ISSN 0030-1337

September 1989
Vol. 72, No. 9

JOURNAL OF THE OIL AND COLOUR CHEMISTS' ASSOCIATION

JOCCA

■ Coatings for Plastics

Enter 1101 on Reader Reply Card

Vol. 72 No. 9 SEPTEMBER 1989

JOCCA

JOURNAL OF THE OIL AND COLOUR CHEMISTS' ASSOCIATION

Contents

Cover: Polypropylene car bumpers being heated by a flame-throwing robot before primer application at the Saiag-Plast factory, South of Rome (Photo by courtesy of Graco UK).

Forthcoming Features: October — Marine & Offshore Coatings, November — Wood Finishes. December — Waterborne Coatings. Contributions are welcomed at least five weeks prior to publication date.

ISSN 0030 - 1337

JOCCA is published by the
Oil and Colour Chemists' Association
Priory House, 967 Harrow Road, Wembley HAO 2SF, England
Tel: 01-908 1086 Fax: 01-908 1219 Telex: 922670 (OCCA G)

Annual subscription rate for 1989: £80.00 ($160), post free by surface mail.
Single copies £8.00 ($16), post free by surface mail.

Editorial correspondence should be addressed to the Honorary Editor, and general correspondence addressed to the General Secretary, at the Association Headquarters.

Printed by The Herald Press, 17 Rother Street, Stratford-upon-Avon, Warwickshire CV37 6NB Tel: 0789 66261

BP Chemicals speciality monomer capacity up

BP Chemicals Fine Chemicals Group is implementing a substantial debottlenecking programme at its Speciality Monomers Unit at Hythe. The debottlenecking will increase the plant's capacity in Bisomer hydroxy methacrylates and Bisomer hydroxy acrylates used in surface coatings, by between 25 and 30%. This increase in capacity is additional to the 75% increase undertaken by BP Chemicals in 1988.

RTZ Zirco Aluminates

RTZ Chemicals, Northern Division have been appointed the official distributor for the Cavco® Mod range of zircoaluminate coupling agents for all territories outside North and South America.

DSM Resins UK to merge

DSM Resins UK Limited will move from their Redditch Office and will relocate to the offices of Freeman Chemicals Limited (FCL) based at Ellesmere Port, S Wirral. From the 1st January 1990 the Polymer Division of FCL will merge with and trade as DSM Resins UK Limited. The new company will be headed by Mr A. R. Criddle, as Managing Director and Mr R. A. Mills will be the new company Chairman.

Hays Colours formed

Hays Chemicals Distribution Ltd have announced the formation of Hays Colours Ltd. This move follows the recent aquisition of Dykem North, Midland Dykem Chemicals and Altex Chemical company. Managing Director, Paul Williams, explains that the establishment of Hays Colours Ltd is part of a major development programme which will include the extension and improvement of facilities in addition to further strategic acquisitions. Hays colours operates sales offices, laboratories and production/ distribution centres in London, Leicester and West Yorkshire.

SCM's US TiO_2 production expansion

Sir Gordon White, Chairman of Hanson Industries, the US arm of Hanson PLC (NYSE-HAN) has recently announced that Hanson's SCM Chemicals unit will expand substantially its titanium dioxide production operations at Ashtabula, Ohio. This expansion, at an anticipated cost of $67.5 million, will increase the annual production capacity of SCM Chemicals' Ashtabula Plant I by 58,500 tons to 107,000 tons. Completion of construction and start-up is anticipated by early 1991.

Sir Gordon stated, "This expansion is in response to the continued strong world demand for titanium dioxide. It follows the successful completion and start-up in January 1989 of SCM Chemicals' new 77,000 tons per year chloride process facility at Bunbury, Western Australia. SCM Chemicals is the world's third largest producer of titanium dioxide and after completion of this new production unit at Ashtabula, the company's worldwide production capacity will have increased to 500,000 tons per year.

Croxton + Garry plant receives BS 5750

The Croxton + Garry (C+G) Melton Whiting Plant is the largest calcium carbonate production unit within the Croxton + Garry Group, as well as the biggest UK producer of this type of mineral. It is the second plant to achieve registration to BS 5750 : Part 2 : 1987 and ISO 9002 - 1987. The Presentation of the BS 5750 Certificate was made by Mr James Cran (right), Member of Parliament for Beverley, to Mr Jim Nichols left), Executive Director, Production on 21 July 1989.

Also present were The Lord Mayor of Hull, Councillor Mr John Stanley and Mrs Anne Stanley; the Deputy Mayer of Beverley, Councillor Mrs Doreen E. Stephenson; Mr Max Hart and Mr Dick Breakell, Sales and Production Directors respectively of C+G.

Morton forms new company

The shareholders of Morton Thiokol, Inc have approved the spin off of the commercial businesses of the Corporation to a new company named Morton International, Inc., with sales at $1.5 billion and assets at $1.3 billion. One of the objectives is to give focus and international identity to the Speciality Chemicals Group in the businesses of Morton International, Inc.

In Europe, the change of name results in the company being called Morton International. Our businesses in Speciality Chemicals are located in various centres in Europe: the U.K., Holland, West Germany, Italy, France, Belgium and Copenhagen. All of these facilities will be named Morton International, and associated with this name will be the primary business involved in that location.

Manders Liquid Inks formed

Following the recent acquisition of QC Colours and the liquid inks interest of Johnson & Bloy by the Manders Holdings Group, the new company Manders Liquid Inks Ltd will be formed. Manders Liquid Inks Limited is lead by Managing Director, John Mackenzie with a strong, experienced Team, including Hamish Somerville as Deputy Managing Director, Eric Simpson — Finance Director, Ken Phillips — Sales Director and Eric McMillan and Denis Williams as Technical and Sales Executives.

Thomas Swan expands USSR chemical trading

Thomas Swan & Company Limited of Consett, Co. Durham, manufacturer of speciality chemicals, is seeking suitable product lines to extend its established trading operation with the Soviet Union. The company has a well-established Moscow office, and is amongst the top UK chemical traders dealing with the USSR. Apart from its own manufactured products, Swan is offering selected lines from major European and American producers to the Russians, with a number of Soviet products being sold to the West.

Launch of new research centre

UMIST Surface Analysis Research Centre with AEA Technology, Northern Research Laboratories have jointly formed the Centre for Surface and Materials Analysis. The objective of the Manchester-based centre is to make available, through one point of contact, the full range of chemical and physical testing necessary to define and understand the true nature of the surface and structure of materials.

For further information on the Centre for Surface and Materials call 061-200 4433.

Northpoint takes on Vapocure

Northpoint Limited of Trafford Park, Manchester recently commissioned a coating facility which they believe is the first of its kind in Europe to be installed by a trade coater. The Vapocure plant is sited in a purpose-built factory extension covering 20,000 square feet.

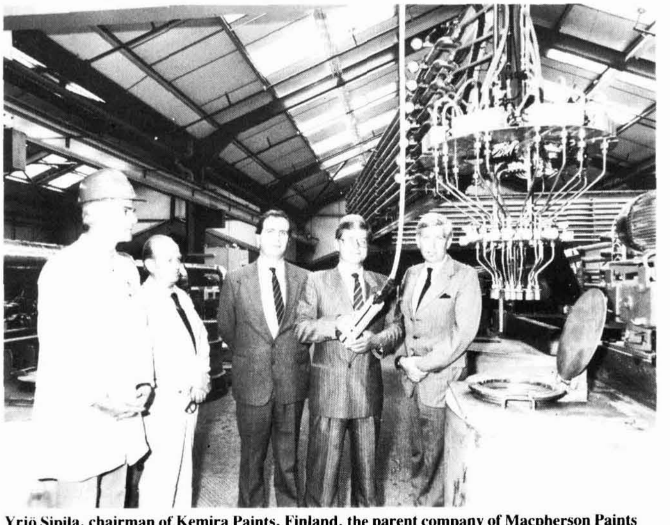
Working alongside Northpoint in extending this new technology is Carrs Paints of West Heath in Birmingham. Carrs have developed a series of high performance polyurethane paint systems for the plant which achieves a consistent rapid cure at room temperature over a variety of substrates using the Vapocure system.

Unique special products plant for Macphersons

A new £1.5 million special products manufacturing plant which provides a raw material blending system unique to the United Kingdom was recently opened at Macpherson Paints, Bury, Greater Manchester. The plant, which increases the company's existing special products production capacity by 60 per cent to a total of 11 million litres, was opened by Yrjö Sipila, Chairman of Kemira Paints Division, of Finland, the parent company of Macpherson Paints Limited.

It will produce specialist products for niche markets including high durability masonry paints such as Powerkote and Marbletex, Epimac floor coatings, Mosaico and heavy duty glazes and specialised emulsion paints. They will increase the Bury side's all-products capacity to 45 million litres.

Manufacture at the new plant is on a totally new basis and will replace out of date equipment. The technology is unique in terms of raw material blending with a system which provides the accurate introduction of liquid components to dispersion and mixing vessels. It includes advanced computer-controlled tinting from an overhead remote stainer dispenser which ensures precision batch-to-batch colour reproduction. "Big bag" handling of powdered raw materials increases efficiency in the Unit.



Yrjö Sipila, chairman of Kemira Paints, Finland, the parent company of Macpherson Paints (second from right), opens the new special product manufacturing plant at Macpherson's Bury, Greater Manchester site. Accompanying Mr. Sipila are (left to right) Derek Halsall, Macpherson Project Engineer, Bury; Dr Uusitalo, Deputy Chairman of Kemira Oy; Mark Brian, General Manager, Macpherson Paints, Bury; (Yrjö Sipila); Charles Wenham, Chief Executive of Macpherson Plc.

Products

Water-based polyurethane dispersions

A wide range of water-based polyurethane dispersions capable of producing high performance coatings for a variety of applications is now available from the Applied Chemicals Division of Baxenden Chemicals Ltd.

For further information Enter 1201

New paper coating co-binder

Acrosal E 20 D is a new co-binder developed by BASF for paper coating. Acrosal E 20 D is a 50% dispersion based on acrylates, vinyl acetate, and acrylic acid. The product, being a co-binder that can be thickened slightly with alkali, is particularly suitable for high coating colour concentrations and high machine speeds, for board coating and for 'CF' coating of carbonless papers.

For further information Enter 1202

New water dispersible colourants

Sandosperse W pigment preparations are water dispersible colourants based on a water soluble acrylic resin and contain no other solvents or dispersing agents. They are compatible with a wide range of water based binders and are suitable for the colouration of: air drying and stoving industrial paints, packaging inks and printing inks for PVC. Sandosperse W fill a gap for high quality dispersions where light and bleedfast pigmentation is a prerequisite.

For further information Enter 1203

Polyurethane UV absorbers

Croxton + Garry Ltd. have been appointed the sole UK distributors for the Givsorb® range of industrial UV-absorbers. The products, Givsorb® UV-1-, a liquid formamidine compound, and Givsorb® UV-2- a solid formamidine, are manufactured by the chemical and perfumery group, Givaudan. Commercial applications include solvent free one pack and two pack PU sealants and adhesives. An important characteristic of the materials is their excellent solubility in polyols, which facilitates ease of dispersion in many types of polyurethane systems.

For further information Enter 1204

New lustre pigments

The Mearl Corporation of New York, has introduced two new Pearlescent Lustre Pigments for plastics and surface coating applications. The company is moving ahead rapidly with the development of an expanded line of metallic-like gold pigments which will cover a wide spectrum of shades. The newest grade is called Mearlin Majestic Gold. A lustrous yellow powder, it consists of platelets of mica coated with titanium dioxide and iron oxide. The resulting effect is a bright, lustrous gold with a very slight reddish cast. The second product is Exterior Mearlin Blue-Green, the newest addition to Mearl's line of weather-resistant grades. This pigment is a free flowing powder consisting of mica coated with titanium dioxide and chromium oxide. It exhibits a lustrous blue-green colour which until now was obtainable only by mixing.

For further information Enter 1205

New CO2 coating system

A new technology from Union Carbide Chemicals & Plastics Company (UCC&P), in the USA, has been introduced to reduce solvent emission during paint application by spraying to vehicles, furniture, domestic appliances etc. the system, knowns as Unicarb, will be licensed to British spray coating applicators and UCC&P will also work with a number of paint and equipment companies, under licence, to manufacture and sell Unicarb system coatings and equipment in Britain. Union Carbide's new system of specially-designed spray coating equipment and a special coatings mixture replaces up to two-thirds of the solvents used with recycled carbon dioxide. This will reduce solvent emission and enables users of spray coating equipment to achieve the more stringent requirements of the USA's proposed new Clean Air Act amendments. World wide patents for the new system are currently pending.

For further information Enter 1206

New primer

Biokil Chemicals has introduced Primate Premium, a water-based epoxy resin coating designed as a universal primer for use on a wide variety of new metals or prepared and rust-free metal surfaces.

For further information Enter 1207

Concrete repair product

Fastfill from the Flexcrete range of concrete repair and protection products marketed by Liquid Plastics Limited has been listed by the UK Water Fittings Byelaws Scheme. Fastfill — a single component, shrinkage compensated, polymer modified, Portland cement-based mortar — sets in 10 minutes at 20°C, yielding high early strength to make it ideal for carrying out repairs to defective concrete in situations where closure for long periods is impractical. The product needs only the addition of water before mixing on site, has exceptional tensile and impact strength, excellent low sag properties and incorporates the very latest proven cement chemistry, polymer and fibre technology.

For further information Enter 1208

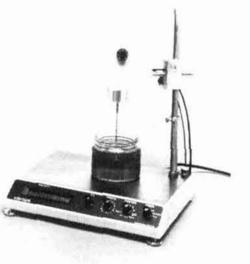
New Webking Hi-Speed inks

BASF Coatings + Inks has launched Webking Hi-Speed gloss and Webking Hi-Speed SC — two advanced series of inks formulated to give optimum printed results on coated and super calandered papers.

For further information Enter 1209

Equipment

BDH viscometer



The Viscolog, now available from BDH has all the electronics effectively packaged in the base of the instrument. This viscometer has the flexibility to provide readings in centipoise units, in centistoke units for users accustomed to U-tube viscometry, as well as providing average, peak and percentage readings. BDH, supplies the Viscometers UK Ltd range of instruments as well as Brookfield viscometers.

For further information Enter 1210

Electrochemical corrosion monitoring

*A*CM Instruments and British Nuclear Fuels have entered into a licensing agreement to market world wide the latest technology in Electrochemical Interfaces or Multiple Channel Dynamic Zero Resistance Ammeters. The BNFL product is capable of running four independent electrochemical cells with completely different sweep rates as well as being able to perform potentiodynamic tests on galvanic couples of up to four working electrodes which is useful for the investigation of weld failures, fluid flow corrosion problems and environmental testing of painted samples. BNFL Research and Development Department had to develop this product with ACM Instruments as existing instruments were not suitable. This instrument runs with the Solartron 1250 range of frequency response analysers enabling AC Impedance and Harmonic Analysis to be performed.

For further information Enter 1211

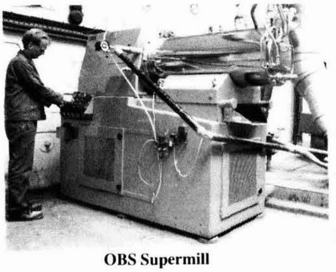
Solvent recovery

*T*itanium Fabricators Ltd has introduced a range of Raywell Solvent Recovery Plant which uses wiped film evaporator technology. The units operate continuously under vacuum and therefore lend themselves to application in the paint and printing ink industry. The Raywell Solvent Recovery Unit recovers a wide range of solvents from Acetone to Xylene, and in addition custom designed fractional distillation plant can be supplied to achieve separation of one solvent from another or to recover a solvent from water.

For further information Enter 1212

Mills for temperature critical primers

A further 150 litre OBS Supermill, supplied by OBS Machines has been installed at the Wednesfield site of BASF Coatings + Inks to process high volume low temperature dispersions for the production of automotive paints. The OBS Supermill was specified for the dispersion of primers based on temperature critical resins which gel above 60°C. The Supermill's dispersion efficiency arises from a horizontal milling shell which is filled with grinding media (up to 85% of the shell volume) to provide many shear surfaces.



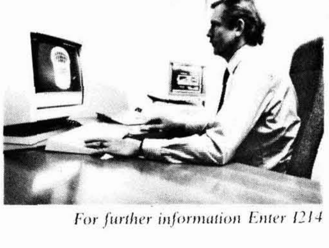
OBS Supermill

Automotive primers used by both OEM's and vehicle refinishers are produced in a separate production building at Wednesfield equipped with bulk storage tanks to hold batch quantities up to 7 tonnes. Both OBS Supermills are now mounted on the first floor and draw primer from a mixing vessel and deliver it to a finished storage tank. Commonly only one pass is required to obtain the necessary dispersion and typically a 7 tonne batch is processed in around five shifts.

For further information Enter 1213

Reed strengthens custom design service

*R*eed Plastic Containers has purchased a "Sun IV" CAD/CAM workstation and advanced modelling software — including a 2-D draughting package linked to a 3-D modeller. This new facility will enable the company to produce, in an extremely short timescale, lifelike 3-d representations from initial design concepts.



For further information Enter 1214

Literature

Paint & allied trades

*I*CC Financial Surveys Ltd has recently published the 20th, and latest edition of the "Paint & Allied Trades" Financial Survey. This updated survey enables company comparisons to be made for either individual or overall industrial performance: Turnover, Pre-Tax Profits, Current Assets, Current Liabilities, Return on Capital Employed, and Profit Margin.

An initial analysis of companies showing full accounts indicates: 46.6% of companies show an increasing profit over the 3 years. 61.4% of companies show an increasing turnover figure over the 3 year period. 34.0% of companies indicate increases in both profit and turnover. 9.4% of companies show losses in their latest accounts. Covering over 565 quoted and unquoted companies active in this sector, the survey contains financial and company data from the last 3 years' available accounts.

For further information Enter 1215

Herberts company profile

*H*erberts have just published a profile of the company's operations in the UK. The report (12pp), available upon application, covers the company's operations in the industrial coatings, automotive and vehicle refinishing sectors.

For further information Enter 1216

Paint shipments at sea

*T*he Paintmakers Association has issued a new guide to the safe transport of paints and printing inks at sea, which contains information invaluable to shippers for compliance with the International Maritime Dangerous Goods (IMDG)Code. It was written for the European Paint and Printing Ink Associations (CEPE) by Arthur Hancock, PA's packaging consultant, but includes information unique to the UK's own situation. 'Guidelines for the

Transport by Sea of Paints and Printing Inks' is available free to PA members and at a cost to £20 to non-members from: The Paintmakers Association, Alembic House, 93 Albert Embankment, London SE1 7TY.

Competition policy and intellectual property rights

The report's summaries of licensing law in the various OECD countries, as well as its recommendations, should be particularly useful in counseling clients and dealing with government officials on licensing matters in the various OECD countries. The report price £11 is available from OECD Publications Service, 2 rue Andre Pascal, 75775 Paris CEDEX 16, France.

Literature miscellaneous

A 'Surface Coating Resin Guide for 1990' is available from **Cray Valley Products Limited** listing all standard products, including many new resins.

For further information Enter 1217

The Chemicals division of **Hoechst UK Limited** have just released a new brochure on their waxes for electrostatic powder coating, "Hoechst Waxes in powder coatings".

For further information Enter 1218

Applied Color Systems, Inc. (ACS) announces development of a new library of programs relating the measurement and statistical analysis of product color.

For further information Enter 1219

ICS Texicon has published the following brochures: Laboratory Dispensing, Production Colour Measurement System, the Multilight range of Colour assessment cabinets, Series 9 Colour Management Systems.

For further information Enter 1220

Lloyd Instruments has published a series of 10 leaflets covering many of its testing grips, clamps, compression cages, platens and flexural cages for the successful testing of many types of materials.

For further information Enter 1221

Meetings

SBPIM Annual Lecture

The SBPIM Annual Lecture will be held in the Main Lecture Theatre of The Royal Institution, Albemarle Street, London, at 6.30 pm on 16 October 1989. The lecture will be given by Mr Richard Grey, Engineering Director of Varnicoat Ltd, on the subject "The Impact of COSHH on the Printing industry".

UK Corrosion '89

The annual exhibition and conference of the Institution of Corrosion Science and Technology and NACE USA will be held at the Crest Hotel, Blackpool on 8-10 November 1989. Among the many coatings and linings topics at the conference there will be papers on alloyed zinc coatings, architectural aluminium coatings, coating pipeline field joints and the initial painting. For further information call 0525 851967.

13th National OCCA Symposium: Advance Notice

The 13th National OCCA Symposium will be organised by the Cape Section of the South African Division of OCCA, at the Lord Charles Hotel, Somerset West, Cape from the 3-6 October 1990.

The organising committee is at present deciding on a title/theme for the symposium, which will be announced shortly, and are already requesting possible presenters of papers to come forward. Should you wish to offer a paper, could you kindly advise the Chairman of the Organising Committee, by letter, telephone or fax at the address/numbers below, giving if possible the title of your paper.

More information on the symposium will be made available early Autumn 1989. The Chairman of the Organising Committee is: John Copeland, PO Box 428, Paarden Eiland, Cape, South Africa 7420 Tel: SA-(021)-511-2647 Fax: SA-(021)-510-2681.

People

W Hawley & Son appoints Chairman

The Board of Directors of W. Hawley & Son Limited of Duffield, Derby have appointed **Michael Hall** as Chairman, to succeed Sefton Hawley who died in June after a short illness. The company is a specialist pigment manufacturer recognized as one of the world's leaders in the processing of natural iron oxides and is wholly owned by the Hawley family.

New fire coatings consultancy

Prometheus Developments Ltd, is the new consultancy established by **David Aslin** following 7 years experience in the design, development and testing of Intumescent Coatings, primarily for structural steel applications. Previously he was Intumescent Products Development Manager at Mebon Paints Ltd and before that Technical Manager with Fireguard (Contracts) Ltd.

D. C. Aslin

The objectives of Prometheus Developments are to aid companies through the numerous pitfalls encountered when entering this market. Additionally, research is to be undertaken into advanced formulations in both Intumescents and Fire Retardant Products for a variety of clients. Products can be designed for special applications and existing products uprated to achieve special properties required by changing markets.

An extensive and growing range of facilities, available to clients, is being installed at the company's new premises in Belper. ■

Biwater
Process Plant

Behind our success lies one very simple principle, a commitment to quality through design.

It is one reason for the integration of computer aided draughting into our design methods.

And why several major resin manufacturers have selected us to plan, construct and commission their plants.

We think your business could benefit from our involvement.

Call us on 0625 532711.

To design and build a modern synthetic resin plant is no small undertaking.

You need time, effort and meticulous forward planning.

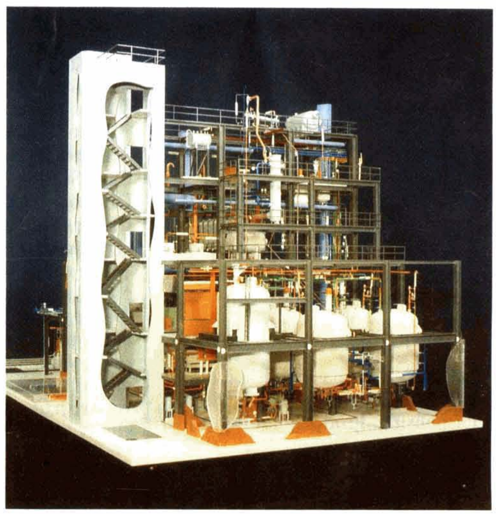
You need chemical, mechanical and instrument engineering know-how.

In other words, you need a company like Biwater Process Plant.

Over 20 years in resin plant engineering has made us one of the most experienced in our field.

As Chemical and Thermal Engineering Ltd., we earned our reputation for technical excellence even before joining the Biwater Group.

Now with the backing of a major organization we are able to take that expertise as far afield as South America, Africa and the Middle East.



Biwater
Process Plant

Chemical & Thermal Engineering Limited

52 Alderley Road, Wilmslow, Cheshire SK9 1NY England
Tel: (0625) 532711 Telex: 669007 Fax: (0625) 527497

Enter 1106 on Reader Reply Card

Resins & Pigments 89

The twelth Resins & Pigments Exhibition, organised by PPCJ, will be held at the Frankfurt Sheraton Hotel on 25-26 October 1989.

