculty of Technology, Manchester Polytechnic, Chester Street, Manchester M1 5GD.

Register of Members

The following elections to membership have been approved by Council. The Section to which new members are attached is given in italics.

Ordinary Members

CARROLL, BRIAN, BSc, 40 Woodrow Crescent, Knowle, Solihull, West Midlands. (*Midlands*)

CORRIE, WILLIAM TREVOR, ICI (Ireland) Ltd., 5-9 South Frederick Street, Dublin 2. (*Irish*)

DAVIDSON, S. LEONARD, 42 Kemp Avenue, Fairhaven, NJ 07701, USA. (*General Overseas*)

FARMER, BRIAN JOHN, Van Leer (SA) Pty Ltd., PO Box 559, Springs (*South African*)

FRANK, DIETHARD, 5461 Verscheid, Waldbreifbacherster 29, West Germany. (*General Overseas*)

GREEN, PETER NICHOLL, BSc, PhD, 8 Quickswood Drive, Woolton, Liverpool 25. (*Manchester*)

HUGHES, ANTHONY HAROLD, BSc, 8 Moor Close, Radcliffe, Manchester M26 0QF. (*Manchester*)

LAMB, IAN, 46 Swartkops Crescent, Boorendal, Edenvale 1610. (*South African*)

MARTIN, ANTHONY WILLIAM, Damar Coatings Ltd., PO Box 2030, Tauranga, New Zealand. (*Auckland*)

MASTERS, LESLIE THOMAS, 129 Shrubcote, Tenterden, Kent. (*London*)

He taught us a lot about hospital hygiene.

A pig needs extra help when it comes to keeping clean.

Like a hardwearing, chemically-resistant paint for his sty.

An Araldite based solvent-free coating.

The same paint that helps hospitals keep high standards of hygiene.

Araldite is your first choice if you need toughness. Or durability. Or long term corrosion resistance.

In our time, we've developed paint resins for everything from ships to gasholders. Car bodies to sewage treatment tanks.

And we'll help you get exactly the resin you need. By working closely with you till we're all happy with the result.

(That's if our backroom boys haven't already solved the problem you've only just come across.)

Get in touch now, we'll be pleased to help you. Contact:

Plastics Division, CIBA-GEIGY (UK) Limited, Duxford, Cambridge CB2 4QA.

Or ring Sawston (02203) 2121.

ARALDITE®
CIBA–GEIGY

CLASSIFIED ADVERTISEMENTS

Classified Advertisements are charged at the rate of £2.50 per cm. Advertisements for Situations Wanted are charged at 60p per line. A box number is charged at 50p. They should be sent to the Director & Secretary, Oil & Colour Chemists' Association, Priory House, 967 Harrow Road, Wembley, Middlesex HA0 2SF

GENERAL

Licensing arrangements wanted CANADA

A group of Canadian manufacturers will be in the UK from 13-25 September 1975 seeking machinery, equipment, controls, processes and techniques, and so forth for manufacture under licence in Canada.

Items which the Canadian manufacturers will want to discuss include:

Resins for the printing industry.

Products of new technology engineered for the petroleum, petrochemical, power and process industries.

Materials handling equipment.

Filter presses, pumps and equipment; in particular continuous belt-type filter presses and vacuum filters. Pollution control and treatment equipment.

Organisations wishing to meet the Canadian manufacturers should reply indicating their area of interest and enclosing two sets of their descriptive literature, and should write to the Director & Secretary of the Oil & Colour Chemists' Association at the address below, indicating names of any companies or persons to whom they would **not** wish the information to be forwarded.

Reply in the first instance to:

OIL AND COLOUR CHEMISTS' ASSOCIATION
Priory House,
967 Harrow Road, Wembley,
Middlesex HA0 2SF England
Telex: 922670 (OCCA Wembley)

SITUATIONS VACANT

UNION CARBIDE

The Chemical Coatings Resin department of Union Carbide's Chemical and Plastics Laboratory at Versoix, Switzerland, seeks a

Paint—Polymer Technologist

The vacancy requires a person holding a university degree in chemistry or the equivalent and having at least four years' experience in the development or technical service side of the industrial surface coatings technology.

The job involves developing application technology based upon Union Carbide's resins and intermediates for the coatings industry.

After a short period of training, the selected candidate should be capable of working independently on assigned projects and should, in addition, be willing to travel to customers all over Europe to provide technical advice and to present the technology we have developed.

In addition, a good command of English is essential and knowledge of other European languages is desirable.

If you are interested, please send your detailed curriculum vitae with recent photograph to

UNION CARBIDE EUROPE S.A.
Mr W. Buchi, Personnel Manager
5, rue Pedro-Meylan
1211 Geneva 17

CLASSIFIED ADVERTISEMENTS

SITUATIONS WANTED

Technical executive returning from overseas seeks challenging position with paint company in UK or overseas. Wide experience in formulation, testing and manufacture of decorative, industrial, automotive and marine paints. Box No. 407.