In conjunction with the exhibition the Paint Research Association will hold its ninth International ference on "High Coatings" at the same venue on 23-25 October 1989. Companies exhibiting include:

Air Products (Rm 4055, 4056) will present Surfynol Surfactants. Based on acetylenic chemistry the Surfynol 104 combines wetting and defoaming in one molecule. This will help in water based systems to cover difficult to wet substrates without foam. These unique properties are also used to grind pigments efficiently by means of Surfynol GA, TG or CT-136. Especially difficult to grind pigments such as carbon black and iron oxide in all its varieties, are well grinded with Surfynol CT-136. For specific uses, ethoxylates are available in four grades, with 20% to 85% EO (Surfynol 400 series). A new defoamer is the non-silicone Surfynol DF110L, for initial and sustained defoaming. To wet low energy substrates like PE or PP, Surfynol 61 is available. This is a volatile surfactant which evaporates from the film. No water sensitivity is the result, and therefore wet rub resistance of e.g. water based flexo inks is excellent. New defoamers have been added to the product line for water based systems.

For further information Enter 1301

Akzo Resins bv (Rm 5054,5056). For coatings: For automotive applications: a medium solids base coat, a medium solids clearcoat and solid colour topcoat, a two-component clearcoat. Resins modified with sag control agents (SCA). For vehicle refinishing and industrial applications: medium solids acrylic polyols. Recent developments in curable products. For printing inks: Waterbased resins for printing inks and overprint-varnishes. Recent developments for radiation curable monomers and prepolymers. Latest news about hard resins and alkyds for web- and sheetfed offset inks. For adhesives and sealants: Waterbased and solventbased acrylic polymers for pressure sensitive applications. Linear, branched, solvent free and solventbased polyester-polyols for PU-adhesives. Acrylic polymers for UV and EBC.

For further information Enter 1302

Allied Colloids (Rm 5003,5004) will feature their well-known resins and additives for emulsion paints and water-based inks. New at the exhibition will be Dispex R50, the latest high activity pigment dispersing agent. Also on display will be new additions to the Glascol range of acrylic and styrene acrylic emulsions for printing inks and overprint varnishes. Other products featured will include:
Rheovis — associative thickeners, Viscalex — alkali soluble thickening agents and Surcol — acrylic resins in bead form. Stand personnel: Eric Alston — Sales Manager, David Marshall — Marketing Manager, Chris Batchelor — Product Group Manager, Inks and Lacquers and Horst Lattek — Allied Colloids, GmbH.

For further information Enter 1303

Aqualon (Rm 5086) will exhibit its full range of water soluble cellulose thickeners: NATROSOL hydroxyethylcellulose, bioresistant NATROSOL B, CULMINAL methylcelluloses, BLANOSE CMC, KLUCEL, hydroxypropylcellulose, with special emphasis on its latest development NATROSOL Plus modified HEC, a new associative thickening agent.

For further information Enter 1304

ARCO Chemical Europe, Inc. (Rm 5084) a subsidiary of ARCO Chemical Company, is one of the major producers of propylene oxide and its derivatives on a worldwide scale. A few years ago, ARCO started — first in the US and then in Europe — to produce propylene glycol ethers and acetate under the trademark of ARCOSOLV®. They are solvents for the paints and coatings, printing ink, cleaner and various other industries. The driving force behind the project was the toxicity issue. It has been proved in several independent studies that propylene based solvents are far less toxic than the traditional ethylene glycol ethers and acetates. Apart from their low toxicity, propylene glycol ethers and acetate have qualities similar to those of ethylene-based solvents and can often be substituted for them. Largely because of their toxicological profile, they have acquired a significant share of the glycol ether market and demand for them is growing rapidly. During the exhibition, you will have the chance to discuss these products and get technical information on them from S. Lyons — Product Manager, D. Penninck — Technical Service Co-ordinator and several other representatives of ARCO Chemical European Operations.

For further information Enter 1305

The speciality chemicals division of **Baxenden Chemicals** (Rm 4053, 4054) produces acrylic and urethane intermediates for the surface coatings, adhesives and chemical building product industries. The standard range of products are supplemented with toll manufactured materials and specials for single customers. The standard range includes: TRIXENE SC760 series — aromatic isocyanate based prepolymers for sealers and primers. TRIXENE SC770 series — for production of flexible coatings and sealants. TRIXENE SC780 series — an MDI range of prepolymers for primers, sealers, adhesives, sealants and printing ink modification. TRIXENE SC790 series — an aliphatic isocyanate range of products available in both blocked and unblocked form: Baxenden produces its own proprietary blocking agents for low temperature cure. XENALAK RANGE — a series of solution acrylic polymers for use as adhesives, surface coatings and ink formulations. TRIXENE AS RANGE — monofunctional isocyanates for moisture scavenging. Staff will be on hand to discuss the above applications, specific customer requirements and custom manufacturing facilities which include high temperature, fast throughput vacuum distillation facilities for temperature sensitive materials.

For further information Enter 1306

BIP Chemicals is one of the leading European manufacturers of high quality melamine and urea resins used by major paint manufacturers throughout the world for the production of industrial surface coatings where quality and performance are of paramount importance. The 'Beetle' range of amino resins has been developed for technically demanding applications where consistent high quality and reproducibility are essential, such as automotive, can, coil and wood finishes. Details of the extensive range of 'Beetle' amino coating resins will be available and the display will feature the newer, high technology products including partially and fully methylated melamine and mixed ether resins.

For further information Enter 1307

Blagden Chemicals Limited (Rm 4094) introduced the Cargill range of Polyurethane Surface Coating resins into Europe and the UK in the 1960's as, imported materials. Production is now, however, fully integrated into our modern and recently expanded facility at Haverhill in Suffolk. A full range of polyurethane alkyds, polyurethane oils, silicone modified and moisture cure types are offered to satisfy a wide range of surface coating needs. Our display will feature many aspects of these resins and their special properties in Decorative and Industrial finishes and also solvent free types for printing inks.

For further information Enter 1308

Braive-Instruments (Rm 4016) well-known manufacturer of high quality instrumentation, presents a wide range of equipments designed for testing corrosion, ageing, adhesion, elongation, impact and cupping, washability, scrubbing and brushability. We also specialise in measurement and control instruments for density, wet and dry film thickness, hardness, application of films, chalking of paints, grinding and fineness of grinding, softening point, surface cleanliness, opacity power, viscosity, permeability and drying time of paints. Latest development: CoRI-Stressmeter, made under licence from Coatings Research Institute, for the determination of stresses in organic coatings.

For further information Enter 1309

BYK-Chemie (Rm 4018, 4020) is exhibiting their range of additives for coating industry: wetting and dispersing additives, defoamers, levelling and surface flow agents, silicone additives. Especially highlighted are the new developments:- Mineral-oil-free defoamers for waterborne coatings: BYK-022, BYK-023, BYK-045. A surface active silicone additive for improved surface substrate wetting and levelling: BYK 331. Polymeric wetting and dispersing additive for solvent systems: Disperbyk-161. BYK-Labotron is showing the range of testing instrument especially those on gloss, such as the MICRO-GLOSS.

For further information Enter 1310

Cera Chemie (Rm 5090) was founded in August 1972 and is an autonomous enterprise without any ties to larger groups of companies. Being a small company of twenty employees we can act and respond quickly on behalf of customers as well as show flexibility in rapidly changing market conditions, without the constraints of mother company policies. We specialise in the processing of waxes, the world CERA is, in fact, Latin for WAX, transforming solid waxes into dispersions and emulsions for use as performance products in industry. Commercially available waxes from any parts of the world are represented in our *"Ceratheque"*. Regardless of sources of supply the waxes are classified according to their properties and behaviour thereby giving the user a good selection for this specific application. We have excellent laboratory and pilot plant facilities to enable us to break down the wax in solvent, binder or water.

For further information Enter 1311

Cray Valley Products GmbH (Rm 4057, 4059, 4B). In continuing the expansion programme of innovative products for the surface coatings industry, we have new decorative and industrial resins on offer, including a thixotropic alkyd in xylene designed for stoving applications. Back-up information will be available covering all new product grades, and technical staff will be ready to give advice.

For further information Enter 1312

The latest developments in two-pack acrylics for high performance industrial coatings will feature strongly in an exhibit designed to preview some of the many innovative coatings polymers becoming available from the R&D laboratories of **Cray Valley Products Ltd** (Rm 4057, 4059, 4B). Originators of ambient temperature curing acrylic/isocyanate systems and suppliers of the well-known Synocure resins, the exhibit this year will concentrate on the newer non-isocyanate types. CVP is regarded as the experts in thixotropic resins; Gelkyds and Super Gelkyds are used world-wide in decorative paints. The extension of this technology into the development of new resins for both decorative and industrial coatings will be shown. With greater emphasis on higher performance and "user friendly" characteristics, CVP are devoting considerable effort in the development of coating resins meeting these requirements. Although markets may not be ready yet for such innovations, the industry needs to be prepared to have the products available. Some of our new developments in this area will be featured. The rooms will be manned by technical staff able to discuss your requirements in detail.

For further information Enter 1313

During the last two years **Croda Resins** (Rm 5105) have redefined themselves as manufacturers of resins for industrial surface coatings and inks. At the same time a major investment programme on new plant has taken place culminating with a multi-purpose 30 tonne reactor coming on-stream in April 1989. Featured promptly this year will be our range of Crodapol oil free polyesters which is amongst the largest range in Europe. New this year are: Crodapol 0-65, Crodapol 0-66, Crodapol 0-70, Crodapol 0-90 all formulated to be cured with isocyanate specifically for automotive and aircraft finishes. Crodapol 0-17 has the same stoving schedule as conventional alkyds but much improved performance. Crodapol 0-80 the "Rolls Royce" of oil free polyesters. Silicones: the SC range of silicone modified polyesters, alkyds and epoxies will be shown. Highlighted will be the new SC-55, a high silicone content polyester for heat resistant cookware coatings. UV Resins: A new range of acrylic and polyester resins will be shown, in particular, UVE 100, an acrylated epoxy which gives exceptionally water white varnishes. Acrylics: The Crodac range of thermoplastic and thermosetting resins will be shown for the first time.

For further information Enter 1314

Crosfield Chemicals is a leading European manufacturer of specialised silicas and silicates with an impressive record of innovation in the surface coatings industry. Developments in the field of matting have been at the forefront of Crosfield technology with the HP200 range setting new standards of excellence. These high performance products are used to matt top quality wood finishes, coil coatings paints and top coatings and examples of their use will be displayed at R&P '89. Other areas covered will be the matting of radiation curables and nitrocellulose lacquers where HP39 and HP64 complement the HP200 range. In emulsion paints Crosfield precipitated silica and silicate extenders have a long record of successful use.

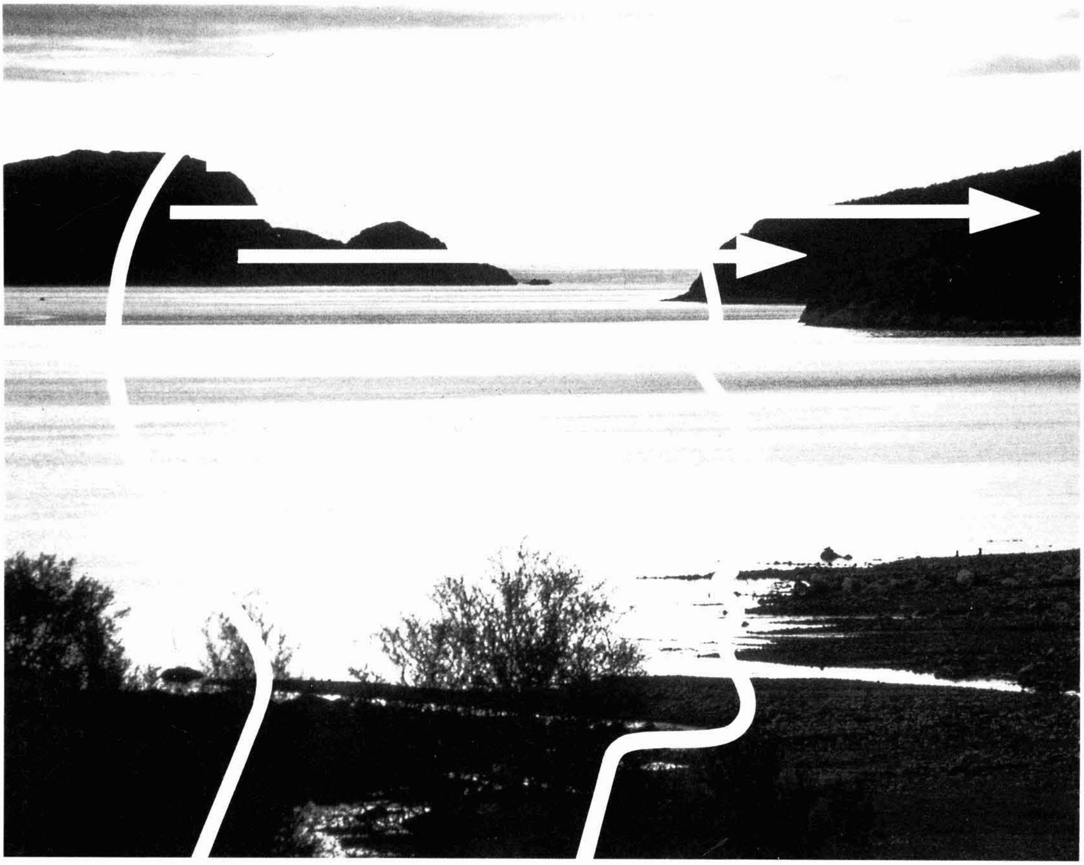
For further information Enter 1315

DSM Resins (Rm 5094, 5095, 5096) feature for the exhibition will be QUALITY AND ENVIRONMENT. Some of the products on show: Powder Coating resins, Polymer dispersions and alkyd emulsions in water, High solid alkyd and acrylic resins, Polyester resins for waterborne stoving enamels, Printing ink resins.

For further information Enter 1316

Dyno Cyanamid (Rm 5035, 5037) the joint-venture of American Cyanamid Company and Dyno Industrier A. S., will exhibit their range of Cymel® and Dynomin® amino crosslinking resins. Established to be the leader in amino crosslinking technology, Dyno Cyanamid implemented a Quality Assurance Programme throughout the company early 1988 and invested in a major expansion of methylated amino resins, completed in June 1989. During the exhibition the company will emphasize the use of amino resins in low organic solvent emission formulations such as waterborne, high- and medium solids coating systems. Experts are attending the exhibition to answer your specific questions.

For further information Enter 1317



ECC International (Rm 4001, 4002) is a major supplier of white minerals for the paint and allied industries. The HyPerformers range of products includes: PoleStar calcined clays, Supreme and Speswhite fine china clays, Claytone organo-bentonites, as well as a comprehensive range of china clays and calcium carbonate extenders and other minerals. Although ECC International has been traditionally known as a United Kingdom-based producer of china clays; the Company now produces its wide range of products in many locations in Europe, and throughout the world. ECC has a comprehensive system of storage and distribution facilities; and is particularly well suited to serve customers in Central Europe with its storage and distribution plant at Lixhe, near Liège in Belgium. ECC International will be represented at Resins & Pigments by F. G. Pickering (Marketing Manager), A. P. Ferris, R. M. McGuffog, D. Grolman, D. Vink, S. Larbey and H Janssen.

For further information Enter I318

EFKA Chemicals BV (Rm 5043, 5044) will feature: (1) The concept of resin minimal pigment-concentrates based on high molecular weight wetting agents such as Polymer 401 and EFKA-46. (2) EFKA-Polymer 400. A dispersant especially designed to stabilize opaque organic pigments. (3) EFKA-Polymer LP 7980. A high molecular weight dispersant for industrial aqueous coatings. (4) Furthermore new developments of defoamers and levelling agents for aqueous and solvent-based coatings.

For further information Enter I319

"European Colour Plc" (Rm 5027) is the new name of the company resulting from the merger of two long-established pigment manufacturers — Horace Cory, London and Ellis Jones, Stockport (UK). The company will show the major end-uses for which its pigments are used, i.e. printing inks, paint, plastics and artists' colours. the products of the combined pigment range will be illustrated in a new European colour brochure.

For further information Enter I320

Harcros Chemicals UK Ltd will feature its range of Photomer UV and EB radiation curable monomers and oligomers for inks and coatings. Polyurethane intermediates and prepolymers will include the Quasilan liquid polyisocyanate prepolymers, Lankrothane aqueous polyurethane latices and Estolan and Propylan polyester and polyether polyols. Surfactants for emulsion production and pigment dispersion are also featured.

For further information Enter I320

The **Heubach Group** (Rm 4109, 4110) has manufacturing plants in West Germany, USA and Brazil. Among chrome yellows and molybdate reds, there are also low dust preparations and are producing mixed metal oxide pigments for extreme temperature and durability requirements, pigment preparations and concentrates for concrete floor coatings, solvent based zinc, zinctetroxychromate and strontium chromate pastes, water-based lead silicate and strontium chromate pastes, 75% heat stabilised chrome yellows and molybdate reds, microfine zinc phosphates (also modified ones with improved anticorrosion and adhesion properties), micaceous iron oxides with long term corrosion protection, highly concentrated aqueous colour dispersions for printing inks, paints and textile printing, transparent iron oxide paste for wood protection, zinc flakes in lamellar form supplied as paste, zinc dust with spherical particle form in various particle size distribution, zinc white, zinc oxide, (low dust) red lead, litharge, battery oxide, lead sulphates, white lead as well as decorative products (sand, gravels and split coated in various colours and available in various grain sizes for decorative wall and floor coverings).

For further information Enter I322

Hüls (Rm 4028, 4030, 4A) is represented as in previous years with its wide range of binders, resins and additives. This year's special attraction to be highlighted will be the DYNAPOL® coating polyesters, supplemented by the VESTURIT® grades exhibited hitherto. The areas of application on which emphasis will be placed are coil-coating, can-coating and industrial coatings. DYNAPOL coating polyesters and Hüls tried and tested range of polyurethane raw materials are the basis for tailor-made and trend-setting coatings. Particularly abrasion-resistant and weather-resistant coatings are obtained by combining polyester urethanes with VESTOSINT® fine powders (PA 12). Another focus of attention are air-drying, water-dilutable anticorrosive systems on a modified polybutadiene base. Newly-developed LIPATON® products are aqueous dispersions for low-odour interior paints and for corrosion protection. For products from Hüls silicon chemistry section — DYNASYLAN®, DYNASIL® and metal acid esters (titanates/zirconates) — our experts will be at your disposal in room 4030.

For further information Enter I323

ICI Colours & Fine Chemicals (Rm 5061, 5062, 5063, 5064) will display its range of 'SOLSPERSE' Hyperdispersants, exceptionally powerful wetting agents, as well as pigments for paint and ink supported by technical management.

For further information Enter I324

ICI Resins (Rm 5016, 5062, 5063, 5064) will exhibit a range of new acrylic and polyurethane emulsions,
INDUSTRIAL COATINGS: Haloflex 202 rust converter and performance primers for steel and galvanised steel. Haloflex 202 formulations for automotive and Big Rolling stock. Winnofil effect fillers and NeoCryl A-1060 in chip resistant underbody coatings. New combination of polyurethane and acrylics for waterbased plastic coatings. New development in wood finishes with improved chemical resistance NeoRad waterborne UV-curable polymers.
DECORATIVE PAINTS: NeoCryl XK-90 acrylic emulsion with excellent anti-blocking properties. NeoCryl XK-84 acrylic-alkyd copolymer with very high gloss. NeoPac E-106 urethane-acrylic copolymer, one component parquet lacquers with excellent chemical and high abrasion resistance. Lumiflon fluorpolymers with extreme outdoor durability.
INKS/ADHESIVES: New developments in waterborne inks and overprint lacquers based on acrylic. NeoRez polyurethane emulsions. Haloflex 402 cardboard and paper coating with water barrier properties. NeoTac series; a range of new products for use in blister adhesives, cold seal adhesives, high performance laminating and pressure sensitive adhesives.

For further information Enter I325

As in Amsterdam in 1988. **ISC Alloys** (Rm 4048) will be again happy to welcome visitors to the 'Rusty Bucket' to discuss Zinc Dust and Zinc Phosphate, and to enjoy the atmosphere of an English Pub with traditional beer, food and pub games. Commercial and technical staff will be on hand to serve information and beer!

For further information Enter I326

Kirklees Chemicals Limited (Rm 4102) are exhibiting their latest VIKING® developments in emulsion binders for the European paint, adhesives and textile industries. New vinyl acetate-VeoVa10 copolymers for the paint industry will include VIKING 2900, a high performance general purpose grade demonstrating excellent performance in matt wall paints, semi-gloss wall paints and exterior textured and masonry systems. Based on well-proven technology and weathering

data, this grade offers excellent value for money and the opportunity to minimise your dispersions inventory. In addition, a cost-effective grade, VIKING 2100, for vinyl silks, offering excellent gloss development and retention together with good rheology contribution and excellent reactivity with synthetic gellants is available. For more demanding applications a wet adhesion promoted styrene-acrylic, VIKING 5110, is available for discussion. The latest offering, VIKING 1645, for our adhesive customers will be a woodworking base with good performance under damp conditions to DIN 68602,B3. Developments for the textile industry include vinyl acetate homopolymers for textile stiffening, such as VIKING 1650 and an efficient cross-linkable grade, VIKING 1745. Kirklees Chemicals' technical and commercial staff will welcome customers, both old and new, in Room 4012, to discuss the VIKING range and support will be provided by our German agents, Krahn Chemie GmbH.

For further information Enter I327

George M. Langer & Co (Rm 5021, 5022) will introduce new defoamers for water based systems and aqueous pigment concentrates for industrial systems. Extra fine micronised PTFE/PE waxes for can coatings and thin film systems will be exhibited. New application fields for LANCO-paint additives will be shown. Wax Dispersions of the LANCO-GLIDD-range are cold prepared wax dispersions in various solvent/binder combinations. LANCO-GLIDD ML is a new high concentrated PE-wax-dispersion, binder free, for the use in wood varnishes. Highly efficient wetting and dispersing agents for pigment pastes will also be exhibited.

For further information Enter I328

Monsanto (Rm 5045 and 5047) will exhibit their range of Speciality Resins, Flow Aids and Intumescent agents for the industrial coatings industry. Main highlights will be Resime® High Solids melamine formaldehyde crosslinkers, Santolink™ advanced crosslinkers and Modacure™ curing additive, for high performance coatings satisfying environmental requirements for oven curing-, air- and forced dry 2-pack and radiation curing applications. The Resimene® series of High Solids melamine formaldehyde resins offer a wide variety of proprietary high solids methylated, butylated, coetherified and modified crosslinker resins for automotive, can, coil, general industrial and wood applications.

For further information Enter I329

Münzing Chemie GmbH (Rm 4088) supplier for the paint, printing ink, adhesive industry will exhibit:
AGITAN — Defoamers for aqueous and non-aqueous systems.
METOLAT — Dispersing and Wetting Agents for aqueous and non-aqueous systems and Emulsifiers.
EDA PLAN — Additives for lacquers, varnishes, powder, aqueous coatings. OMBRELUB - Water Proofing Agent, Corrosion Inhibitor for aqueous systems. TAFIGEL — PU Thickener for aqueous systems.
UMBRELINK — Curling Agent for epoxy and urethane systems.

For further information Enter I330

Nevcin Polymers have specialized for 30 years now in the production of hydrocarbon resins. We have the flexibility to manufacture a wide range of products. These include petroleum coumarone indene and modified resins together with epoxy-modifiers and resin solutions. This flexibility enables us to offer large quantities of standard resins plus "tailor made" products. Our staff will be available to advise you how to obtain the optimum benefits from our resins in adhesives, concrete curing membranes, paints, coatings, printing inks, resins, road markings and many other fields.

For further information Enter I331

Today **Norwegian Talc** (Rm 4090, 4092) is offering a broad range of proved high-quality additives for the production of paints and lacquers as well as for related industries. But the company also offers decades of comprehensive application experience acquired in all the markets of the world. Own raw materials deposits in Norway and modern processing facilities in Norway, the Netherlands and in the UK, ensure permanently high product quality and controlled properties of materials for applications without problems. The presentation covers not only the traditional mineral additives MICRODOL, MICRO-TALC, MICRO-MICA and SILOFIL but also the light and superlight additives SIL-CELL, NORTEC and NORFIL. Latest addition to the line are the MICHELMAN products, i.e. aqueous wax emulsions based on carnauba wax to be used mainly as anti-blocking additives in aqueous coating systems. Furthermore Norwegian Talc is offering MAGWHITE i.e. a mineral additive applicable with a wide variety of paint systems. The spacing effect typical for this type of material can lead to a significant saving of titanium dioxide without sigificantly affecting the optical characteristics. In some paint formulations MAGWHITE will also increase the abrasion resistance of the paints. More detailed information and technical documentations of all products are available at the booth.

For further information Enter I332

Perstorp Polyols (Rm 4041, 4042) is a world-leading producer of Pentaerythritol and Trimethylolpropane with production sites in Italy, Sweden and USA. In our range of products we also have dimers, alkoxylates and allylethers of Pentaerythritol and Trimethylolpropane. New applications with Pentaerythritol and Trimethylolpropane in water-borne and high solids alkyds will be presented. standard allylether product is Trimethylolpropane diallylether. New allylethers in our product range are Trimethylolpropane-mono-allylether, Trimethylolpropane-diallylether with higher di-content and Perallylether with equal mix of mono and di. Pentaerythritol-triallylether is a new development product. Applications of allylethers in high solids alkyds, styrene and formaldehyde free wood coatings and UV curing polyesters will be presented. Ethoxylated Pentaerythritol and Trimethylolpropane with various degrees of ethoxylation are available. Development products are Pentaerythritol with 15 eo and a propoxylated Trimethylolpropane. The alkoxylates have found a growing interest for making acrylated monomers with low skin irritation in radiation curing systems. Technical information about the application of alkoxylates in polyurethane coatings will be available. Alkoxylates can also be used as reactive diluents in stoving paints. Our Polyol PX is an interesting alternative where a low cost is the prime consideration. Application of Polyol PX in air drying alkyds will be presented.

For further information Enter I333

The Q-Panel Company (Rm 4043) will display the Q.U.V. Accelerated Weathering Tester, a well established, low cost equipment designed to reproduce in the laboratory effects of outdoor exposure. The Q.U.V. utilises fluorescent lamps with defined spectral outputs to simulate sunlight in the UV region and condensation to reproduce the effects of rain and dew. A newly developed lamp, the UV-A 340, was introduced about a year ago — this lamp provides the best available simulation of sunlight in the critical short wavelength UV region between 365 nm and the solar cut-off at 295 nm. Also on display will be a selection of Q-Panels.

For further information Enter I334

Rohm and Hass promotes a formulation package for architectural and industrial coatings consisting of: PRIMAL Emulsions, ACRYSOL Rheology Modifiers and Thickeners, OROTAN dispersants, SKANE and KATHON Biocides and ROPAQUE Opaque Polymer. The technology of these products has been designed for maximum compatibility and is supported by a commitment to good technical and sales service, as well as high quality standards. The strong research orientation of the Rohm and Haas Company assures that there will be plenty of new attractions for visitors, for discussion according to individual requirements.

For further information Enter 1335

Rotgerswerke AG (Rm 4061, 4062) produce a wide range of aromatic and heterocyclic chemicals together with a comprehensive line of C9 hydrocarbon resins, aliphatic modified C9 resins, indene-coumarone resins, modified indene-coumarone resins, modifiers for epoxy, polyurethane and polysulphide systems. The forementioned resin range is marketed worldwide by Verkaufsgesell schaft for Teererzeugnisse (VfT)mbH. The resins offered range from liquids to high softening point solids. The versatility of the VfT-resins permits great latitude in formulating: Developments products available in autumn 1989 are the Rüta-mod range of modifiers for epoxy and polyurethane systems. This supplement to the carbo-mod series does not have to comply with the labelling requirements laid down by the German Hazardous Goods Regulations.

For further information Enter 1336

The Metalorganics and Pigments Group of **RTZ Chemicals, Northern Division** (Rm 4095) will be exhibiting a selection of raw materials for the surface coatings industry including: Manosec® Driers for lead and barium free systems including CD44 the novel zirconium-free combination drier. Alusec® aluminium organic cross-linkers for high solids decorative and industrial coatings. Manchem® (formerly Cavco Mod) Zircoaluminate coupling agents for improved substrate adhesion and corrosion resistance in industrial paint systems. Manalox® rheology control agents for offset printing inks and varnishes. Easispere® iron blue pigments, the cost effective alternatives to alkali blue for toning black inks.

For further information Enter 1337

The Performance Chemicals Group of **RTZ Chemicals, Northern Division** (Rm 4095) will be featuring a range of additives for the surface coatings industry including: Bevaloid® dispersants — A comprehensive range of acrylic homo and copolymers customised to individual needs for pigment dispersal. Bevaloid® thickeners — A new range of acrylic polymers for the rheology modification of water-based coatings. Bavaloid® paint binders — The introduction of novel polymers as binders for water-based coatings, such as exterior wood coatings, stains and clears, furniture coatings, plastics coatings and 'wet room' wall coatings. Bevaloid® foam control agents for polymerisation, blending compounding and application in adhesives, paints, lacquers and inks, including: BGA approved — 6575GM, Water-based — 6693, Biodegradable — 6695, Non-hydrocarbon — 999, For solvent systems — 6421, F.D.A. Approved — 6681. Most coatings additives either cause foam or stabilize foam. Bevaloid destroys foam.

For further information Enter 1338

Bernd Schwegmann GmbH & Co Kg will be exhibiting its full range of additives for use in paints, varnishes, printing inks and similar coating systems. The new developments for the application of waterborne coatings will be shown. A PU-thickener and a corrosion inhibitor. Another enterprise range of Schwegmann will exhibit the sieve and filter articles. These sieve bags are offered in a wide range of sizes.

For further information Enter 1339

SCM Chemicals (Rm 4063, 4064, 4065) the world's second largest producer of titanium dioxide by the environmentally preferred chloride process, will be featuring information on the comprehensive range of TiONA pigments, in particular: RCL-628 a specialist grade of TiO_2 for high performance coatings, where outstanding durability, high opacity and exceptional gloss are demanded. RCL-535 a unique multipurpose grade of TiO_2 designed to be used in a wide range of applications, without compromising on performance. RCL-69 a readily dispersing, blue tone grade of TiO_2, designed to meet the requirements of the plastic industry. SCM Chemicals will also be displaying information on its commitment to Total Quality Control.

For further information Enter 1340

The Coating Additives & Colorants Division of **Servo Delden B. V.** will feature highlights of SER-AD and Nuodex Coating Additives and Nuodex Colortrend colourant systems. New developments in low-odour additives, SER-AD PU-thickeners, Exkin anti-skinning agents, Chroma chem industrial colourants and ethylene glycol free colourants will be emphasised. New Nuodex Lead-free driers will be shown.

For further information Enter 1341

Silberline Ltd will be exhibiting an entirely new range of high performance pigments branded SSP-Grades (SPARKLE SILVER PREMIER GRADES). SSP-Pigments reflect the latest trechnology in acid resistant, lenticular ('Silver dollar') pigments for OEM and Refinishing applications, particularly higher solids and water-borne systems.

For further information Enter 1342

Shamrock Technologies SA (Rm 4071, 4073) is the wholly owned subsidiary of Shamrock Technologies Inc. at Newark, N.J. Shamrock will exhibit its production range of micronized speciality waxes and additives for the surface coating industries and printing inks. Specialities include several finely micronized waxes (PE, PP), PTFE, and wax blends designed to meet specific surface properties. Also TEXTURES, a range of texturizing agents and AQUAPELS, a line of products to impart and improve hydrophobicity and water repellency of coatings.

For further information Enter 1343

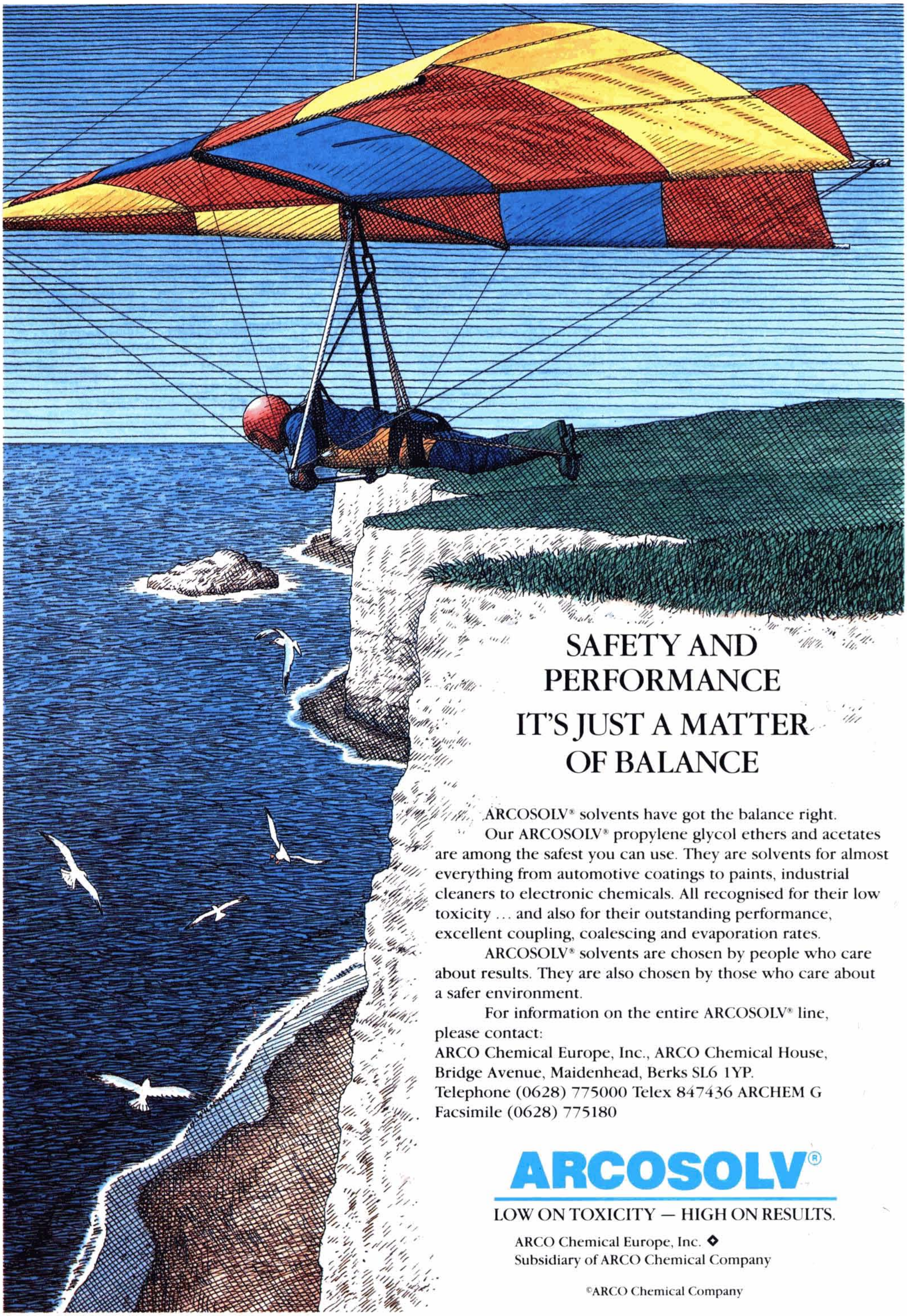
Thomas Swan & Co Ltd (Rm 5088): Epoxy Powder Coatings — New curing agents giving matt finishes complementing the well-known CASAMID range for high gloss finishes. Epoxy Resins — an extensible epoxy resin to widen the range of CASAREZ epoxy resins. Non-Reactive Polyamide Resins — A polyamide resin resistant to gelation at sub zero temperatures extends the range of CASAMID polyamide resins for inks and lacquers. Test Equipment — A range of Test Equipment from GL instrumentation for the printing, packaging and polymer industries will be on display in addition to the new N121 uv curetester, which is much improved on the N101. Other Activities — In addition, access to Swans wide Trading and distribution network, including USA and USSR, and the extensive custom and toll manufacturing facilities will be available.

For further information Enter 1344

Tikkurila Oy (Rm 4017) will be exhibiting the Temacolor Tinting System for industrial paints, Monicolor Tinting System for decorative paints, Valtti wood protection products.

For further information Enter 1345

Tioxide Group Plc (Rm 5016, 5018, 5020) will be showing new technical data concerning its World Standard



Enter I109 on Reader Reply Card

pigment Tioxide TR92 as well as comparing the fitness for purpose between Tioxide pigments TR92 and R-XL. Up to date technical developments will show — the characterisation of surfaces, fatigue life measurements and the electrostatic bell. Tioxide Chemicals will be showing how new products and applications can solve industrial problems. It will also be promoting its latest technology in organometallic products. In addition Tioxide's commitment to both Quality and the Environment will be highlighted. Main stand personnel will be: John Balfour, John Goodby, Rob Rauch, Neil Reeves — UK. Kevin Adamson, Elaine Hills — Tioxide Chemicals, UK. Pierre Audouin, Denis Huchette, Toni di Nallo, Olivier Raffarin — France. Denis Becherel, Horst Martiensen — Germany. Alberto Fdz Mota, Jesus Zori — Spain. Fulvio d'Alessandro, Luigi Cutrone, Giorgio Muttini — Italy. Agne Johansson — Sweden.

For further information Enter 1346

The involvement of **UCB's Speciality Chemicals Division** (Rm 5028, 5030) in organic coatings is based on three different resin technologies: Ebecryl and Uvecryl products: multi-functional monomers, acrylate and polyester oligomers, cured by ultra-violet light and electron beam; Ucecryl water-based emulsions: acrylic and acrylic-styrene emulsions, Especially for coating cement-based materials: Crylcoat polyesters for powder coating: a wide range of carboxylated and hydroxylated polyesters for powder coating systems. All three technologies contribute towards cleaner and more economical organic coating systems.

For further information Enter 1347

Vinamul (Rm 5067, 5068, 5069) will feature its latest pressure polymer emulsion including the Vinamul 3600 series of terpolymers which offer high performance in applications ranging from solvent free interior paint to durable exterior coatings. Also to be presented: terpolymer emulsions for water resistant and non-slip ceramic tile adhesives, and for flooring adhesives with low solvent and plasticiser requirements; vinyl acetate — ethylene emulsions for high speed packaging; powder polymers for high performance in building and adhesive applications.

For further information Enter 1348

Winter-Bouts B. V. (Rm 5053, 5055) is one of the leading producers of coloursystems in Europe. We can offer a range of various systems e.g. DIY market: machine tinting and injector system, Professional market: Coltac Coloursystem (universal colourants), Industrial market: M.P.S. system (multi-purpose colourants), Inplant Tinting systems: These systems are delivered exclusively to the paint industry. We are represented by agents in every country in western Europe.

For further information Enter 1349

Worlée-Chemie GmbH (Rm 5009, 5011) will exhibit their specialities which are: Worlèekyd — high solids and environmentally acceptable alkyd resin solutions for coatings. Worléekyd — alkyd resins for offset inks. Worléesol — water thinnable alkyd resins.

For further information Enter 1350

For further information on the Exhibition contact: Joan Ridge, Resins & Pigments 89, Queensway House, 2 Queensway, Redhill, Surrey RH1 1QS, UK. Tel: 0737 768611 Tlx: 948669. Fax: 0737 761685.

For further information on the PRA Conference contact: Dip Dasgupta, The Paint Research Association, Waldegrave Road, Teddington, Middlesex TW11 8LD, UK. Tel: 01-977 4427. Tlx: 928720. Fax: 01-943 4705. ■

The future of coatings for plastic substrates in Western Europe

by Information Research Limited

Presented here are the main conclusions from our recent extensive in depth study of the West European coatings for plastics market.

□ There are more than ten main types of plastic substrates that are currently coated by various means. These comprise some thermosetting plastics (notably polyurethane RIM products and polyester based SMC material), and several generic types of thermoplastics. The latter include the engineering plastics, such as acrylonitride-butadiene-styrene, polyphenylene oxide, polycarbonate and polyamide, together with polyolefins, the latter usually being used in a modified form.

□ A diversity of coatings are used on these substrates for decorative purposes and for added protection of the surface, the most important being essentially paints and inks of various types, while other forms of coatings include foils and metallic particles. The latter are applied by plating, thermal spraying and vapour deposition.

□ The paints utilised on plastic substrates comprise several generic types. The most important are those based on polyurethanes and acrylic resins, while epoxies and polyesters are also widely used for specific purposes. In addition, water-borne coatings are of considerable interest although these are not used widely at present.

□ The choice of a specific coating for use on a particular substrate depends on a number of factors. These include the compatibility of the coating and the plastic surface, the size and shape of the object being coated, the required final appearance and the degree of protection that is required. The use of coated plastics for many applications is restricted by the upper temperature limit at which the material can be used. Adhesion can also be a problem and some types of surfaces have to be modified to obtain a satisfactory bond between the coating and the substrate.

□ The demand for coatings for plastic substrates in 1988 is estimated at 46,000 tons (valued at around DM 700 million) for all Western Europe, compared with around 20,500 tons in 1980. This represents an average growth rate of 10.6% yearly over this period. The most important national markets are those of West Germany (with over 33% of the total), France (18.5%) and Italy (17.4%). The United Kingdom and Spain each account for over 8% of the total.

□ Of the total usage, the transport industry (notably the automobile sector) dominates the demand utilising some 26,850 tons of coatings. Of this, around 80% is for exterior components of vehicles and the remainder for interior items. The electrical appliance and electronic equipment (such as business machines) are the other major usage sectors, accounting for around 16,525 tons in 1988. Other areas of use include furniture, packaging items, toys and leisure goods and various building components.

□ In most countries, seven or fewer firms hold over 80% of the market. The supply of coatings for use on plastic substrates in Western Europe is dominated by four large multinational groups, with several small-to-medium sized firms also of importance in their local markets. The most important suppliers throughout Europe are the Dutch group AKZO (with some 22% of the total), the two West German multinationals Herberts (Hoechst) and Glasurit (BASF) with 20% and 10% respectively, together with the US company PPG Industries (12.5%). The relative positions of the suppliers varies between the different geographical markets as a reflection of their local strengths.

□ The demand for coatings for plastic substrates is expected to grow steadily over the next decade, at an average of around 10% p.a., the main impetus for increased demand coming from the automobile industry. On this basis, it is anticipated that the West European market will reach a level of 120,000 tons by 1998.

□ The most important coating materials in the future are expected to continue to be the polyurethanes and the acrylics, with water-borne coatings gradually growing in importance. The extent of use of the latter materials will depend on the satisfactory resolution of technical problems and the impact of any legislation against solvent-borne types.

□ There are ample opportunities for firms in the field to develop special expertise in coatings for plastics. This will be achieved not only in-house but by means of an increasing number of co-operative ventures between the producers of coatings and of substrates and the end users. It is expected that the market leaders will strengthen their positions (particularly by means of acquisitions) while the smaller firms will become increasingly specialised in their activities.

Rotary screen printing: A revolution in wallcovering production

by G. E. Scott, Development Manager, Nairn Kingfisher Ltd, Lune Mills, Lancaster LA1 5QN, UK

Summary

Rotary screen printing has gained increasing popularity over recent years in the wallcoverings industry. This paper describes how the rotary screen printing process evolved and how it differs from the more traditional wallcovering printing methods. Reference is made to the different types of rotary screen and printing media and also the basic printing principles associated with the process.

Introduction

One of the earliest methods of wallcovering decoration is stencil printing which dates back to the eighteenth century. Stencilling consisted of brushing or stippling a printing ink through cut out shapes and onto a receiving material underneath. Many stencil shapes were used but as they became more intricate they had to be tied together for additional support. This was a painstaking process involving fine strands of silk or human hair so that no mis-prints appeared beneath the ties.

The realisation that printing inks could flow beneath fine silk threads culminated in the early twentieth century with the first flat screen printing process. The process consisted of stretching and tacking a piece of fine woven silk across a wooden rectangular frame and scraping the printing ink with a squeegee across and through the silk and onto the receiving material underneath. Designs were applied to screens by sticking hand cut stencils to the underside of the silk but nowadays a photomechanical method is used which allows much more intricate designs to be printed.

As the flat screen printing process developed it eventually found its way into the textile industry. However, by todays standards the printing method was extremely tortuous. Cloth was fed into the machine one design repeat at a time and the individual prints drawn down by hand. The cloth was then moved along another design repeat and the process repeated. In this way the designs were built up in stages using register marks to fit the individual prints together.

The major problem with the flat bed printing method, even when automated, was the slow production speed, but it was not until the early 1960's when the first rotary screen printing machine was developed that faster printing speeds became possible. The rotary machine was based on similar lines to the flat bed machine except the printing tables were replaced by perforated seamless nickel cylindrical screens. A blade mounted inside each cylindrical screen was then used to force the printing ink out through the holes in the screen and onto the receiving material travelling underneath. The absorbency of fabric substrates permits wet-on-wet multi-colour printing using aqueous inks.

It was not long before rotary screen printing was being considered for use in the wallcoverings industry. However, because the substrates to be printed were generally less absorbent than fabrics each individual print colour had to be dried by heat before the next print colour could be applied.

Heaters were first installed between printing stations but unfortunately as well as drying the prints on the piece they also dried the printing inks inside the screens. The problem was eventually overcome by replacing these heaters with hot air driers mounted vertically above each printing station. An additional attraction of the vertical drier, of course, was that it did not take up any extra floor space. A schematic diagram of a typical rotary screen printing machine for wallcovering manufacture is illustrated in Figure 1.

The advantages and disadvantages of rotary screen printing

Compared to some of the more traditional printing methods such as gravure, rotary screen printing does offer the wallcovering producer a number of advantages. At the same time like many other processes it does have certain disadvantages (Box 1). The decision to use the rotary screen printing technique therefore really depends on the aesthetics of the design. Simple designs for example in high contrast colours are well suited to screen printing whereas sophisticated tonal effects are more likely to be produced by gravure or flexo.

Box 1

Advantages/Disadvantages of rotary screen printing.

Advantages	Disadvantages
□ Rotary screens are relatively cheap, easy to handle and can be stored by hand.	□ Rotary screens are prone to damage and have to be replaced.
□ Short runs can be accommodated economically since design change-overs are very rapid and base paper can be overall coated with PVC in tandem with printing.	□ The application weight and thus material cost of screen print is high.
□ Screen printing offers specific aesthetic qualities, eg. high contrast colours such as white on black, expanded prints, etc.	□ Tonal printing is fairly crude.

Types of rotary screen

Two types of rotary screen are produced. One is the Lacquer screen and the other is the Galvano screen. Both types of screen are made by an electrogalvanic process where nickel is deposited onto a steel former bearing the design to be printed in a hardened resist. During the plating process the nickel builds up around the steel former and at the same time holes build up in the areas covered by the resist. After plating, the screen is removed from the steel former as a perforated, hollow, cylindrical tube.

The major difference between Lacquer and Galvano screens is that whereas the holes in a Galvano screen can vary in shape and size and actually make up the design to be printed, the holes in a Lacquer screen are the same throughout and form a regular mesh across the whole surface. It is only after engraving that the design to be printed appears on the Lacquer screen. The traditional engraving method is a photomechanical process similar to that used for flat screen printing. The rotary screen is first of all coated with a thin layer of light sensitive emulsion. The emulsion is then dried and a clear film bearing the required print design in black is carefully wrapped around the screen which is then exposed to UV light. During exposure the coating polymerises in the areas covered by the clear film but not in the areas covered by the black design. After exposure the unpolymerised coating is washed off with water leaving the design to be printed as open holes in the screen.