SITUATIONS WANTED

Indian, 33 years, working in USA. Broad experience in paint, printing ink formulation. Knowledge of G.C. and I.R. Also, emulsion and acrylic solution polymer experience. Looking for an opening in India or other parts of Asia. Box No. 410.

FOR SALE

Complete bound volumes of Journals for years 1938-1966 available. Please phone offers to Mr. Sewell, 01-554 6461.

SITUATIONS VACANT

Confidential Reply Service

CHEMISTS

AUTOMOTIVE FINISHES

Port Elizabeth – South Africa

Our client, Plascon Evans Paints (Tvl) Limited, is one of the largest paint manufacturing concerns in South Africa and have vacancies at their Automotive Branch in the large coastal town of Port Elizabeth.

They are seeking qualified Chemists with experience in Automotive Finishes for assembly plants.

Promotion prospects are excellent and they offer a rewarding salary, generous annual bonus, shares scheme, pension & medical aids funds, etc.

Interviews will be held in London but write in the first instance giving full details of age and experience, quoting Ref: RA/P3 to the Managing Director.

We know the profession from within

Lloyd Advertising Ltd

72-74 Brewer Street, London W1R 4DA.

Postans Limited

have the following vacancies in their Laboratories:

Senior Technologist

Applicants should possess either City and Guilds in Paint Technology or H.N.C. in Chemistry and have had several years' experience in the formulation of general industrial paint products and should be capable of working with a minimum of supervision.

It is unlikely that candidates under 25 years of age would have gained sufficiently wide experience.

Salary: Senior Technologist *c* £3000

Paint Technologist

Applicants must have had previous experience of working in a Paint Laboratory.

Salary: Paint Technologist *c* £2300

Applications in writing to:

I. Llewellyn
Technical Manager
Postans Limited,
95 Aston Church Road,
Birmingham B7 5RQ

OCCA CONFERENCE

Scarborough

17-21 JUNE 1975

Papers given at the Association's Conference 17-21 June under the title "The performance of surface coatings—does the reality match the theory?" will be published with discussions in the *Journal* later this year, starting in September.

There are, however, a few spare copies of the bound preprints now available, and these may be purchased by those not able to attend the Conference at £10.00 per copy (*Prepayment only* to Oil and Colour Chemists' Association, Priory House, 967 Harrow Road, Wembley, Middlesex HA0 2SF, England).

CLASSIFIED ADVERTISEMENTS

SITUATIONS VACANT

WE ARE:

The parent company of a young International Group based in urban Lanarkshire, manufacturing a successful range of paints and specialist surface coatings for application to masonry or structural steelwork.

WE OFFER:

membership of a young team of executives, each enthusiastically co-operative and crisply efficient in his own sphere.

Modern laboratory and works premises and equipment.

Attractive starting salary, bonuses, pension and life assurance. Four weeks' holiday per annum.

JOB SATISFACTION AND FREEDOM TO BE EFFECTIVE

WE NEED:

a SENIOR PAINT CHEMIST

CHIEF CHEMIST/TECHNICAL MANAGER DESIGNATE

having appropriate academic qualifications and the wide practical experience of all aspects of paint formulation and manufacture to enable him to rapidly assimilate the needs of the group and take full control of our technical operations.

A MAN WHO CAN GROW WITH US AND THE JOB

THE JOB:

offers much scope for originality. Imagination, and progressive advancement. May ideally suit ambitious chemist whose promotion is presently blocked.

Write in confidence, stating qualifications and experience, quoting ref. 72, to Managing Director. Box No. 411.

INDEX TO ADVERTISERS

Printed in England by Metchim & Son Ltd., 8 Storey's Gate, Westminster, London SW1P 3AT.

OIL & COLOUR CHEMISTS' ASSOCIATION

TECHNICAL EXHIBITION

ALEXANDRA PALACE

23-26 MARCH 1976

The motif for 1976, designed by Robert Hamblin, continues the theme of the last two Exhibitions—in which attention was drawn to the heavy participation by exhibitors and visitors from overseas—by showing the target for 1976 as London, where all the previous Association annual Exhibitions have been held.

COMPLETE AND RETURN THIS COUPON FOR A COPY OF THE INVITATION TO EXHIBIT

To: Director & Secretary, Oil & Colour Chemists' Association, Priory House, 967 Harrow Road, Wembley, Middlesex HA0 2SF ENGLAND
Telephone 01-908 1086 Telex 922670 (OCCA WEMBLEY)
We are interested in exhibiting at OCCA-28 (23-26 March 1976, Alexandra Palace, London). Please send us a copy of the Invitation to Exhibit.

.....

BLOCK LETTERS PLEASE