The main advantage of Galvano screens is the different hole shapes and sizes enable different effects to be printed from the same screen, something which is particularly useful where the number of printing stations on a machine is limited. Even so a wide range of Lacquer screens is produced and if anything these tend to be more commonly used.

The major features of any Lacquer screen are the Mesh Number, the Screen Thickness and the Open Area. The Mesh Number is a measure of the number of holes per linear inch and defines the fineness of the screen. As a general rule the higher the Mesh Number the better the print definition. The Screen Thickness determines the durability of the screen and ink application weight. Thicker screens are more durable and increase the application weight. The Open Area is the ratio of hole to metal on the screen and is dependent on the Screen Thickness and the Mesh Number. As a general rule the higher the Mesh Number the lower the Open Area.

The finest mesh possible in the early years of rotary screen manufacture was approximately 100 holes per linear inch and this very practical limit imposed serious restrictions on the rotary screen printing process. However in 1978 Stork Screens developed their Penta screen which enabled meshes as fine as 215 holes per linear inch to be produced with a reasonable screen thickness and durability. Nowadays rotary screens with mesh numbers as high as 300 holes per linear inch are being produced for use in the textile printing industry.

The rotary screen printing process

Rheological requirements of printing media

In order to print a medium through the holes in a rotary screen it must have the right rheological properties. Rheology is a complex subject but put quite simply, there are three different basic types of behaviour (Figure 2). The best rheology for rotary screen printing is either Pseudoplastic or Newtonian behaviour where the viscosity of the medium at printing shear rate (ca.10,000 Sec^{-1}) is sufficiently low to allow free passage through the holes in the screen. Newtonian liquids tend to be used for overall screen coating where the relatively low viscosity at zero shear rate allows the liquid to flow out into a coherent film. Pseudoplastic liquids are used for design printing where the relatively high viscosity at zero shear rate ensures the print does not flow out but stays where it was printed on the piece. Dilatent liquids are not suitable for rotary screen printing due to their relatively high viscosity at printing shear rate.

Principles of rotary screen printing

The printing medium is applied to the substrate by forcing it out through the holes in the screen with a blade. The position of the blade inside the screen is important since this determines to some extent the amount and quality of the print applied. The ideal printing conditions are when the tip of the blade coincides with the centre line of the screen and the backing roller and the blade pressure is such that it can be increased or decreased as necessary. By altering the area between the blade and the surface of the screen, it is possible to either increase or decrease the application weight. The smaller the area the higher the application weight and vice versa. The effect of different blade settings and blade dimensions on application weight is illustrated in Figure 3.

Figure 2
Types of reheological behaviour

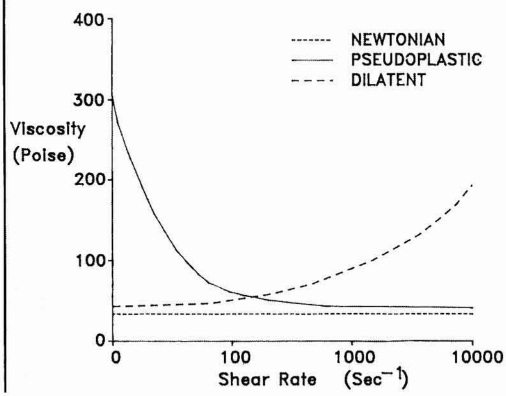
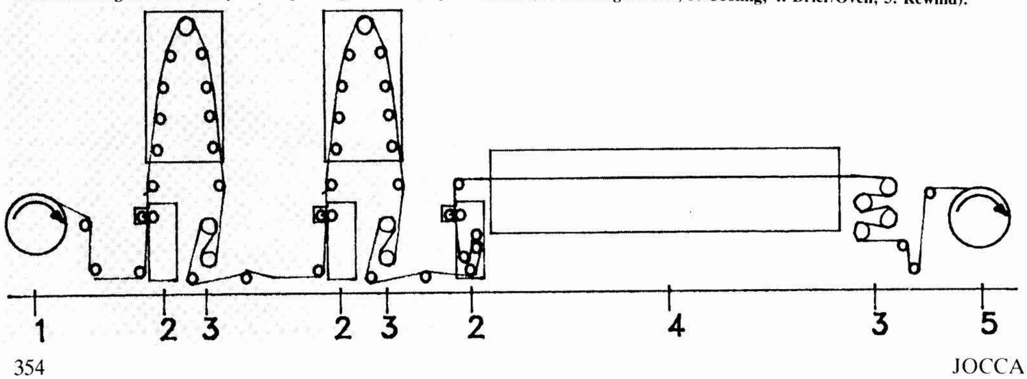
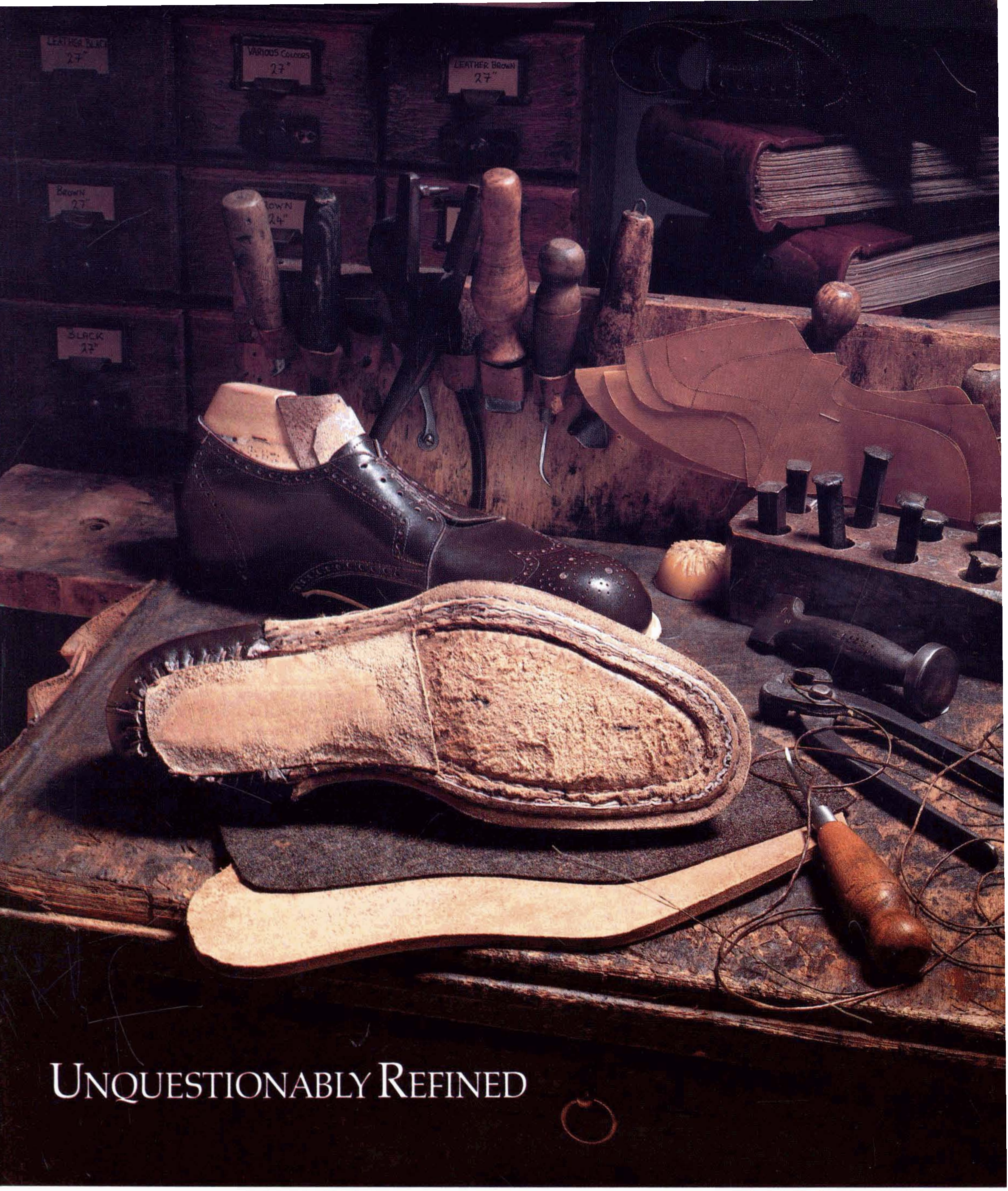


Figure 1
Schematic diagram of a rotary screen printing machine (key: 1. Unwind, 2. Printing Station, 3. Cooling, 4. Drier/Oven, 5. Rewind).





Take the finest materials and apply the skills of craftsmen.

Utilize these ingredients over the years and the result is a name that inspires confidence.

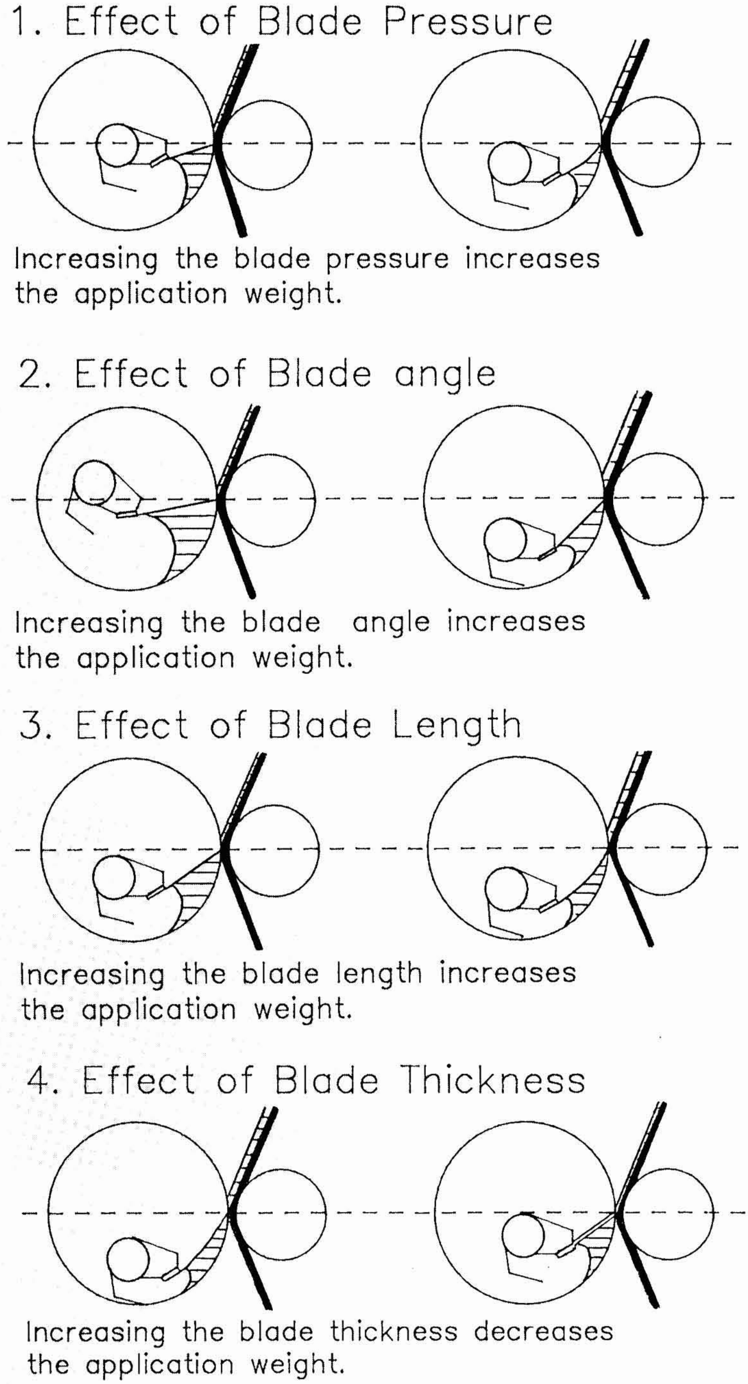
Epikote. The epoxy resins range with a name that's synonymous with quality. Through a constant search for even higher product standards, Shell intend to maintain this reputation.

In the 1990's, Epikote will be made from enhanced quality raw materials using all our manufacturing skills. So for resins of outstanding quality and consistency there will only be one name.

Epikote. The leading edge for resin-based products in the 1990's and beyond.

Shell Resins

Figure 3
The effect of different blade settings and blade dimensions on application weight.



Printing media

Many different types of printing media are amenable to rotary screen printing but the one most commonly used in the wallcoverings industry is PVC Plastisol. PVC plastisols are dispersions of fine particle polyvinylchloride resins in a phthalate ester plasticiser such as Di-octylphthalate (DOP). At room temperature PVC plastisols are fairly viscous free flowing pastes, but when heated they fuse to form flexible thermoplastic materials and it is at this stage that the full properties of the PVC are developed. The attraction of PVC plastisols is that they can be formulated in many ways to produce a wide range of different effects. Table 1 for example illustrates a typical plastisol formulation for flat vinyl printing.

Table 1
PVC plastisol formulation for flat printing

	Parts by weight
PVC	100
Plasticizer	55
Heat Stabilizer	2
Viscosity Depressant	1
Pigment	15
Filler	30
Diluent	5

By adding "blowing agents" the same PVC plastisol can be made to expand when heated. When heated the blowing agent decomposes to release a large volume of gas which gets trapped in the molten PVC thus producing an expanded cellular structure. A widely used and effective blowing agent for PVC plastisols is azodicarbonamide.

Azodicarbonamide is always used in combination with a metal salt, the so-called "kicker", which reduces the decomposition temperature of the azodicarbonamide to 140-180°C, the fusion temperature of the PVC composition. By altering the amount and type of kicker present the azodicarbonamide can be made to decompose at different temperatures.

Thus, by suitable formulation PVC plastisols can be prepared which give flat, solid prints with matte or glossy aspect or foam so-called "structured" prints of high or low relief and smooth or textured surface. By combining these different effects a wide variety of attractive wallcovering effects are being produced today.

Increasingly nowadays more and more thought is being given to using acrylic based aqueous printing inks for wallcovering decoration. The main attraction of aqueous inks is that they are environmentally friendly and easy to clean up and like PVC plastisol can be formulated in a number of ways to produce a wide range of different effects, both flat and foamed. Also, being water-based dispersions of small particle size, the inks are suitable for printing anything from an overall colour wash to the most delicate of printed motifs from fine screens. Almost certainly these inks will become increasingly more popular as the pressures to reduce solvent emissions from factories increase over the coming years.

Conclusions

Rotary screen printing is an extremely versatile process and very much at the forefront of wallcovering decoration today. The growth of screen printed blown vinyls in this country (11.4 million rolls in 1985 cf 30.4 million rolls in 1988) together with the enormous investment in machinery suggests rotary screen printing will continue to play a major role in wallcovering design in the future.

Acknowledgements

Thanks are due to Nairn Kingfisher for granting permission to publish this paper and in particular to Mr W. G. Niven and Mr A. Craig for their valuable assistance.

Paper presented to OCCA Manchester Section on 20 March 1989. ■


ECC International
HyPerformers
HyPerformers
ECC International
ECC 1

A new dimension in Colour Matching

Just three years ago, in July 1986, Colourgen Limited was formed as a wholly-owned subsidiary of Colorgen, Inc. of Boston, Massachusetts USA, and the Group's European headquarters opened in Warrington.

Since then, with developments such as a joint marketing agreement with BASF Coatings + Inks and growing sales to major European paints groups, the company has established itself as a leader in the supply of cost-effective, fast and accurate colour-management systems to the European coatings industry.

Colourgen works closely with its clients, aiming to make an important contribution to their marketing strategies, helping them increase their business.

The Vision

The Colorgen group was established to release the technology for colour match prediction from use only in specialised central laboratories and into everyday applications. As has happened with the personal computer, much lower prices have created whole new market opportunities, and now the Colourgen DCM-1100 system is equally at home in the laboratory and the retail shop.

John O'Brien, a Masters graduate of Rennselaer Polytechnic and the University of Paris saw the opportunity in 1982. Using his background in solid-state engineering and with financial backing from private US investors, he began work on a prototype colour-matching system. In 1985 he established Colorgen and raised capital to finance the company's apportunities through a placing on the Unlisted Securities Market - the first American greenfield start-up company to do so.

The markets

Colorgen had developed a high-quality, efficient computerised colour-matching system at a price significantly below the competition, The initial focus was to develop products for the retail paint market in the United States, where the company soon established a visible lead.

By the end of 1988, Colorgen had made its first $1 million dollar sale to the mass-merchandiser and chain-store market.

It was planned that the European operation would be the spearhead of the drive to create commercial opportunities in other markets where colour management can also be used as a marketing and sales aid. In addition to introducing the system to European paint companies, Colourgen Managing Director Peter Wall, formerly with ICI, began a pioneering program to develop an affordable matching system for inks and translucent materials.

He approached Leeds University, which has the only fUlly-funded independent Colour Chemistry Department in the world, The Department was anxious to cooperate with commercial concerns, and soon a close relationship developed between the University and Colourgen. After some months of work, Dr Jim Nobbs, Senior Lecturer at the Department, was appointed Technical Director of Colourgen, The first fruit of the relationship was the development of an absolute two-constant theory match prediction program for translucent and transparent materials such as printing inks, With support from a Department of Trade and Industry grant, the program has been developed to handle textiles and surface coatings.

The new program was a significant breakthrough in the handling of very awkward materials, and the results created considerable interest, with sales to companies throughout the world.

In July, BASF Coatings + Inks Limited concluded a joint marketing agreement with Colourgen to promote Colourgen colour matching systems and supporting software, together with BASF/Fishburn printing inks. BASF locke + Farben is Europe's largest printing ink manufacturer, In the UK, BASF Coatings + Inks are market leaders in the packaging and publishing industry, BASF have placed Colourgen systems on their own sites, and together with Colourgen will locate systems on site with their key customers,

Enter 1100 on Reader Reply Card

At the same time, Colourgen has announced a substantial initial order for calour matching systems and supporting software from a major European paints group. It is planned that a number of similar orders will be placed over the next six months.

Colourgen is also bringing effective colour management as an affordable marketing and quality control tool to new industries, with test progroms in textiles, plastics and autamotive sectors.

The Colourgen effect

The Colourgen sysem has been devised not only for the laboratory, but for use in the real world – as a marketing tool, or as an instrument for quality control that can be used wherever colour differences need to be measured.

In the United States, installing Colourgen systems in the paint mass-merchandiser and chain-store market makes the customer aware of the potential for colour-matching and creates a new demand. For the first time, the customer can match paint to her own home furnishing colours. In the printing industry, ink manufacturers can place Colourgen systems loaded with their own databases in major customer sites in return for a commitment to purchase their inks. Similarly, in the textile industry, manufacturers are developing programmes for clothing customers in return for increased commitment to their products.

Colourgen is having a direct effect on marketing and quality control, and the group is committed to working closely with its clients to help them manage the change and meet the new opportunities.

These opportunities can only grow. We are now at the brink between hardware driven and information driven systems. In future, the colour computer will not be simply a stand-alone tool or a provider of raw information; rather it will be part of an integrated system which will be designed to give the information that the user wants in the way he wants it.

The Colourgen System

Hardware

The OCM-llOO colour-management system comprises Colourgen's own CS-llOO spectrophotometer linked to an IBM or compatible PC and printer driven by Colourgen's own software.

The CS-llOO spectrophotometer is a dual beam solid state diffuse reflectance spectrophotometer with a 6" integrating sphere and advanced solid state electronics. It is complete with its own CPU on board which contains an electronic lock to protect the software and databases. There is a keyboard controlled specular port.

The CS-llOO can be supplied with an operating protocol as well as the complete Colourgen software so that CS-llOOs can be used by companies who have their own software requiring spectrophotometric measurements. The Colourgen spectrophotometer has been found to be a reliable, fast and very accurate state of the art instrument, but in case of any problems there is a full diagnostic array panel for easy trouble shooting.

The CS-llOO can be linked to any IBM or compatible PC running with MS DOS. All of the Colourgen software is designed to run on a 20mb hard drive and all use the latest co-processor technology. Software for all tasks from quality control to full match prediction of transparent materials is available. It is all menu driven and designed to be especially user friendly.

Software

Colourgen's absolute two-constant colour match prediction software can only be appreciated with some understanding of the basic colour physics involved in the management of transparent and translucent as well as opaque materials.

Two basic interactions take place as a ray of light passes through a pigmented layer - the light can be absorbed or scattered by any pigment particle it encounters. The two constants that determine the probability of absorption or scattering as the beam passes through unit distance are usually termed K and S respectively, and are treated as additive, thus the value of K and S for a layer containing a mixture of pigments is obtained by summing the K and S values from each of the pigments.

To predict the reflectance of a layer, and therefore its colour, it is necesssary to know the values of K and S for each component in the layer, In turn, it is possible to use this information to calculate the colour produced by a layer containing a mixture of components or colouronts applied to any substrate over a wide range of layer thicknesses, The equations used are not straightforward and a number of simplifications are often made but approximate theories only apply under specific conditions,

One-constant programs

The one-constant approximation may be applied to dyed textile materials and opaque pigmented layers containing a Virtually transparent colourant mixed with a highly scattering opacifying pigment, for example tinting colourants mixed into a white base paint material.

The reflectance of such an opaque layer depends essentially on the ratio of K of the colourants to S of the opacifier and not on their absolute values, Because of this, the optical properties of each colourant are represented by a single constant, the ratio of their absorption Kc to the scattering power of Sw of the standard white base paint or textile material.

Relative two-constant programs

The relative two-constant approximation may be applied to opaque layers in general whether they are paint, plastic or some other material. Again, the reflectance depends essentially on the ratio of K to S for the layer and not on their absolute values, The optical properties of each colourant are now characterised not only by the ratio of the absorption of the colourant to the scattering power of a standard white (Kc/Sw), but also by the ratio of the absorption of the colourant to the scattering of a standard white (Sc/Sw). The white standard is often titanium dioxide,

Absolute two-constant programs

The absolute two-constant method may be used to predict the reflectance of both an opaque layer and of transporent and semi-transparent layers over a substrate, For transparents and semi-transparents, reflectance will depend on the absolute values of the absorption (K) and the scattering (8) constants of the layer, the thickness of the layer and on the reflectance of the underlying substrate, The optical properties of each colourant are now determined by the absolute absorption (K) and scattering (S) constants,

But it is clear that the absolute two-constant approach is the most appropriate for the recipe prediction of transparent and translucent materials, especially printing inks,

Obviously, all match prediction systems are most accurate when the predicted recipes are proofed by the same method, at the same film thickness and on the same substrates which were used to prepare the data base prints, Indeed, if manual or semi-manual proofing methods have been used to produce the data base prints, then the predictions may be best for prints produced by the specific colour technician who made the data base,

Data bases also need adjustment in the light of their performance, By keeping records of predicted and corrected recipes it is possible to identify, quickly, inks that are consistently over or under predicted - the base may then be adjusted to compensate for this,

Adjusting formulations

Because of batch colour changes in both pigments and substrate after the building of a data base, it is sometimes necessary to adjust formulations, and a useful facility of match prediction is the ability to suggest how the initial formulation or recipe of a paint or ink should be altered to improve its match to the colour of a standard sample,

The colour of a drawdown panel of the first formulation is measured by spectrophotometer and this information together with the data base is used to calculate a new formulation, adjusted to take account of batch variations,

What can be achieved

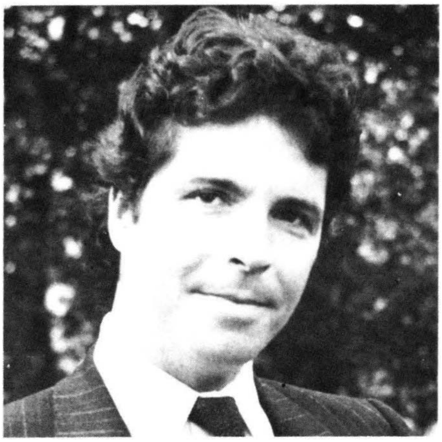
Using the Colourgen match prediction system provides the ability to formulate rapidly new materials, formulate new matches and to match more closely, to adjust one-off shade formulations, and to use up surplus stocks,

In matching translucent materials, the Colourgen system is certainly not a substitute for the skill and craft of a trained colour technician, but a valuable tool for matching up and reducing recipe costs, thus increasing the effectiveness of the colour technician and the business,

Colourgen provide a full data base building service where required, although the software is designed so that clients who choose to do so may load their own data bases,

The Colourgen Team

John O'Brien (41)



Founder of Colorgen, President, CEO and Chairman of the Boord, John O'Brien is a Masters graduate of Rennselaer Polytechnic and the University of Paris, specialising in solid state electronics and nuclear physics, In 1985, he established Colorgen and raised capitol to finance the company's opportunities through a placing on the Unlisted Securities Market - the first American greenfield start-up company to do so.

Peter Wall (41)

Main Board Director and Managing Director of Colourgen Ltd, he has been with Colourgen Ltd since its formation. Prior to joining the group, he served with ICI for 17 years in various management capacities before establishing a UK subsidiary for a Belgian textile manufacturer.

Jim Nobbs (39)

Technical Director of Colourgen Ltd and Senior Lecturer in the Deportment of Colour Chemistry at Leeds University, the only separately funded independent Deportment of its type in the world. He is on acknowledged expert and pioneer in the field of colour management.

Lew Boyd (43)

Main Board Director, Director of Colourgen Ltd and President of Coastal Technology Inc'' he is a valued adviser to the company,

Julia Baynes (38)

Joined as Commercial Manager of Colourgen Ltd two and a half years ago from 3M following extensive experience with Ferranti and 3M where she gained a very wide knowledge of computer-based systems.

Paul Webster (30)

Technical Manager and a most accomplished C programmer who has worked on several new projects in the colour field in his nearly two years with Colourgen, He is also responsible for the technical support of the systems.

Helene Wilson (41)

Administration Manager responsible for all of the financial and administrative functions of the company and for all export, import and distribution malters, she has been with Colourgen since its formation

David Pryce (25)

The most recent recruit who joins Colourgen as Installation and Service Technician with responsibility for the systems in the field

If you would like to know more or see a system in aperation, please contact:

Peter Wall, Managing Director

COLOURGEN

825 Birchwood Boulevard, Birchwood, Warrington, Cheshire WA3 7QZ, United Kingdom

Telephone: **0925 822577** Facsimile: **0925 837087**

Robotic painting of plastic car bumpers

by P. St Clair, Graco UK Limited, Wednesfield Road, Wolverhampton WV10 0DR, UK

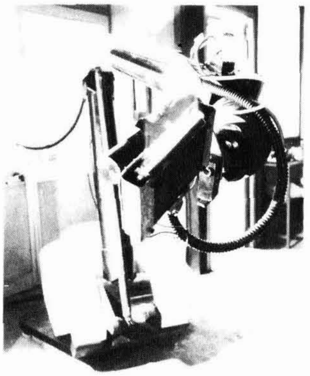
One of the more visible examples of the use of PVC and polypropylene materials in automotive manufacture has been the increasing use of bumpers and body side trim panels. Virtually all new models which are launched have bumpers constructed of this material.

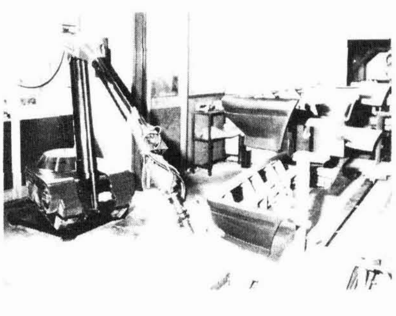
When the material was first introduced, it was common for the bumpers to be fitted to the car without any form of final finishing, merely relying on the self-colour of the injection-moulded material. With increased use however, has come a requirement for bumpers to be finished in the same colour as the body of the vehicle itself, and this in turn has dictated a quest for effective methods of applying primer and finishing coats to these components.

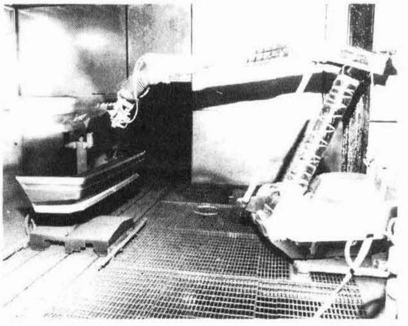
A car bumper is likely to be subject to knocks, bumps and scratches, and therefore the paint finish used must be of the highest quality in order to minimise the risk of flaking due to abrasion.

At the Saiag-Plast factory at Frosinone, South of Rome, a complete production operation is devoted to producing car bumpers, kick strips and side deflector panels for models in the Fiat and Alfa Romeo ranges. The bumpers in particular are required to be finished to match the colour of the vehicle, and engineers at Saiag-Plast were faced with the problem of how to ensure adequate adhesion of the paint film to the surface of the bumper. They came up with a revolutionary solution to this problem, one which has proved simple to operate in a production line environment, and also to be very effective in producing a high quality finished product.

A propane gas torch is mounted on the OM500 arm which can reach all parts of the component with ease.







The Graco A800N automatic air spray gun applies primer precisely 4 minutes after flame.

The technique used is to apply a naked flame to the surface of the bumper for a specific period of time, and this operation causes a chemical change in the molecular structure of the surface, such that when the paint film is applied, the molecules of the paint bond themselves to the molecules of the bumper surface and become part of it. Similarly when the finishing coats are applied, the same molecular bonding action takes place, and the final product has extremely hard-wearing and abrasion-resistant qualities.

When it came to deciding how to apply the flame to the bumper and also how to apply the various finishing coats, it was decided that automatic or robotic application should be used in preference to manual operations. Following trials, Graco's OM500 Robot was selected as being able to perform the intricate movements required to reach all sections of the bumper component, within the working envelope of the manipulator arm.

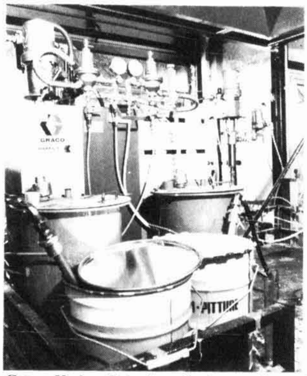
There are four OM500 Robots in use at Saiag, the first of which is fitted with a gas-fired torch. When the bumpers are loaded onto the floor-mounted conveyor bogeys ready for finishing, the OM500 applies the torch in a specific pattern and for a precise period of time to create the required molecular change in the surface of the material. The speed of the floor-mounted bogey track is geared to allow a precise four-minute period between each operation, which gives the process time to "settle" between each stage.

After the flaming process, the bogey moves forward into the primer booth where a single coat of primer paint is applied. The OM500 is supplied with paint from a 200-kilo drum positioned immediately beneath a Graco Monark fluid transfer pump mounted on the outside wall of the primer booth. The contents of the drum are kept in suspension by a Graco air-operated hook agitator. With the primer applied, the bumpers are conveyed through a low temperature curing stage before the finish colour is applied prior to stoving.

The third and fourth robots, fitted with Graco A800N automatic air spray guns, apply the finish coats. Depending upon the finish required, namely acrylic enamel or metallic (clear over base), the bumpers are sprayed either at the first station only (acrylic), or for metallic finishes, the first robot applies the base coat and the second robot applies the clear polyurethane lacquer.

The finish coatings are plural component materials, delivered to the robot booths by Graco's Small Variable Ratio Hydra-Cat proportioning pumps which feed from transit containers of varying sizes. The proportioning pumps

The wall mounted Graco Monark delivers the primer to the booth. The air powered agitator is mounted on the drum cover.

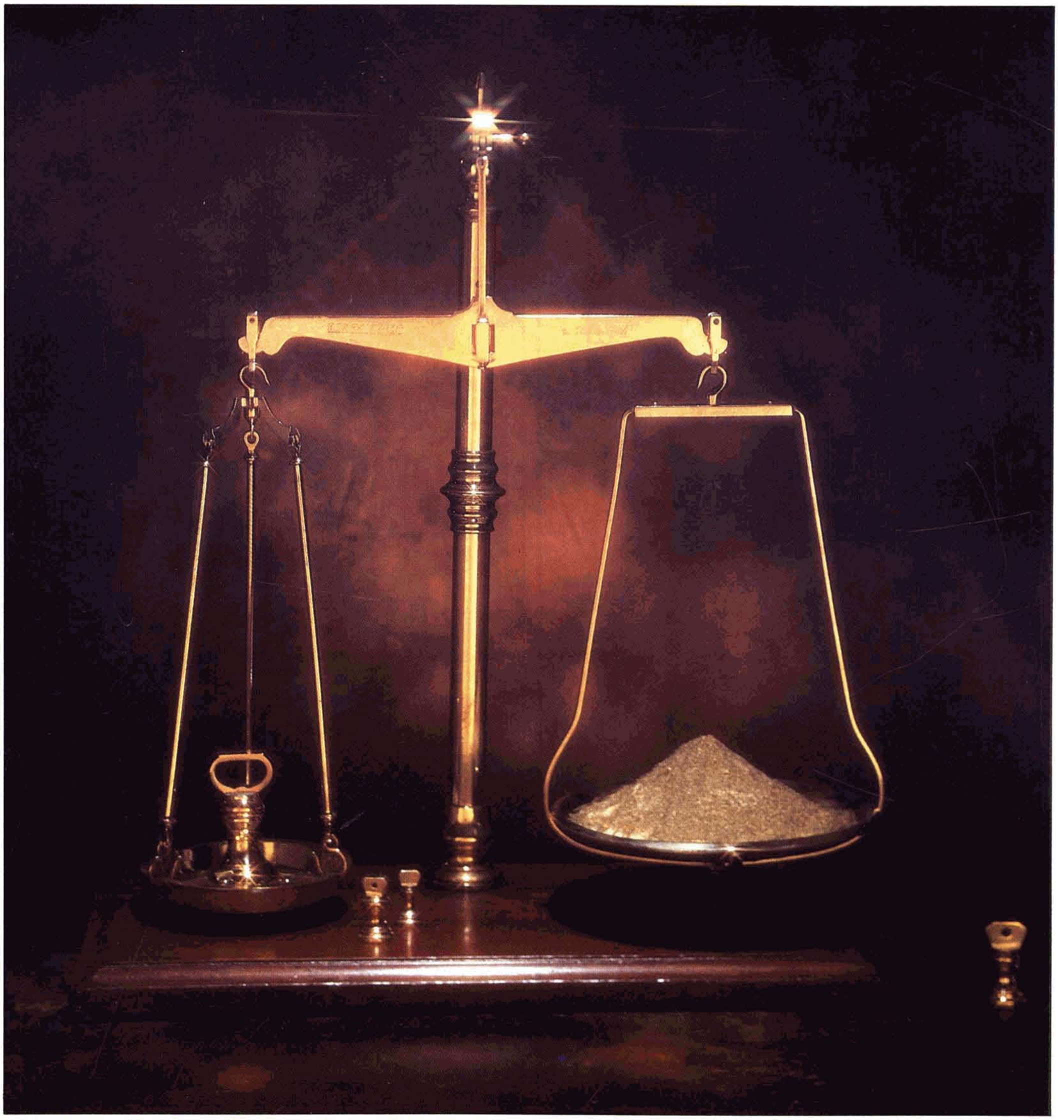


The Graco Hydra Cat mixes the two-pack coatings.

can be adjusted with minimal effort when differing material characteristics dictate a change in the mix ratio of the two components.

The capacity of the Hydra-Cat air motor/pump configuration is selected according to the parameters (input and output air pressure, material viscosity, delivery volumes etc.) of the specific application. Once set up, the pump is completely reliable, and, because the material is mixed and delivered "on demand," waste is minimised and cleaning or flushing is simple and quick to accomplish.

The final operation conveys the finished bumpers into the curing oven where they are treated for a period of approximately 45 minutes at a temperature of 80-90 degrees centigrade. ■



THE INTERNATIONAL GOLD STANDARD

To set the International Gold Standard for producing Bronze Powder you need time...

At least 50 years experience in atomising copper zinc alloys...

50 years experience in milling brass grain to produce lamellar flakes...

50 years experience in polishing the flakes to a highly reflective finish...

Not to mention the surface chemistry required to create speed of leafing and stability, so important in ink and paint mediums and classification techniques to ensure the correct particle size distribution for specific applications.

In other words, you need to be Wolstenholme Bronze Powders.

We really are As Good As Gold.

Wolstenholme Bronze Powders Ltd

Springfield House, Lower Eccleshill Road, Darwen,
Lancashire, England, BB3 0RP
Tel: (0254) 873777 Telex: 63251 Facsimile: (0254) 873009
Springfield House, P.O. Box 14, Darwen, Lancashire BB3 0RX

Polyesters for powder coatings: Resin parameters correlated with coating properties

by T. Misev and E. Belder, SSM Resins BV, Ceintuurbaan 5, 8022 AW Zwolle, The Netherlands

Abstract

In comparison with solvent-based systems, for the case of powder coatings most of the coating properties are almost exclusively dependent on the binder. The characteristics of the resin are therefore of essential importance for overall coating performance. In the article the most important resin parameters like molecular mass, functionality, viscosity and glass transition temperature are discussed with respect to their interdependance and their influence on: the processing properties of the coating during its production, the flow during application and mechanical properties during the exploitation of the coating. It has been concluded that the degree of freedom in adjusting these parameters is rather limited, and that only with a very good understanding of their contribution to the coating properties combined with a careful balance between their values can coatings with good overall performance be produced.

Introduction

Powder coating does not seem to be a very complex system at first sight. If one compares the number of constituents in a powder coating formulation with that in a conventional solvent based coating, this seems to be true. But although the solvent is a nuisance from an ecological point of view, it must be admitted that it is of a great help to the paint formulator in adjusting many properties of the coating. In the case of powders most of the properties are determined by the binder, and even more problematic, many of desired properties are rather contradictory. Therefore, there is probably no other type of coating, where the resin and paint chemists are forced to make so many compromises.

In this paper the most important parameters to which the resin chemist has to pay attention such as molecular mass, functionality, glass transition temperature and viscosity will be discussed, with an attempt to explain their correlations with properties of the paint.

Molecular mass

Like all polymers, polyester resins are blends of molecules of different molecular masses. Therefore averaging of the molecular mass is the only way to express it with a relevant value. From the several different ways of averaging the molecular mass two of them are important for the properties of powder coatings: number average molecular mass (Mn) and mass average molecular mass (Mm) which are expressed by the well-known equations:

$$Mn = \Sigma MiNi/\Sigma Ni \quad Mm = \Sigma NiMi^2/\Sigma NiMi \qquad (1)$$

Mechanical properties of the powder coatings such as tensile strength and impact resistance are mainly dependent on the number average molecular mass, while the mass average molecular mass governs the melt viscosity of the resin.

For polymers, mechanical properties can be expressed by the following formula[1]

$$X = X_\infty - A/Mn \qquad (2)$$

where X is the property considered, X_∞ is its value at very high molecular mass and A is an empirical constant.

Based on a wide range of collected data it has been established that the main range of molecular masses is between 20,000 and 200,000 for commercial polymers in which they exhibit good impact and tensile strength[2].

Lets now consider this fact and try to implement it on powder coatings.

Suppose a linear carboxyl terminated polyester resin with a number average molecular mass of Mnp is to be cured with a linear type of bisphenol A based epoxy resin with a number average molecular mass of Mne. If there is a complete consumption of the epoxy groups during curing, in a slight excess of carboxyl groups coming from the polyester resin, the number average molecular mass Mn of the cured coating can be easily calculated by the following formula:

$$Mn = (x+1)\ Mnp + x\ Mne \qquad (3)$$

where x is the degree of polymerisation of the block copolymer composed of blocks of polyester (P) and epoxy (E) nature.

$$P - (E-P)\ x$$

Obviously, the molar ratio between the functional groups can be expressed by:

$$z = (x+1)/x \qquad (4)$$

It is clear that $x = \infty$ only for an ideal stoichiometric ratio between the carboxyl end epoxy groups, i.e. for z=1. Let us assume that for good mechanical properties the lowest value for Mn to achieve good properties after curing has to be 20,000. Using Equations 3 and 4 and supposing a equivalent weight of the crosslinker of 725 (Araldit GT 7004 from Ciba-Geigy for example) the values of z for obtaining this molecular mass can be calculated. These figures are presented in Table 1 for polyesters with a molecular mass range of

Table 1

Mole ratio between carboxyl and epoxy groups for obtaining number average molecular mass of 20,000 g/mol.

Mn polyester	z
1000	1.13
2000	1.19
3000	1.26
4000	1.34
5000	1.43
6000	1.53

between 1,000 and 6,000. The results show that the lower molecular masses of the polyesters need a closer ratio of polyester/epoxy to the stoichiometric ratio. In other words, the system is more sensitive to: the deviations which are quite common in weighing raw materials during coating manufacture, determination of acid, hydroxyl or epoxy equivalent values, degree of hydrolysis of the oxirane rings during the storage of the coating or the epoxy crosslinker itself and the extent of reaction during the curing cycle. The logical choice of making polyesters with higher molecular masses has as a consequence an increase of viscosity which gives problems concerning the processability and flow of the coating.

Functionality

The problem of the sensitivity of the coating formulation to the correct ratio between the functional groups can be overcome by increasing the functionality of the crosslinker, or the functionality of the polyester itself. In this way, the system will be less sensitive to the necessary stoichiometry for obtaining an infinite network.

Using Gordon's theory of branching processes with cascade substitutions[3-6], calculations have been made for a system based on a carboxyl functional polyester with number average molecular mass of 3,800 and functionality being between 2-3.25, and bisphenol. A epoxy resin with a number average molecular mass of 1500 and epoxy functionality of 2. Figure 1 represents the dependance of the number average molecular mass of the system at different degrees of freedom of conversion of the epoxy groups during the curing process. As can be expected, the build up of the molecular mass is much faster with increasing functionality. A number average molecular mass of 20,000 is obtained at a conversion of 86% in the case of a polyester with functionality of 2, and 62%, 24% and 8% conversion when functionality of the polyester resin is 2.5, 3 and 3.25 respectively. But, as usual, the formulator is once more faced with the difficulty in taking this option as a solution to the problem. High functionality will consequently give a fast increase in the melt viscosity, thus this will shorten the time available for flowing of the coating during film formation. The result will be bad flow with an emphasised orange peel effect. On the other hand the functionality, the number average molecular mass and the acid or the hydroxyl value are not independent variables. In the case of the acid terminated polyester resins which are to be crosslinked with epoxies, this dependance can be expressed by the following equation:

$$Fn = AV^*Mn/56100 \qquad (5)$$

This means that for the same acid value of the resin (in order to keep constant weight ratio polyester/epoxy), if one wants to increase functionality, higher molecular mass has to be chosen. The other option is to keep the same molecular weight, but then one has to increase the acid value which has a direct influence on the desired polyester/epoxy ratio.

The increase of functionality leads also to a higher mole fraction of branching components in the main formulation. In the case of a random esterification process the number average molecular mass increases linearly with the functionality at constant acid value, but the increase of the mass average molecular mass is very rapid.

Using the Flory-Stockmayer theory for molecular mass distribution in nonlinear polymerisation[7,8], a calculation has been made for a series of resins based on neopentyl glycol, isophthalic acid and trimethylol propane as a branching component, with an acid value of 35 and functionality between 2 and 4. The results are presented in Table 2. At functionality of 3.5 the resin is already beyond the gel point. Because of the assumptions which have been made in deriving the Flory-Stockmayer theory (especially the neglecting of the intramolecular reactions which lead to cyclisation) there is a certain discrepancy between the theoretical predictions of gelation and the practical results[9]. Therefore, it is possible to make a resin even with functionality of 4, but the viscosity of it will be too high for practical application, and the gel point distance is too small to have a safe production process.

Figure 1

Mn as a function of conversion during curing for polyesters with different functionalities and bisphenol A epoxy resin as curing agent.

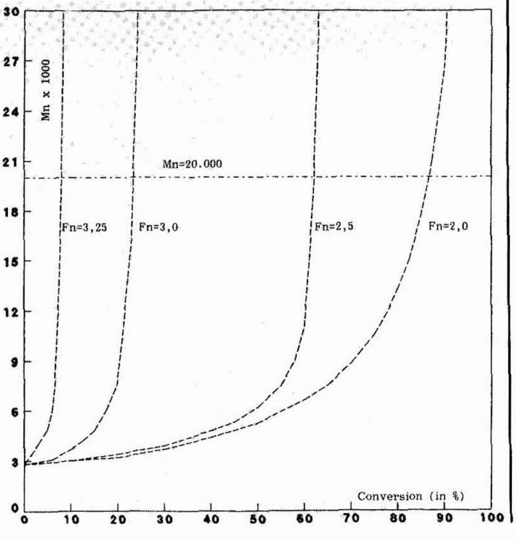


Table 2

Dependance between Fn, Mn and Mm in case of nonlinear polyesterification.

Fn	Mn	Mm
2.0	3200	6550
2.5	4000	12800
3.0	4800	384000
3.5	5600	∞
4.0	6400	∞

Glass transition temperature

This parameter of the saturated polyesters is of great importance for the physical stability of the powder, but it has also considerable influence on the melt viscosity of the coating composition and on the thermal stress development in the cured film.

Although wrong, Tg is very commonly defined as the temperature below which the polymer is in a brittle or so called glassy state and above which it is in a rubbery or viscoelastic state. Probably it is much better to define Tg as the temperature above which there is an increase in the temperature coefficient of expansion[10]. The importance of the glass transition of the polyester resins for the physical stability of the powder coatings can be explained by the mobility of the polymer chains. Polymers exhibit two types of motion: A localised mobility of the segments called segmental motion and a total mobility of the molecule called molecular motion. In a glassy state the motions in the polymeric materials are restricted to vibrations on a short range and rotational movements. Below Tg only 1 to 4 chain atoms are involved in the motions[11]. Reaching Tg with an input of thermal energy, vibration of the segments over a long range in a co-ordinated manner begins. From a plot of Tg versus the molecular mass between the cross-linking points (Mc) it has been calculated that this segmental motion in the polymers involves 10-50 chain atoms[12]. Above Tg the vibrations of the segments are strong enough for freeing the neighbouring segments apart, thus creating empty holes which contribute to an increase of the free volume of the polymer, i.e. the volume which is not occupied by the molecules making up the material. The overall result is a change in the slope of the curve representing the dependance of the specific volume of the polymer on the temperature. This is the so called rubbery or viscoelastic state. If the system is not crosslinked, the molecules jump into the holes in a random Brownian motion exhibiting mobility on molecular scale. When stress is applied, the jumps are in the preferred directions relieving the stress, and the polymeric material flows.

Assume there is a layer of powder coating particles exposed to a certain pressure derived from their own weight of the powder particles on top. If the Tg of the powder is higher than the storage temperature, because of the absence of segmental mobility there is no diffusion of the material on the segmental or molecular scale between different particles. In the case of having Tg lower than the storage temperature, the segmental mobility is high enough to produce in the long term a considerable degree of interpenetration of the molecular chains between different powder particles, resulting in blocking of the powder. Therefore a high Tg of the polyester powder coating resins is a prerequisite for good physical stability of powder coatings.

The glass transition temperature of the resin has an influence upon the melt viscosity which will be discussed later, but also an influence upon the development of stress in the cured coating. The reasons for internal stress development in the coatings during curing and its determination are described in many papers[13-17]. The expansion coefficients of the coating and the substrate are in general different. Therefore, during the cooling of the thermally cured coatings the dimensional changes in the substrate and the coating are different. As a result of this difference an internal stress will develop in the cooled coating. When the exploitation temperature of the coating is above Tg, the internal stress is completely relieved due to the fast relaxation processes. Below Tg the dependance between the stress and the temperature is given by the following expression[17]:

$$S_T \quad \frac{M\,(\alpha_f^T - \alpha_s^T)\,(Tg-T)}{1-v} \qquad (6)$$

where:

S_T = Thermal stress at temperature T

M = Young's modulus of the coating

α_f^T = Thermal expanison coefficient of the coating at temperature T

α_s^T = Thermal expansion coefficient of the substrate at temperature T

v = Poison's ratio of the coating

This equation shows that the value of the stress developed in the coating is directly proportional to the difference between Tg of the cured film and the temperature to which the coating is exposed. The values of internal stresses in different types of coatings are represented in Table 3[18].

From the table the highest stress value occurs in powder coating. It is, however, comparable with that of a high solids coating.

Table 3

Stress values at 21°C and 0% relative humidity for different types of coatings.

Type of coating	Tg (°C)	S (MPa)
Polyurethane thermoplast	<0	0.24
Air drying alkyd	<0	0.60
Conventional polyester-melamine	25	0.80
High solids polyester-melamine	33	2.10
Powder coating (polyester/TGIC)	62	3.60

Although the stress development in principle is not a typical problem connected to the powder coatings, as is the case for radiation curing coatings, for example, attention should be paid to it. The stress affects the adhesion of the coating to the substrate, and in extreme cases when it exceeds the adhesive forces, detachment can occur.

Since the powder coating formulation is composed at least of two major constituents of organic nature (excluding the organic pigments), the resin and the crosslinker, calculation of the Tg of the coating knowing Tg values of the constituents can be very helpful to the coating formulator. Two equations which can be used for that purpose are given below[19,20]:

$$1/Tg = Wa/Tga + Wb/Tgb \qquad (7)$$

$$Tg = Tga + kWb(Tga\text{-}Tgb)/Wa \qquad (8)$$

where:

Tg = Glass transition temperature of the blend.
Tga, Tgb = Glass transition temperatures of the constituents.
Wa, Wb = Weight fractions of the constituents in the blend.
k = Ratio of the termal expansion coefficients between the rubber and glass states of the constituents.

The glass transition temperature of the saturated polyesters depends on the nature of the raw materials used for the resin preparation, the molecular mass of the resin, the degree of branching, and the presence of different functional groups.

Polyols and polyacids of aromatic and cycloliphatic nature introduce rigidity in the polymer chains resulting in an increase of Tg, while long chain aliphatic containing monomers (like adipic acid, sebacic acid or hexane diol) lower the Tg of the resins.

Tg of the resins increases with increasing molecular mass rapidly in the beginning and levels off after a certain molecular mass has been reached. This dependance can be expressed by the following equation[12,22]:

$$1/Tg = 1/Tg\infty + KMn \qquad (9)$$

where:

Tg∞ = Glass transition temperature of the polymer at infinite molecular mass.
Tg = Glass transition temperature at molecular mass Mn.
Mn = Number average molecular mass.
K = Constant typical for the specific polymer.

In principle the branched polyesters have lower Tg than the linear ones of a same molecular mass, although these differences are very small[23].

The hydrogen bonds present in the hydroxyl and carboxyl terminated polyesters increase the intermolecular interactions, decreasing in that way the segmental mobility, resulting in a considerable increase of the glass transition temperature.

Viscosity

The logical direction of making polyesters with as high as possible a molecular weight for good mechanical properties and as high as possible Tg for good stability of the powder coatings is restricted by the melt viscosity of the polyester resins.

The variations of viscosity with molecular mass is given by the following expression[24,25]:

$$\log \mu = A \log Mm + B \qquad (10)$$

where A and B are constants, μ is the viscosity and Mm is the mass average molecular mass. In contrast to Equation 2 which shows that the mechanical properties of the polymners level off after certain molecular mass has been reached, Equation 10 shows that with increasing molecular mass, viscosity increase exponentially to infinity.

Melt viscosity of the polyesters is directly dependent on the glass transition temperature. This dependance is mathematically expressed by several equations, one of them, the so called WLF equation best fits the experimental data[26]:

$$\log \mu_T = \log \mu_{Tg} - \frac{17.44\,(T-Tg)}{51.66 + (T-Tg)} \qquad (11)$$

where:

μ_T = Viscosity of the polymer with glass transition temperature Tg at temperature T.

μ_{Tg} = Viscosity at T=Tg

Comparison of the viscosities of two polymers with Tg=60°C and Tg=30°C obtained by using the WLF equation for a temperature of 150°C gives the following results:

$$\mu_{Tg_{60}} = \mu_{Tg} \times 10^{-11}$$

$$\mu_{Tg_{30}} = \mu_{Tg} \times 10^{-12}$$

When the viscosity of both polyesters at T = Tg is of the same order, then the one with Tg of 30°C will at 150°C have a ten times viscosity than the other.

The viscosity of the resins has a direct influence on the processing characteristics of the powder coatings during the extrusion and later, on the flow properties during film formation. The probability that a pigment cluster will be de-agglomerated during the grinding is directly proportional to the energy density present to overcome the forces holding the primary particles together[27]. The energy supplied by the motor in the case of shearing types of machines, e.g. the extruder, is proportional to the viscosity of the media in which the pigments are supposed to be dispersed. Also in these types of machines where the pigments are dispersed in a gradient of shear, the shear stress will be the determining quantity with respect to the efficiency of the de-aglomeration process. The equation which describes the mutual dependance between the shear stress and the viscosity is as follows:

$$\tau = \mu D \qquad (12)$$

where:

τ = Shear stress
μ = Dynamic viscosity
D = Shear rate

In other words the high resin viscosity is favourable considering the efficiency of the extruder as a dispersing machine. On the other hand the wetting of the pigment which is in fact displacement of the air or other contaminants (water for example) adsorbed on the surface of the pigment particles by the resin, is controlled by the velocity U with which the resin penetrates the pores on the pigment surface given by the following expression[28]:

$$U = Kr/\mu \qquad (13)$$

where r is the radius of the pore, μ is the viscosity of the resin and K is a constant related to the surface tension coefficient of the resin. It is quite obvious that the low viscous resin will facilitate the wetting of the pigments. From these two equations it can be concluded that there is an optimal viscosity at a given temperature (which is again restricted by the reactivity of the system) that provides the best dispersing efficiency of the extruder. This optimum depends on the type of the extruder, the coating formulation and the types of pigments.

Low viscosity of the resin promotes apart from better wetting also better flow of the coating. The relationship between the levelling of the coating, viscosity, surface tension, film thickness and time are given by Orchard's equation[29]:

$$\ln \frac{a^o}{a_t} = \frac{16\pi^4 \gamma x^3}{3\lambda^4} \int_o^t \frac{dt}{\mu} \qquad (14)$$

where:

a^o = initial striation amplitude
a_t = amplitude at time t
x = average coating thickness
λ = wavelength of striation
γ = surface tension
μ = viscosity of the coating
t = time

In order to make an integration the function μ = f(t) has to be known, but even supposing that the viscosity does not change during curing, it is quite obvious that a higher viscosity means a need for a longer time for levelling.

Conclusion

A powder coating is a very complex system with regard to the required properties. In solvent containing coatings the final properties of the cured film are determined by the binder, while the processing and application performances can be adjusted by a suitable solvent or solvent blend design. In the case of powder coatings all of them are almost exclusively dependent on the resin. Therefore the characteristics of the binder are of essential importance in overall coating performance. One of the biggest challenges for the resin chemist is to achieve the proper balance between the molecular mass of the resin, its functionality, viscosity and glass transition temperature in order to optimize processing characteristics of the coating during its production, combined with good stability during storage, good flow during application and good mechanical properties during the exploitation of the coating. Quite often, improving one property has almost always a negative influence on the other properties. The degree of freedom in the powder coatings field is thus rather limited. Therefore a good understanding of the interdependance between different resin and paint parameters by the resin and paint chemists, and the very carefully balanced characteristics of the resin are necessary if coatings with good properties are to be produced.

References

1. Krevelen, van D. W., in "Properties of Polymers",

Shining through.

Coating raw materials from Hüls – they are binders, crosslinkers, synthetic resins, PU raw materials, hardeners, components for powder coatings, coating powders, dispersions, solvents, plasticisers, dispersion and wetting agents, emulsifiers, catalysts and additives – a rounded programme for the paints and coating industry. Coating raw materials from Hüls – today more than ever, that means research and development for new products with higher environmental quality from an aspect of raw materials and energy conservation, searching for tailor-made formulations and realistic testing. Coating raw materials from Hüls – what also shines through is close cooperation with producers and users.

We'll make your problem our problem. Because we at Hüls want you to shine through your products. Hüls (U.K.) Ltd., 43-51, Windsor Road. Slough, Berkshire SL1 2HL.

4/7489/2 E

Resins & Pigments Exhibition, Frankfurt 1989 Room 4 A/4028/4030

hüls

Enter I118 on Reader Reply Card

Elsevier Sci.Publ.Comp., Amsterdam, Oxford, New York, 1976, p.19.
2. Govarkier, V. R. et al., in "Polymer Science", *John Wiley and Sons*, New York, 1976, p.98.
3. Gordon, M., *Proc.Roy.Soc.London*, 1962, **A268,** 240.
4. Gordon, M. and Malcom, G. N., *Proc.Roy.Soc.London*, 1966, **A295,** 29.
5. Dusek, K., *Adv.Polym.Sci.*, 1986, **78,** 1.
6. Tiemersma-Thoone, G. P. J. M., Scholtens, B. J. R. and Dusek, K., ICIAM 1987 Proceedings.
7. Flory, P. J., in "Principles of Polymer Chemistry". *Cornell University Press*, Ithaca N.Y., 1953.
8. Stockmayer, W. H., *J.Polym.Sci.*, 1952, **IX**(1) 69.
9. Munary, A., La Chimica e L'Industria, 1985, **V67**(N12) 694.
10. Wicks, Z. W., Jr., *J.Coat.Techn.*, 1986, **58**(743) 23.
11. Sperling, L. H., in "Introduction to Physical Polymer Science", J. Wiley and Sons, New York, 1986, p.232.
12. Boyer, R. F., in "Encyclopedia of Polymer Science and Technology, Suppl., Vol. 2, Bikales, N. M. Edition, *Interscience*, New York, 1977, p.822.
13. Corcoran, E. M., JPT., 1969, **41**(538) 635.
14. Shimbo, M., Ochi, M. and Arai, K., *JCT*, 1984, **56**(713) 45.
15. Shimbo, M., Ochi, M, and Arai, K., *JCT*, 1985, **57**(728) 93.
16. Perera, D. and Eynde, D. V., *JCT*, 1981 **53**(677) 39.
17. Perera, D. and Eynde, D. V., *JCT*, 1987, **59**(748) 55.
18. Perera, D. Greidanus, P. and Misev, T., unpublished results.
19. Fox, T. G., *Bull.Am.Phys.Soc.*, 1956, **1,** 123.
20. Gordon, M. and Taylor, J. G., *J.Appl.Chem.*, 1952 **2,** 493.
21. Fox. T. G., and Loshaek, S., *J.Polym.Sci.*, 1955 **15,** 371.
22. Coucham, P. R., *Polym.Eng.Sci.*, 1981 **21**(7), 377.
23. Holda, E. M., J. P. T., 1972 **44**(570) 75.
24. Billmeyer, F. W., Jr., Textbook of Polymer Science, 2nd ed., *Interscience Inc.*, New York, 1972.
25. Middleman, S., the Flow of High Polymers, *Interscience Inc.*, New York, 1968.
26. Williams, M. L., Landel, L. F. and Ferry, J. D., *J.Am.Chem.Soc.*, 1952, 77, 3701.
27. Winkler, J., Klinke, E. and Dulog, L., *JCI*, 1987, **59**(754) 35.
28. Patton, T. C., in "Paint Flow and Pigment Dispersion", Sec.Ed., J Wiley and Sons, New York, 1979, p.377.
29. Orchard, S. E., *Appl.Sci.Res.*, 1962. **A11,** 451 ■

Keynote Address at OCCA Chester Conference 1989

Profitable R & D

by David Pirret, General Manager, Resins & Materials, Shell Chemicals UK Ltd, Heronbridge House, Chester Business Park, Wrexham Road, Chester CH4 9QA, UK

History

Industrial R & D has been growing since the 1930s, but the recognition of technologies contribution to the war effort encouraged many companies to re-assess and upgrade the role of technology in their future. Thus began the growth phase of industrial R & D which lasted for approximately 20 years. Historical literature suggests that in the mid-'40s the process of technological innovation generally was underestimated and oversimplified by managers resulting in a simplistic approach that working in the relevant field of company interests would be beneficial. It may be that following the disruption of the mid-'30s to '40s and the dawn of major advances in chemistry and electronics this attitude was adequate to yield success.

As in most growth phases there was some lack of control as R & D managers attempted to enlarge the role of their new function. It was argued, and still is, that R & D was different from other functions in two particular ways, firstly that it was impossible to forecast programme outcomes and secondly, that resources could not be switched on and off but needed to be continued at the agreed rate. This era resulted in centralised research facilities which demanded programme autonomy to produce results of scientific merit.

In the late 1960s companies began to question the return they achieved on their R & D spend and their failure to commercialise some of the technical achievements. Management literature at this time was full of screening tests for new product development, applications of project management to R & D, etc., all very much concerned with operational management of the R & D budget.

The 1970s were punctuated by two oil price hikes which, amongst other things, provided focus for many R & D programmes. In a short space of time process R & D was aimed at improving the energy intensity/utilisation of many chemical processes, solvent price increases encouraged different application technologies and high solids, solvent free and water-borne products came of age.

Current environment

The 1980s have witnessed enormous changes in the business environment — they dawned against a background of high cost oil and resulting low economic growth rates which decimated industrial profits throughout the Western world. The early response to this pressure was plant closures, cost reduction programmes, etc., to stem the cash haemorrhage. This period coincided with the widespread application of strategic planning concepts which hitherto had been confined to the realms of academia and consultants. The application of these concepts resulted in strategic rationalisation which was evidenced by portfolio swaps, focusing on key sectors, repositioning of businesses, etc.

So while Western managements were justifying their plans to increasingly competent analysts and journalists watching quarterly earnings, cashflow and ROI, life continued on the far side of the planet. The saturation of many Western markets which were now in a mature phase caused many companies to review the commercially untapped markets of the Pacific Rim — particularly East Asia — which had large educated populations and high economic growth rates. In some circles there was even talk of Europe dropping out of the core of the industrial world which would increasingly be focused on the US and Asia. Fortunately, the arrival of the new Asian bloc has not resulted in our drop out but it certainly poses a threat.

In the developing countries of Asia the Japanese companies have licensed state of the art technologies to a host of industries. The US and European companies also have been fighting with each other to build joint-ventures to compete in this high growth opportunity. The queue of willing international partners created a buyer's market, thus technology was licensed relatively cheaply — certainly not at development cost — plant building costs are low as are labour costs relative to the West. The result is that we are creating aggressive new competitors not only in the Far East markets — for they have Global ambitions. The technological platform which has been provided will be actively developed to produce new generations of products.

Another force for change emerging from the '80s is the Green movement. This is not a passing fad but a long-term direction which will call into question many of our products and their associated manufacturing and application processes. Toxicological testing of products adds a new dimension to the R & D problem both in terms of complexity and cost. Many of the technical solutions believed to be available will be ruled out on toxicological grounds. Designing an acceptable product is only half the problem — can it be manufactured acceptably? — how many of the products supplied to the Paint industry result in more effluent than product? I regret to say the answer is not a small number. Responsible companies will be aware of their problem processes and be search for alternative routes as a matter of urgency — again a challenge for R & D. The packaging lobby is concerned about recycling and in some European countries disposal of plastics is increasingly controlled. The Green lobby will affect us all — if it hasn't already — we should not view it as a threat but as an oppportunity to be grasped.

Quality will be a major force for change in the 1990s. Customers increasingly demand improvements in absolute performance and consistency. I believe we should deliver these changes not as altruism but as a strategic drive.

In summary we will be working in an increasingly competitive Quality conscious world trying to minimise the environmental impact of our activities and if that is insufficient challenge we will be faced by a shortage of skilled people. At a time when demand for graduates is increasing there will be fewer of them leaving universities and colleges. This demographic problem is not unique to the UK. Will we be able to maintain our business in every sector or will we be forced to increase our focus to conserve our human resources or will computing power yield the productivity gain to offset the problem?

Strategic role of R & D

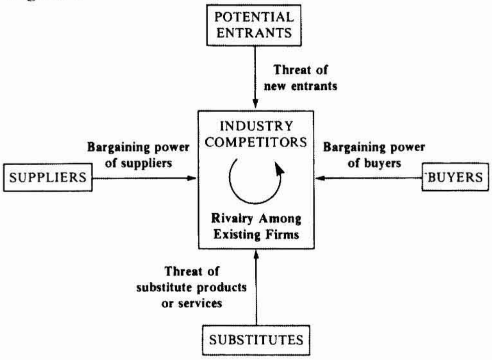
The business environment will remain dynamic and this change creates a favourable environment for R & D but will

companies spend?

The answer to that question lies in the strategic direction the company chooses which brings us back to the strategic management concepts mentioned earlier.

All of you will be aware of the Product life cycle and Product portfolio matrices but I would like to use Porter's five forces model (Figure 1) as a framework to understand what is driving the industry in which you operate and potential R & D roles. Porter argues that long-term profitability will be low if the level of competition and rivalry in a business is intense and analyses these forces — substitutability, possible new entrants, supplier power and customer power.

Figure 1



☐ Analysis of potential new entrants is vital as the lower the barriers to entry the (generally) lower the profit — a high technology base is often a major barrier to entry provided by high R & D spend.

☐ Potential product substitutes often raise the level of rivalry. I recently visited an oil blending plant constructed of galvanised I-beams instead of the usual painted mild steel. We have a subsidiary company — Fibreforce — which produces pultruded polyester glass I-beams to sell to the chemical and water treatment plant industries. Both of these are substitutes to the heavy duty paint systems many of you are involved in.

☐ The power of suppliers if high can move value up the chain. Power tends to increase where the buying industry is an unimportant customer, where there are a limited number of suppliers as, increasingly often, capacity is limited. R & D's role is to develop products from different raw materials or to minimise the use of key materials.

☐ Customer power can also remove value particularly where there are a number of producers wishing to supply. This is a common situation in major end-uses for paints and opens up either a cost-reduction role for R & D or a product differentiation opportunity.

Having analysed the industry in which you operate you then move on to identify what are your relative strengths and weaknesses. This requires a great deal of honesty regarding your own company and an understanding of your competitors.

I mentioned earlier the City watchdogs and most managements desires to satisfy them which often result in explicit statements of strategy in the press. In the areas of can-coatings and automotive paints I would be surprised if competitors were unaware of each other's objectives. Against the above background top management must explicitly articulate their vision of the company in, say, 10 years which delineates the pitch upon which you will play. Strategy development is now possible and this should involve a wide functional cross-section for this iterative process of matching resources and opportunities.

Porter identifies 3 generic strategies:

☐ overall cost leadership
☐ differentiation
☐ focus

The role of R & D in each of these strategies is different.

In pursuit of cost leadership the classical R & D role is minimal but depending upon the industry it can be significant for example in the Chemical industry in areas such as process research where existing processes are less efficient or hazardous than necessary.

Differentiation need not be product differentiation but could be service differentiation such as the case of Porter Paint in the US where their warehouses provide a meeting place for professional decorators. Product differentiation is a major play for R & D and requires a totally different approach to that given above under cost leadership.

Focus is very much a limited market exposure with an R & D role of either of the above types. Focus is only feasible when the lower volume cost penalty is less than the price premium achieved.

In addition to understanding the strategic role of R & D it is also necessary to set clear objectives as part of a subordinate technology strategy. Survival in the '90s will require increasingly clear strategic plans and R & D will perform some role in most options.

Operational issues

R & D remains a growth business but it is a high risk business which poses a large number of operational problems.

In terms of risk there have been many studies which show less than 20% of projects result in a new product launch and of those that do 1 in 3 fails. The risk is not homogenous but varies as companies move away from their established products and markets. A company can move from its existing base in 3 directions — market, product and technology. Studies (Adams in the UK) showed that market risk increases from a 52% failure rate with existing customers and channels to 92% to new customers and new channels.

Product risk is lower ranging from 48% for incremental changes through 68% for an original product to 84% for a me-too — the latter due to its lack of novelty in the market place.

3Ms have also found similar results where "maintenance of existing business" programmes were 5 times more likely to succeed than "unrelated new business" programmes and "related new business" was twice as likely to succeed. Related new products were also found to be more likely to succeed if they were aimed at large target markets. Unrelated new products were most likely to succeed (and have the highest profitability) if they were genuinely innovative and 3M had a strong competitive position in the closest industry.

In addition to the above there is a risk of timing — many products have been developed before their time and consequently failed, we have had our share, the only saving grace is they can be dusted off when the market is ready unlike projects that miss the market because they are late.

So it is into this minefield that you leap when you decide to undertake R & D and this makes the case for regular project review — it also explains why we witness so few earth shattering leaps forward as industrial R & D tends to make incremental changes to avoid risk.

As a marketing man it would give me great pleasure to claim that my fellows had a monopoly on great ideas but there is evidence that shows in the industrial field at least as many ideas come from technologists. For this reason it is vital to provide a forum for discussion between technologists and the "business". If we assume that the quality of ideas are normally distributed then it is vital that we generate a large number for screening. Ideas exist in other technologies, markets and continues — do you have a mechanism for their collection?

If one assumes that we have more ideas than our resources can develop a number of options exist:

□ external R & D. Universities and Research Associations are ideal for basic research — particularly pre-competitive research which may even be funded by the Government.

□ licensing-in. Don't re-invent the wheel, it may be more effective to adapt existing technology to your problem or your problem may have occurred sooner in a distant market.

□ partnering. This is now fashionable whether it be with customers, suppliers or even distant competitors, there is often little need to shoulder the burden alone. Several years ago the synthetic rubber industry whose major end users were the large tyre manufacturers who were secretive about their technology and had effectively reduced SBR to a commodity — even a standard nomenclature throughout the industry — and their ability to differentiate rested with their compounding ability. The synthetic rubber producers focused their R & D on process improvements to reduce costs. This became inappropriate when the US Government introduced their CAFE regulations as an energy saving measure. The auto suppliers then dictated a programme of improvements in Rolling resistance to the tyre suppliers who soon realised that their compounding technology on currently available polymers would be inadequate. We had to change R & D direction when we were approached to join tyre development programmes to develop new polymers to meet the challenge. By understanding the linkage between molecular structure and tyre performance — a massive fundamental programme — we were able to produce the necessary new polymers.

It seems that the Paint industry is equally secretive and will ultimately reach the limits of its compounding ability — why not consider more openness under suitable safeguards of confidentiality, it may save you money!

A further positive aspect of partnering is the clarity of customer requirements which are clearly stated, discussed and modified during the development process.

Each company must decide what mix of the above technology options is optimal in terms of cost effectiveness.

Cost of R & D

Cost of R & D clearly impacts on its profitability and in the increasingly competitive world described earlier will be a major issue to be faced in the '90s. R & D productivity is difficult to measure but more and more companies are demanding the R & D managers demonstrate their contribution to the bottom line — I believe more objective measurement will be required. This is a further reason for very clear objectives both at the department and project level. We are using milestones as a programme management tool — these are agreed up front and provide a framework against which progress may be measured.

Computers have already boosted productivity — ranging from the simplest interpretation/standardisation of GPC results to 3-D modelling of molecules. Statistical design of experiments and interpretation of results has reduced the number of experiments required to reach conclusions which not only reduces costs but also increases speed. We have produced contour diagrams/maps in some product areas which assist customers in determining starting formulations to meet key properties.

Modelling of solvent evaporation or flow in the mould aids understanding of phenomena thus providing shortcuts to solutions. Perhaps the most impressive use of computing is the 3-Dimensional modelling of molecules. When we were involved in the tyre rubber programme mentioned earlier the correlation of tyre properties and polymer structure was only feasible with powerful computers. Having designed the optimal molecule process models were then used to identify the recipe for manufacture — this reduction of trial and error not only reduced pilot plant time, thus boosting the number of new products available in a given time, it also shortened the time lag between concept and market. Artificial Intelligence and Expert systems will also permit the dissemination of individual knowledge — Salesmen will be able to visit every customer with expert back-up. The improvement in telecommunications assists the establishment of satellite laboratories close to the customer without replicating the more esoteric skills required in central laboratories.

Information and computing offers a powerful weapon against escalating R & D costs.

Exploitation

Moving to the exploitation of R & D output, it is clear that this will be vital in maximising the return on each project. This very much depends upon the size of your company and the target market. If one of the major can coating suppliers has a breakthrough then both the company and target market is sufficiently large to exploit it globally in-house. On the other hand, if a local specialist coating company identifies a new, say, anti-graffiti coating then licensing may provide useful income. There is also the serendipitous result which lies outside your existing market and could best be exploited by selling the rights to another company.

Innovation is a 2-stage process — invention followed by exploitation.

Conclusion

I have tried to show that we live in a changing world which will continue to offer opportunities for R & D particularly resulting from the quality, green, competitive and manpower drives.

The increasing importance of strategic clarity will provide a variety of roles for R & D depending on the company position at a given time and as a result the function will require flexibility.

Increasing R & D spend will conflict with need to deliver the bottom-line particularly when the hit rate is low and costs will need to be controlled which will require external technology input in all but the very largest of companies.

Computing offers exciting opportunities to increase R & D productivity and customer service.

Exploitation of output will remain a critical activity. ■

Dr Terry Corner, Group Research Manager, Coates Brothers Plc reports on:

The fifteenth international conference on organic coatings science and technology

The Fifteenth International Conference on "Organic Coatings Science and Technology" was held in Athens, Greece from 10-14 July 1989. Over 140 participants were attracted to this year's Conference by a programme comprising 31 invited papers and 9 contributed papers. The quality of the papers presented at this annual meeting seems to improve every year and not surprisingly there was an active discussion after every paper. In my opinion this meeting must now be the premier conference dealing with surface coatings.

The first speaker at the conference, Dr J McTague — Vice President, of Research of Ford Motor Co., set the tone for the meeting by describing how the challenges which the surface coatings industries face can be tackled by a fundamental understanding of the basics of coatings materials, their applications technologies etc. Research plays an important role in developing this understanding and Dr McTague illustrated this with examples from within the Ford research laboratories. Dr D. C. van Beelan of Akzo then described the development of waterborne metallic basecoats for automotive applications in which gel-type binders are used to give similar optical quality to low-solids, solvent-borne systems. A second use for "Micro-gels" was described by Dr H Sakamoto of Nippon Paint. In his paper, Dr Sakamoto described micro-gel granules with soft-shells/hard cores which are used in cationic electro-coatings to give excellent coverage of sharp edges. The resultant coatings offer superior protection against corrosion. Continuing on the "automotive theme" Dr C. Wamprecht of Bayer AG described novel, flexiblised acrylics and polyesters which, when used in conjunction with urethane-modified biuret polyisocyanates, gives rise to new, highly flexible coatings systems for plastics.

Modern analytical techniques offer surface coatings scientists and technologists many, new opportunities to gain a more fundamental understanding of the mode of operation of additives, of degradation processes etc. etc. As a result it is becoming a rare event if papers on surface coatings do not contain acronyms such as SIMS, ESCA etc. Dr H Bohnke of Sandoz Ltd. described the use of various analytical methods in an investigation of the mode of action of hindered, amine light stabilisers (HALS) in automotive finishes. Following this paper Dr W. J. Muizebelt of Akzo presented various spectroscopic data on the analysis of alkyd resins which revealed the fate of oxygen taken up during curing. Thereafter, Professor R. M. Hill of King's College, London described preliminary work on the use of dielectric measurements in the study of latex film formation. It appears that by using a wide and very low frequency spectrum it is possible to study the various processes which occur during evaporation of water, particle aggregation, coalescence etc.

Degradation processes in surface coatings are of great interest and Dr K Tsubouchi's (Kansai Paint) paper on the use of ESCA and FT-IR in a study of degradation processes in melamine cross-linked coatings generated lots of discussion. In alkyd polyol systems it appears that hydrolytic processes dominate whereas in acrylic polyol based systems it is the oxidation reactions. An important factor in the degradation of surface coatings which in the past has received little attention is microbiological action. Mrs. M. Stranger-Johannessen of the Centre for Industrial Research, Sweden gave a paper which vividly illustrated the manner in which micro-organisms attack surface coatings. The attack on the coatings is from the outer side of the coating via metabolites secreted by the micro-organisms. It was shown that irreproducible results in salt spray tests etc. can sometimes be attributed to micro-biological action of this type. The reliable prediction of weathering performance is always difficult with organic coatings. It was therefore welcome news to hear from Dr A Mackor of TNO that it is possible to employ rapid photo-oxidation methods to establish the relative long term performance of pigments in alkyd and acrylic coatings within a few days. Nevertheless, it must be remembered that probably all of the current acelerated ageing tests are subject to one deficiency or another. This was clearly pointed out by Dr J W Martin of the N.I.S.T., Washington, D.C. Dr Martin's paper described a probability-based procedure which can help overcome deficiencies due to cumulative damage effects, variations in response by nominally identical panels etc.

Two papers were presented on new systems for use in formulating anti-corrosion coatings. Dr F.L. Lloyd of the Glidden Company described a "vinyl" system which has excellent barrier properties, a low voc and which does not require inhibitive pigments in order to give long term protection. Apparently a passive interfacial layer is eventually formed between the paint and the steel substrate which gives corrosion resistance even when the film is physically damaged. A completely different system was described by Dr R. A. Elms of Dow Corning. Dow's new system is a 100% silicone elastomer which when applied as a clear, unpigmented coating gives outstanding protection despite its high permeability to water vapour and oxygen. The inherent flexibility of the coating makes it ideal for protecting steelwork which is subject to temperature cycling. During the discussion of Dr Elm's paper it was suggested that providing a barrier to chloride ions is perhaps more important for protection against corrosion than providing a barrier to water vapour and/or oxygen. Also that water uptake is probably more important than water vapour permeability.

The role of modern instrumentation in obtaining a better understanding of surface coatings was further illustrated by Dr Y. Kojima of the Hitachi Chemical Co. Dr Kojima has found that in polyester-melamine systems there is a large surface excess of nitrogen atoms. The data, obtained via ESCA experiments at several angles, is consistent with surface heterogeneity arising from self condensation of the melamine to give a melamine rich surface layer. The surface properties of coatings are of tremendous importance and further work by D. Kojima will hopefully explain the reasons for the surface excess of melamine in the systems he described. It is often desirable to modify polymer surfaces in order to improve wetting and adhesion. Dr P. Gatenholm of NIF, Denmark described several ways of achieving this. First, chemical reactions of cellulose with various coupling agents were described and second, modification of polypropylene film by plasma polymerisation of hydrophilic monomers. Both methods yield substrates with improved wetting characteristics w.r.t. water-borne printing inks. Two papers dealing with fluropolymers were given. Dr K Batzar of Du Pont described the principles of obtaining good adhesion between high molecular weight fluropolymers and various substrates whilst Dr G Moggi of Montefluos showed how low molecular weight perfluroethers are being used for the conservation of natural stones.

Several papers dealt with new binders. Dr H. P. H. Scholten of Shell reported the results of model studies using low molecular weight ester diols. The studies have led to the development of polyester resins containing both hard and soft blocks and which can yield coatings with attractive film properties. Dr J. Meixner of Bayer AG described new, water-dispersible, unsaturated prepolymers which are emulsified using specially designed, reactive emulsifiers. On curing (thermal or UV) the emulsifiers are reacted into the film giving excellent water resistance. Coatings can be produced from the prepolymers which contain neither organic solvents nor amines. A new class of acrylic resins containing fully etherified alkoxy (meth) acrylamide have been developed by DSM. Dr J. Reitberg described the new resins which can be used to formulate coatings which possess longer pot-lifes; exhibit extremely low formaldehyde emission; and, give rise to improved hardness, abrasion resistance and chemical resistance. Two papers on new epoxy binders were given by personnel from the Dow Chemical Company. First, Dr P. S. Sheih described the preparation of difunctional (epoxy and phenolic) oligomeric resins from Bisphenol A and the diglycidyl ether of Bisphenol A. These unique oligomers can be used to formulate higher solids systems than is possible with higher molecular weight epoxy resins. During stoving in-situ advancement occurs on the substrate. This advancement is followed by crosslinking of the resultant high molecular weight resin. The new oligomers give rise to superior solvent and stain resistance when compared to conventional low molecular weight epoxy resins and to superior flexibility over typical high molecular weight epoxy resins. Second, Dr J. L. Massingill discussed the relatively poor reactivity of 1,2-oxirane end groups in high molecular weight solid epoxy resins in coatings systems cured using methylol — containing curing agents. Dr Massingill then illustrated how the conversion of 1,2-oxirane groups into reactive 1,2 glycol and/or phosphate ester end groups can give rise to coatings with superior performance. However, improved performance does not always require new binders. This was demonstrated by Dr J. J. Trescol of Akzo who gave a paper in which the merits of polymeric alloys formed by interpenetrating networks were illustrated. Dr Trescol clearly showed how chemically dissimilar networks can be formed simultaneously so as to yield coatings which show many improvements over either system on its own. In particular, unusual combinations of hardness and flexibility can be achieved. Despite the novelty and interest of the aforementioned papers, perhaps the most novel work reported on new binders was that described by Professor F. N. Jones of the North Dakota State University, USA. Professor Jones gave an excellent review of previously published work on liquid crystalline polymers prior to describing his group's research on the use of liquid crystalline polymers (LCP's) as binders for surface coatings. LCP's can be used to give an extraordinary combination of hardness and impact resistance, good adhesion and rheological control. I believe that Professor Jones' paper will result in an increase in research within the surface coatings industries on the use of LCP's, particularly in stoving systems where LCP's may allow higher film weights to be used and in low Tg systems where improved hardness is required.

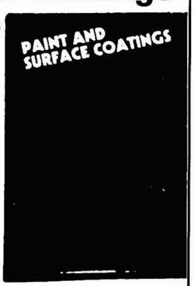
In addition to new developments in binders, several papers concerned with crosslinking reactions and/or new crosslinkers were given. Dr B Singh of American Cyanamid described a series of new carbamylmethylated melamines. These materials are essentially alcohol-blocked melamine-isocyanates which cure within the same temperature range as caprolactam blocked isocyanates. However, the new crosslinkers apparently give films with improved adhesion and chemical resistance properties. Dr G Iwamura of Dainippon Ink and Chemicals described a study of the crosslinking mechanism of blocked hydroxyl groups (by silicone compounds) in acrylic resins with polyisocyanates. The blocked hydroxyl groups are regenerated using an acid catalyst at 80°C in the presence of moisture. An alternative "blocking" approach was described by Dr K. H. Hentschel of Bayer AG. Dr. Hentschel reported the results of an in-depth study of polyurethane reactive resins which were internally blocked with alkyl phenols. The factors which govern curing rate, the role(s) of aminic curing agents and the microstructure of the final cured matrix were discussed in detail. The final paper dealing with polyurethane chemistry was given by Dr L. C. Dammann of the Ashland Chemical Co. Dr Dammann described the use of a polymercaptan-blocked tin catalyst in polyol/aliphatic polyisocyanate systems. The tin catalyst is unblocked using amines and very fast cure can be obtained at ambient temperatures. The durability of the coatings was described as excellent and the coatings can be applied using conventional spray equipment. Dr L. W. Hill of Monsanto reported on the use of dynamic mechanical analysis (DMA) for the characterisation of cure behaviour of two new oligomeric compounds. The materials described were a polyallyl glycidyl ether (PAGE) and a new light stable epoxy (LSE). DMA was used to determine the parameters which are important in the control of cure behaviour. Its' use clearly showed the dual role of PAGE as both an initiator and a crosslinker.

Several papers on various types of pigments were given during the conference. Dr M. R. Hornby of Tioxide discussed the importance of controlling the particle size distribution of titanium dioxide if satisfactory optical performance is to be achieved in coatings. If data relevant to final coating properties are required then it is vital to choose the optimum measuring technique. Opacity can of course be obtained via the use of "opaque" organic pigments. Dr W. Deucker of Hoechst reviewed both the theoretical and practical aspects which must be considered in the use of such pigments if optimum opacity is to be achieved. By contrast, Dr I. C. Chu of DuPont presented the results of extensive studies in which methods of ensuring maximum transparency can be obtained from iron oxide pigments in aqueous media. Excellent transparency can only be achieved if adequate dispersion stability is facilitated using suitable dispersants. Dr Chu showed how the measurement of isoelectric points can be used as a very useful screening method for selecting dispersant/pigment combinations.

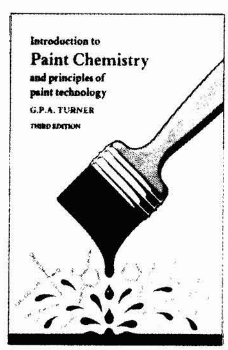
Lustrous pigments are increasingly being used in automotive finishes, in printing inks and in cosmetics. The paper by Dr P. Hauser of BASF was welcome therefore since it described a new theoretical treatment of the optical properties of lustrous pigments. The theoretical treatment allows the reflection colours of lustrous pigments to be calculated using basic optical theories. A second paper dealing with colour was given by Dr M. Piens described how colour corrections can be made during the shading procedure via measurements made with a personal computer. The technique facilitates colour correction from tristimulus values only and it will make the introduction of computerised colorimetry into small workshops an economic proposition. In addition, on-line correction of batches of paint during manufacture may be possible.

Coatings applied to external structures in order to give both protection and decoration are often subject to rust-staining. Whilst the damaged/corroding site can be quite small, a very large area can be affected by the rust stain. Thus, the anti-staining cosmetic coatings described by Dr J. D. Sinclair-Day of Courtaulds Coatings should find a large market in those areas where it is desirable to "maintain appearance". The cosmetic coatings contain sparingly soluble materials which leach out slowly (over several years) to form both soluble and insoluble iron complexes. The complexes are in general white or weakly coloured and are readily removed by washing.

The final invited paper at the conference was given by Professor J. Ugelstad of the University of Trondheim. Professor Ugelstad gave a splendid lecture on his work over the previous ten years or so on the preparation of monodisperse polymer particles. The particles can be made from a variety of monomers and they can be solid, porous, magnetic etc. In addition to their use in chromatography, where their monodispersity gives a unique combination of speed and resolution, the particles are being applied in an increasing variety of different selective cell separation processes. For example, they have been used successfully in the selective removal of tumor cells from human bone-marrow. Whilst the chemical modification of the surfaces of ten micron polymer particles in order to promote binding of selected monoclonal antibodies is perhaps of limited relevance to the day-to-day activities of most workers in the field of surface coatings, Professor Ugelstad vividly demonstrated how a deep understanding of the basics of polymer and colloid science can lead to novel and valuable effects and/or materials. Thus, Professor Ugelstad caused those attending the conference to further reflect upon the words of Dr McTague in the opening lecutre, "Success in the surface coatings industries will become increasingly dependent upon gaining a fundamental understanding of the basics of coating materials and of application technologies. Research will play an important role in developing this understanding". — An important message for all workers in the field of surface coatings. ■



INDEX TO ADVERTISERS



From the General Secretary

The European Paint Show

With the rapid approach of 1992 and the increased awareness of Europe, the Association has been considering its future exhibition policy.

SURFEX is now established as the leading UK traditional style exhibition for the surface coatings industries and SURFEX 90 to be held on 20-21 May at Harrogate is already a sell-out. SURFEX will continue to be developed by the Association and plans have already been drawn up for a more ambitious SURFEX 92. Future SURFEX exhibitions will feature associated activities, including technical meetings, in addition to the very successful exhibition dinner, but will remain a UK based event.

The Association is committed to providing additional services for its members in Europe and has considered a number of proposals for European surface coating exhibitions. These proposals have included a European SURFEX and participation in an enlarged FATIPEC Congress and Exhibition but have rejected both proposals on the grounds that they are likely to lead to a saturation of the European exhibition market and would not be acceptable to exhibitors.

The Honorary Exhibition Officer, other senior officers and myself have held a number of meetings and discussions with the organisers of the Resins and Pigments Exhibitions and, with the approval of Council, have now concluded an agreement whereby in 1991 the Association will sponsor a European Paint Show to be organised through Polymers Paint Colour Journal.

The traditional style exhibition, to be known as The European Paint Show - 1991 Resins & Pigments Exhibition, will be held at the Brussels Exhibition Centre on November 19th, 20th and 21st and have as its theme "1992 and beyond".

The agreement marks a significant co-operative venture between the two major UK publishers of surface coating journals and organisers of surface coating exhibitions and we believe will be welcomed by the industries we serve. The exhibition will also provide the Association with a European presence and the opportunity to develop further its European activities.

The Association's agreement to sponsor the 1991 Exhibition includes no commitment for future exhibitions but it is envisaged that it will be extended on a 2 or 4 year cycle.

The Association has developed various bilateral ventures during the past two years, including joint conferences with the Paint Research Association, Marine Paint Forum and Society of British Printing Ink Manufacturers and will seek to promote further opportunities for collaborative activities between relevant organisations within the surface coating industries.

OCCA Symposia

The Association's exciting Autumn 1989 and Spring 1990 programme of one-day Symposia will soon be underway. Four Symposium have already been announced with a further meeting at an advanced stage of planning.

The full programme comprises:

14 September 1989
"The Implications of Just-in Time"
Contact Rob Lewis 0274 569222

12 October 1989
"Decorative and Protective Coatings for Exterior Woodwork"
Contact John Gant 043 871 5260

25 October 1989
"Organotin antifouling Compositions — The Impact on Shipowners and Shiprepairers of Existing and Proposed Legislation"
Contact General Secretary 01 908 1086

22 March 1990
"Printing Inks for the 90's"
Contact General Secretary 01 908 1086 ■

OCCA Council 1989-90

President	A G North, BSc, FTSC, 1 Highfield, Shoreham, Sevenoaks, Kent TN15 6XN
Immediate Past President	J R Bourne, FTSC, Mebon Paints plc Blackwell Road, Huthwaite, Sutton-in-Ashfield, Notts
Vice Presidents	G H Munro, BSc, 16 Stander Street, Brackenhurst, Alberton 145O, S Africa M H Gamon, 3O St Peter's Grove, Laceby, Grimsby, S Humberside DN37 7HD G J Lewis, PhD, BSc, ATSC, 8O Mill Road Swanland, N.Humberside HU14 3PL J Inshaw, FTSC, 28 Bullimore Grove, Kenilworth, Warwickshire CV8 2QF J Ambury, 125 Jeffcoat Drive, Etobicoke, Ontario, Canada M9W 3B9 B A Canterford, FTSC, 2O Varney Close, Flamstead End, Cheshunt, Herts EN7 6LU J Hemmings, ATSC, The Old Vicarage, 3 Shelley Lane, Kirkburton, Huddersfield, W.Yorks HD8 OSJ
Hon. Secretary	L J Brooke, ATSC, 39 Abbots Way, Westbury-on-Trym, Bristol BS9 4SW
Hon. Treasurer	B F Gilliam, FTSC, 25 Regency Close, Chigwell, Essex IG7 5NY
Hon. Editor	J R Taylor, BSc, CChem, FRSC, FICorrST, FPRI, FTSC, "The Wolds", 51a Porth-y-Castell, Barry, South Glamorgan CF6 8QD
Hon. Research & Development Officer	S Lawrence, PhD, BSc, ATSC, Hollybank, 2 Standa Lane, Stewarton, Ayrshire, Scotland KA3 5BG
Hon. Technical Education Officer	A T Hopgood, FTSC, 17 Shevon Way, Brentwood, Essex CM14 4PJ
Hon. Overseas Secretary	W Borrell, LRSC, 100 Westminster Road, Failsworth, Manchester M35 9HW
Hon. Conference Officer	A C Jolly, BSc, FPRI, FFB, FTSC, 9 Lansdowne, Frodsham, Cheshire WA6 6QB
Hon. Exhibition Officer	F Morpeth, CChem, FRSC, FTSC, Foscolor Ltd, Bickershaw Lane, Abram, Nr Wigan, Lancs
Elective Members	R W Harrison, 19 Holden Road, Wibsey, Bradford, W.Yorkshire BD6 1TF J Kelly, 47 Patch Croft Road, Peel Hall, Wythenshawe, Manchester M22 5JR E R Miller, PhD, Dept. of the Environment, Building Research Establishment, Bucknalls Lane, Garston, Watford WD2 7JR R F Nicholls, 52 Bury New Road, Ramsbottom, Bury, Lancs BLO OBY M Nixon, 62 Willow Avenue, Cheadle Hulme, Cheadle, Cheshire SK8 6AX R H E Munn BSc, FTSC, 12 Berger Close, Petts Woods, Kent BR5 1HR
Section Representatives	*Bristol:* J C Shaw (Chairman); R Saunders *Cape:* P Kretzel (Chairman); D J Morris *Hull:* B J R Mayes, BSc (Chairman); M Gamon *Irish:* N McInerney (Chairman); A L Taylor, FTSC *London:* P Thukral, PhD, FTSC (Chairman); D Bannington, ATSC *Manchester:* N Seymour, FTSC (Chairman); D W N Clayton, ATSC *Midlands:* B Myatt (Chairman & Rep) *Natal:* R Archer, BSc (Chairman); D J Morris *Newcastle:* D Neal (Chairman); S Lynn, CChem, MRSC *Ontario:* D Pratt, LTSC (Chairman); P Birrell, BSc FTSC *Scottish:* R F Hill, ATSC (Chairman & Rep) *Thames Valley:* R Stephens (Chairman); J Gant *Transvaal:* D Lindsay (Chairman); D J Morris *West Riding:* R J Lewis (Chairman); G C Alderson

General Secretary: C. Pacey-Day. *Assistant Editor:* P. J. Fyne, MA, DPhil. *Association offices:* Priory House, 967 Harrow Road, Wembley, Middlesex HA0 2SF, UK; Tel: 01-908 1086, Fax: 01-908 1219, Telex: 922670. *Auditors:* Coopers & Lybrand, Plum Tree Court, London EC4A 4HT. *Solicitors:* Linklaters & Paines, Barrington House, 59-67 Gresham Street, London EC2.

OCCA Committees of Council 1989-9O

Finance Committee

Chairman: B F Gilliam, FTSC
President: A G North, BSc, FTSC
Immediate Past President: J R Bourne, FTSC
Hon.Secretary: L J Brooke, ATSC
Hon.Editor: J R Taylor, BSc, CChem, FRSC, FICorrST, FPRI, FTSC
Hon. Conference Officer: A C Jolly, BSc, FPRI, FFB, FTSC (co-opted)
Hon. Exhibition Officer: F. Morpeth, CChem, FRSC, FTSC (co-opted)
N H Seymour, FTSC
G H Munro, BSc
J Calderbank
D B Bannington, ATSC

Conference Management Committee

Chairman: A C Jolly, BSc, FPRI, FFB, FTSC
President: A G North, BSc
Hon. Editor: J R Taylor, BSc, CChem, FRSC, FICorrST, FPRI, FTSC
Hon. Research & Development Officer: S Lawrence, PhD, BSc, ATSC

Executive Committee

President: A G North, BSc, FTSC
Immediate Past President: J R Bourne, FTSC
Hon. Secretary: L J Brooke, ATSC
Hon. Treasurer: B F Gilliam, FTSC
Hon. Editor: J R Taylor, BSc, CChem, FRSC, FICorrST, FPRI, FTSC
Hon. Research & Development Officer: S Lawrence, PhD, BSc, ATSC
Hon. Technical Education Officer: A T Hopgood, FTSC
Hon. Overseas Secretary: W Borrell, AMCT, LRSC
Hon. Conference Officer: A C Jolly, BSc, FPRI, FFB, FTSC
Hon. Exhibition Officer: F J Morpeth, CChem, FRSC, FTSC

Publications Committee

Chairman: J R Taylor, BSc, CChem, FRSC, FICorrST, FPRI, FTSC
President: A G North, BSC, FTSC
Immediate Past President: J R Bourne, FTSC
Hon. Secretary: L J Brooke, ATSC
Hon. Treasurer: B F Gilliam, FTSC
Hon. Research & Development Officer: S Lawrence, PhD, BSc, ATSC
J Hemmings, LRSC, ATSC
N H Seymour, FTSC
A Hopgood, FTSC
S R Finn, BSc, CChem, FRSC, FTSC (co-opted)

Hon. Publications Secretaries

Bristol: G W Fowkes
Cape: J Copeland
Hull: D Robinson, LRSC
Irish: J Clarke
London: G J Steven, BSc
Manchester: M Langdon, ATSC
Midlands: M J Round, MRSC, CChem
Natal: E Puterman, BSc
Newcastle: J Bravey, MRSC, CChem
Ontario: J G Pitt
Scottish: H Jess
Thames Valley: D Horn
Transvaal: R E Cromarty
West Riding: S Birkett, LTSC

Liaison Committee

President: A G North, BSc, FTSC
Immediate Past President: J R Bourne, FTSC
Hon. Secretary: L J Brooke, ATSC
President: Birmingham Paint, Varnish & Lacquer Club: D Penrice
Chairman, Midlands Section: B Myatt

Awards Committee

Chairman: S Lawrence, PhD, BSc, ATSC
President: A G North, BSc, FTSC
Immediate Past President: J R Bourne, FTSC
Hon. Secretary: L J Brooke, ATSC
Hon.Editor: J R Taylor, BSc, CChem FRSC, FICorrST, FPRI, FTSC
Hon. Treasurer: B F Gilliam, FTSC
F B Redman, FTSC (co-opted)

Professional Grade Committee

Chairman: A G North, BSc, FTSC
Immediate Past President: J R Bourne, FTSC
T A Banfield, PhD, DIC, ARCS, FICorrST, FTSC
J E Mitchell, BSc, FRSC, FTSC
J R Taylor, BSc, CChem, FRSC, FICorrST, FPRI, FTSC
H J Clarke, FTSC
G V Hill, BSc, FTSC
G H Hutchinson, ARSC, FTSC
P Birrell, FTSC
A T Hopgood, FTSC
L A Hill, BSc, FTSC
B F Gilliam, FTSC
B Canterford, FTSC
K Arbuckle, MA, FTSC

Exhibition Management Committee

Chairman: F. Morpeth, CChem, FRSC, FTSC
President: A G North, BSc, FTSC
J Hemmings, LRSC, ATSC
L Morpeth

Technical Committee

Chairman: S Lawrence, PhD, BSc, ATSC
President: A G North, BSc, FTSC
Immediate Past President: J R Bourne, FTSC
Hon. Editor: J R Taylor, BSc, CChem, FRSC, FICorrST, FPRI, FTSC
A C Jolly, BSc, FPRI, FFB, FTSC
M Nixon, LRSC
B A Canterford, FTSC

OCCA Section Officers and Committees 1989-90

Bristol

Chairman: J C Shaw
Chairman Elect: R Saunders
Hon. Treasurer: L J Brooke, ATSC
Hon. Publications Secretary: G W Fowkes
Representative on Council: R Saunders
Hon. Auditor: D N Fidler, BSc, MSc
Committee: H G Amand, ATSC, J P N Hexell, BSc, PhD, M H Prigmore, FTSC, D W Shepherd, BSc, LRSC, ATSC
Hon. Secretary: K A Chippington, ATSC, 37 Shepperd Way, Minchinhampton, Stroud, Gloucestershire GL6 9BZ

Hull

Chairman: B J R Mayes, BSc
Vice Chairman: J A Hasnip, BSc, ATSC
Hon. Treasurer: W T Lander, BSc, ATSC
Hon. Publications Secretary: D Robinson, LRSC
Representative on Council: M Gamon
Hon. Auditor: C G Crawforth, BSc, DPhil
Committee: C G Crawforth, BSc, DPhil, M H Gamon, D R Benn, BSc, J W Wenham
Hon. Secretary: P A Bentley, BSc, 55 Sunningdale Road, Hessle, North Humberside HU13 9BW

Irish

Chairman: N A McInerney
Vice Chairman: J Downing
Hon. Treasurer: J Downing
Hon. Publications Secretary: J Clarke
Representative on Council: A L Taylor, FTSC
Hon. Social Secretary: P Holmes, BSc, ATSC
Hon. Programmes Officer: J Clarke
Hon Auditor: M O'Callaghan
Committee: C Deegan, D Godden, P Murray, MSc, GRSC, PhD, J O'Connor, A Taylor, T Taylor, CChem, MRSC, PhD
Hon. Secretary: P McCrudden, Berger Paints Ireland Ltd, Malahide Road, Coolock, Dublin 17

London

Chairman: P Thukral, BSc, PhD, CChem, FRSC, FPRI, FTSC
Immediate Past Chairman: B Canterford, FTSC
Hon. Treasurer: D Bannington, ATSC
Hon. Publications Secretary: G J Steven, BSc
Hon. Assist. Publications Secretary: N Locke
Representative on Council: D Bannington, ATSC
Hon. Social Secretary: K Arbuckle, MA, FTSC
Hon. Programmes Officer: D Sheppard
Hon. Auditor: T Banfield, FRSC, PhD, DIC, ARCS, FTSC
Committee: R Cunnington, ATSC, B Gilliam, FTSC, BSc, L Jennings, D Tooke-Kirby, ATSC. A J Moncrieff, BSc, F Palmer
Hon. Secretary: J Tooth, FTSC, 64 Ingrebourne Gardens, Upminster, Essex RM14 1BW

Manchester

Chairman: N H Seymour, FTSC
Vice Chairman: F J Morpeth, CChem, FRSC, FTSC
Hon. Treasurer: J T Calderbank, AssIOP, MIST, ATSC
Hon. Publications Secretary: M Langdon, ATSC
Representative on Counil: D W N Clayton, ATSC, MIQA, DMS, MBIM
Hon. Technical Liaison Officer: R Ashton, ATSC
Hon. Programmes Officer: R E Nicholls
Hon. Social Secretary: D J Love, LRSC
Hon. Membership Officer: R Stott, ATSC, CCol, ASDC
Hon. Auditors: F B Redman, FTSC, G R Robson, BSc, ARSC, FTSC
Committee: R B Kinkead, M R Gallon, BSc, ATSC, M Serene, J Jackson, BSc, B Clementson, J B Edwards, M O'Neill
Ex Officio Committee Members: A C Jolly, BSc, FTSC, FPRI, FFB, A G North, FTSC, W Borrell, AMCT, LRSC
Hon. Secretary: G A Fielding, BSc, Ciba-Geigy Pigments, Ashton New Road, Clayton, Manchester M11 4AR

Midlands

Chairman: B E Myatt
Vice Chairman Elect: B A Fowler
Hon. Treasurer: A G Eades, FPRI
Hon. Publications Secretary: M J Round, MRSC, CChem
Representative on Council: B E Myatt
Hon. Social Secretary: B E Myatt
Hon. Auditors: H J Griffiths, ACT, ATSC, D G Williams
Committee: R K Chater, BSc, B J Green, BSc, FRSC, G C Simmons, BSc, MSc, PhD, MRSC, Mrs P A L Wells, R W Owens, BSc, A E Arnold, ATSC K A Watson (co-opted)
Hon. Secretary: B A Fowler, Resiblend Services, Romford Road, Astonfields Industrial Estate, Stafford ST16 3DZ

Trent Valley Branch

Chairman: S H Codd, LRSC
Hon. Treasurer: M J Hannah
Hon. Publications Secretary: R M Brown, BSc
Membership Secretary: A J Fream, BSc, PhD
Hon. Auditor: J Middleton, J C Ellis
Committee: J Dibble, LRSC
Hon. Secretary: D J Grantham, Via Gellia Colour Co Ltd, Brassington, Nr Wirksworth, Derbyshire DE4 4ES

Newcastle

Chairman: D J Neal
Vice Chairman: J J Marron, BA
Hon Treasurer: D McKay
Hon. Publications Secretary: J Bravey, CChem, MRSC
Representative on Council: S Lynn, CChem, MRSC
Hon. Research Liaison Officer: H Fuller
Co-ordinating Officer for Technical Education: S McMillan
Hon. Programmes Officer: I Melville, BSc
Hon. Auditors: A Laws, S Lynn, CChem, MRSC
Committee: A Durdey, W Postma, N Reeves, ARIC, PhD, MRSC, CChem, A Findlay, R Harrison, A Laws
Hon. Secretary: S Walton, 109 Kenton Lane, Gosforth, Newcastle-upon-Tyne NE3 4LD

OCCA Section Officers and Committees 1989-90

Ontario

Chairman: D Pratt, LTSC
Immediate Past Chairman: J Ambury
Hon. Treasurer: T Crooks, BSc
Hon. Publications Secretary: J G Pitt
Representative on Council: P Birrell, BSc, FRCS, FTSC
Hon. Programmes Officer: J G Pitt
Hon. Education Officer: G Parker, BSc
Hon. Membership Officer: J Ambury
Hon. Auditor: G R Paterson
Committee: S Awadalla, BSc, BA, MBA, W D Fulton, F Grootveld, BSc, M Hazen, W Parsons, W H Smith, BSc, D Hammett
Hon. Secretary: J Glynn, BA, Schmidt Printing Inks, 5716 Coopers Avenue, Unit No.10, Mississauga, Ontario L4Z 2B9, Canada

Scottish

Chairman: R F Hill, CChem, MRSC, ATSC
Vice Chairman: A Hunter
Immediate Past Chairman: S Lawrence, BSc, PhD, ATSC
Hon. Treasurer: H Munro, BSc, FTSC
Hon Publications Officer: H Jess
Representative on Council: R F Hill, CChem, MRSC, ATSC
Hon Programmes Officer: R G Gardiner
Hon. Student Group Liaison Officer: J Harte
Hon. Research Liaison Officer: I McCallum, LRSC, ATSC
Hon. Auditor: E M Burns
Committee: N Baird, LRSC, D Findlay, BSc, C Farnocchi, BSc, J Heath, I Bryson
Hon. Secretary: J F Dingwall, Granyte Surface Coatings Ltd, 51 Hobden Street, Glasgow G21 4AT

Thames Valley

Chairman: R Stephens
Hon. Treasurer: M Palmer, BSc
Hon. Publications Secretary: D Horn, MISCT, ATSC
Representatives on Council: J Gant, LRSC
Hon. Programmes Officer: J Gant, LRSC
Hon. Auditor: B Allen
Committee: A W Fell, BSc, LRSC, AMCST, ATSC, E R Miller, PhD, J Inshaw, D Bayer, V A Moore, C A Morrell
Hon. Secretary: G Drinkwater, BSc, Leaside, Chestnut Drive, Whittlebury, Towcester, Northants, NN12 8XD

West Riding

Chairman: R J Lewis
Immediate Past Chairman: J Hemmings, LRSC, ATSC, APR
Vice Chairman: G C Alderson, LRSC
Hon. Treasurer: M Cochrane
Hon. Publications Secretary: S Birkett, LTSC
Representative on Council: G C Alderson, LRSC
Hon. Social Secretary: P R Stanton, LTSC, ASDC
Hon. Auditor: C Butler, LRIC, MBIM, FIWM
Committee: R Bradley, LRSC, A Donkin, BSc, R W Harrison, P J Knight, J S Mason, BA, B L Widdop, LRSC
Hon. Secretary: D J Simpson, BSc, Hoechst (UK) Ltd, Stainland Works, Holywell Green, Halifax, West Yorks HX4 9DL

South African Division

Cape

Chairman: P K Kretzel
Hon. Treasurer: H J Schone
Publications Secretary: J C M Copeland
Representative on Council: D J Morris
Hon. Programmes Officers: D Viljoen, G Reynolds
Hon. Education Officer: C Gibson
Committee: D F Smith, M Zacharias
Hon. Secretary: D Naidoo, Shell Chemicals, P O Box 297, Paarden Eiland 7420, S Africa

Natal

Chairman: R J Archer, BSc, ATSC
Hon. Treasurer: R H Philbrick, ATSC
Hon. Publications Secretary: E Puterman, BSc
Representative on Council: D J Morris
Committee: P Naidoo, A R Van der Walt, T J Hemming K M Engelbert ATC, MSACI
Hon. Secretary: L A Fisher, ATSC, No 1, 7 Harborth Road, New Germany 3610, Natal, South Africa

Transvaal

Chairman: D M Lindsay, LPRI
Hon. Treasurer: D C Peddie
Hon. Publications Secretary: R E Cromarty, ATSC
Hon. Education Officer: R T A Burke
Hon. Social Secretary: P Lind
Representative on Council: D J Morris
Hon. Secretary: Mrs S I Bing, IFLAD Paints, P O Box 391065, Bramley 2018, South Africa

General Overseas Section

Nigerian Branch

Chairman: F S Adefarati, BSc, ATSC
Hon. Publications Secretary: G C Ekeh, ATSC
Committee: D Morris, FTSC
Hon. Secretary: N K Apatira, LRSC, co Portland Paints & Products, Ewekoro Works, P M B 21011, Ikeja, Lagos State, Nigeria

Zimbabwe Branch

Chairman: J C Calasse
Hon. Treasurer: B Ketteringham
Publications Secretary: M Johnson
Representative on Council: V Patel
Hon. Research Liaison Officer: P George
Hon. Auditor: R Johnson
Committee: V Patel, P George
Hon. Secretary: M Johnson, P O Box 3843, Harare, Zimbabwe

Natal Section

Recent advances in polysulphide coating technology

At a meeting held in Westville on 9 May 1989, Dr Tim Lee of Morton-Thiokol, gave an extremely well-prepared presentation on recent advances in polysulphide coating technology.

After dealing briefly with the chemical background to the technology, Dr Lee illustrated how work done primarily in the field of adhesives and sealants for specialist use, can be applied to the surface coatings industry. These applications upgrade such properties as adhesion, flexibility and chemical resistance.

While the polysulphide systems are relatively expensive, the use of these materials can be cost-effective in difficult situations.

His remarks relative to the low permeability of these materials to the Radon gas emanations had an impact on those present. Currently, these emanations cause concern in the field of general health

The vote of thanks was proposed by Mr Tim Henning. The meeting was kindly sponsored by Technichem Sales (Pty) Ltd..

A general perspective of natural oil and gas resources

Terry Ashmore, executive director of Advance Coatings (Pty) Ltd described himself as an amateur minerologist. The commencement of the Mossgas Project in the Republic of South Africa has led him to delve deeper into the study of oil and gas. Mr Ashmore presented an absorbing general perspective of the topic at a meeting held in Westville on 13 June 1989.

Oil was first commercially produced in Rumania in 1857. In 1859 in Pennsylvania USA, oil was pumped out at the rate of 25 barrels/day. A hundred years later, production in the USA was 10 million barrels/day. The commercial production of oil, spelled the end of the use of candles for lighting.

The lecturer covered the origins, chemical composition, exploration, world distribution, the carbon cycle, off-shore action and protection to drilling rigs.

OCCA Natal Meeting, 18 June 1989—"Natural Oil & Gas Resources" (L to R): Robin Archer — OCCA Natal Chairman, Terry Ashmore — Advance Coatings, Llewellyn Jackson — Chairman, Corrosion Institute Natal.

OPEC and political influence in the oil industry was discussed. Since the oil crisis in 1973/4, the price of oil has increased dramatically. However there has been a reduction in the use of oil. Oil and gas reserves are rising and there is generally a surplus of production.

The meeting was a joint meeting with the Corrosion Institute, Natal. The vote of thanks was proposed by their chairman, Mr Llewellyn Jackson who also thanked OCCA for arranging the joint meeting. The meeting was sponsored by Dekro Paints (Pty) Ltd.

E. Puterman ■

New members

The sections to which new members are attached are shown in italics together with the country, where applicable.

Ordinary members

Carroll, M. H. *(Ireland)*
Chapman, M. St. J. *(General Overseas — Singapore)*
Crouchman, P. J. *(West Riding)*
Goode, M. J., BA,DPhil *(Manchester)*
Gray, M. J., BSc*(Cape)*
Horng, A. *(General Overseas — Taiwan)*
Iweanya, A. V., BSc, MSc (General Overseas — Nigeria)
Narker, C., BSc *(Cape)*
Palmer, F. H., BSc *(London)*
Perumal, M. I. *(Natal)*
Rocotas, S. P. *(General Overseas — Greece)*
Sydney, C. E. *(Natal)*
Thomas, J. *(Bristol)*

Associate members

Dickinson, K. J. *(Cape)*
Reddy, M. G. (Natal)
Seale, G. W. *(Cape)*
White, S. P. *(Midlands)*

Registered students

Estarki, A. *(General Overseas — Iran)*
Hossein, P. A. R. *(General Overseas — Iran)*
Piroozfar, H. *(General Overseas — Iran)*

Professional Grade

At the meeting of the Professional Grade Committee held on 10 August 1989 the following were admitted:

Admitted to Fellowship

Simpson, Leslie Ainsley *(Newcastle)*

Upgraded from Associate to Fellowship

Bose, Sunil Kumar *(London)*
Myers, Gordon *(Natal)*

Admitted to Associateship

Ayre, Thomas Richard *(General Overseas — Malta)*
McCrudden, Patrick *(Irish)*
Moodley, Perumall Bangaru *(Natal)*
Philbrick, Richard Hamilton *(Natal)* ■

Classified Advertisements

SITUATIONS VACANT

PAINT TECHNOLOGY RESEARCH ENGINEER

c£15,000 + Bonus, Benefits/Relocation Cheshire

An ongoing commitment to enhance product quality has created a key vacancy with this well-respected Aerospace manufacturer. The product includes prefabricated structures in a variety of materials, with paint systems including cellulose, acrylic, epoxy, synthetic and 2-part polyurethane.

The appointee is tasked to ensure the availability of the latest technology to current and future products, in terms of both paint systems and associated application processes, through the co-ordination of relevant research and the provision of consultancy advice to the Design and Manufacturing functions.

An engineer with appropriate degree qualification and industrial experience is envisaged, although recently qualified post-graduates with a surface coating bias are also encouraged to apply.

An attractive salary and benefit package, including relocation assistance, is offered in return for your experience and commitment.

For further details of this exciting opportunity, please contact **Graham Taylor** on **061 969 1421** 9.00am – 7.00pm, or write to him at:

The Selection Partnership
2 Oriel Court, Ashfield Road, Sale, Manchester M33 1FF

Cambridge 0223 208181 | TSP | Birmingham 021 427 4255
Milton Keynes: 0908 274174

BUREAUTECH SCIENTIFIC STAFF AGENCY

Top jobs for chemists experienced in the polymers, paints, inks, adhesives and surface coating industries. We cover the entire spectrum from technician to M.D.
Our service is friendly, fast and free.
Please send your full c.v., including salary required, desired job and location, to:-
B.S.S.A., 46 Selvage Lane, Mill Hill, London NW7 3SP.
Telephone: 01 959 3517
Enquiries also welcomed from employers.

INSTRUMENTATION

ACM Instruments

ELECTROCHEMICAL INTERROGATOR SERIES

Faster Environmental testing is now possible with an improved degree of accuracy and reproducibility by recent developments in electrochemical instrumentation. Up to 32 environmentally exposed painted samples can now be tested by potentiodynamic AC or DC techniques simultaneously around their individual rest potentials in the same test environment and test tank. This increases testing reproducibility as all samples are treated in exactly the same way with no difference in temperature or emersion time of the electrodes before and during testing. For information and demonstration software:
Telephone or Fax (0706) 64377
Faraday House, 2 Middleton Road, Heywood, Lancs OL10 2HT.

SITUATIONS WANTED

B.Ch.E.(Hons.), A.M.I.I.Ch.E., A.T.S.C. CHEMICAL ENGINEER

17 years' experience in industrial and decorative paint application and technical services. Presently employed in a reputed Indian Paint Company. Interested to work in technical services department. Can tour all over the world keeping headquarters in Calcutta, India, or anywhere in Europe, U.S.A., Canada, Australia, S.E. Asia.

Please apply to
Box 8982, c/o JOCCA, Priory House, 967 Harrow Road, Wembley, Middlesex, England HA0 2SF

JOCCA CLASSIFIED ADVERTISEMENTS
FRANK CRAIK 01-908 1086

PLANT & MACHINERY FOR SALE

BEKEN MIXER 200-GALL. CAPACITY, WITH 6 CHANGE PANS, MILD STEEL, FLAMEPROOF.

MASTERMIX & TORRANCE PASTE MIXERS 10/50 HP, 20 HP COWLESS VARIABLE SPEED MIXER F.L.P., 10 HP GREAVES HIGH SHEAR MIXER, 10 HP VICKERS HIGH SHEAR MIXER, 20 HP SILVERSON, 5 HP LANG, 5 HP SAWTOOTH BLADE MIXERS, 10 HP SAWTOOTH BLADE MIXER 2 SPEED, 15 HP SAWTOOTH BLADE MIXER, SUSSMEYER BEAD MILL SP4 FLAME PROOF, SUSSMEYER CENTRA MILL C250 FLAME PROOF, SUSSMEYER LAB BEADE MILL AUGUST, 20 HP POLYMILL VARIOUS BALL MILLS, WINKWORTH LAB 2 BLADE MIXER 1 PINT, LAB PRESSES, RUSSELL SIEVES, DOUBLE CONE BLENDERS, 45 GALLON DRUM HEATER FLAME PROOF, RIBBON BLENDERS, KEK MILLS.

I Want Your Surplus Plant and Machinery
B. WADDINGTON, FINDA MACHINERY
BOLTON (0204) 68053

Enter 1401 on Reader Reply Card

Winkworth MACHINERY LIMITED **OFFER**

Winkworth Model 53Z Heavy Duty Jacketed 'Z' Blade Mixer, 790 litres, 100 hp, 2 speed, hydraulic tilting model.
Winkworth Laboratory Stainless Steel 'Z' Blade Mixer, 1 litre size, vacuum model.
Baker Perkins 450 Litre Hydisperser.
Lang 450 Litre Jacketed Bottom Entry Mixer
Mastermix 100 HP Toothed Blade Disperser.
Vogele Hydraulic 3-Roll Mill with rolls 20" x 10", flameproof drive.
Jenag Paint Strainers, type 10SF and type 1800.
Also **Stainless Steel Tanks, Mixers, Pumps, Valves, Conveyors,** etc.
Over 500 items in stock.

Winkworth Machinery Limited, Willow Tree Works, Swallowfield, Reading, Berkshire RG7 1QX.
Telephone (0734) 883551. Telex 847967. Fax (0734) 884031.

Enter 1402 on Reader Reply Card

SERVICES

SHELLACS NATURAL RESINS GUMS & WAXES

A. F. SUTER & CO. LTD.

Swan Wharf 60 Dace Road
London E3 2NQ
Tel 01-986 8218. Tlx 919056 SUTERS G
Contact B. A. Slater

SWANLAC
ESTABLISHED 1906

Enter 1403 on Reader Reply Card

PROBLEMS WITH SURFACE COATINGS?

for full chemical analysis of a vast range of materials . . .

Contact:
Andy Swift or Paul Humphrey,
UMIST Surface Analysis Service,
Department of Chemistry, UMIST,
Manchester M60 1QD.
Telephone 061-228 7523

Enter 1404 on Reader Reply Card

INDEX TO ADVERTISERS Page 375

you need Union Camp.

When you buy bulk tall oil rosin from Union Camp, you get consistent high quality rosin made in the United Kingdom...and you get it ready to use in heated road tankers.

There's no energy wasted for remelting...no wasted manpower breaking open rosin drums ...no product loss...no loss of quality due to deterioration from reheating, especially critical for resin manufacturers serving the inks, coatings and adhesives industries.

Plus you get the benefit of Union Camp's technical service expertise accumulated through almost thirty years in the production and applications of tall oil products to a wide variety of end uses.

A DEPENDABLE SOURCE—As a leading forest products company, Union Camp has a dependable base of raw materials in the United States. It begins with Union Camp's intensively managed woodlands, and includes three paper mills which help supply crude tall oil as part of their daily operations.

A QUALITY SUPPLIER—This means a dependable supply of crude tall oil and a rosin product that is of consistent quality. We supply a high quality rosin, manufactured in the U.K. to service the European market, and we can supply you in bulk or drums.

This adds up to better quality, more consistent products for you...from a source that's close to home.

For more information call or write today.

Union Camp
CHEMICAL (U.K.) LTD.

Vigo Lane, Chester-le-Street, County Durham DH32RB, England • Telephone (091) 410 2631 • Telex: 53163

Enter 1104 on Reader Reply Card