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JOURNAL OF THE OIL AND COLOUR CHEMISTS' ASSOCIATION

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Vol. 72 No. 7 JULY 1989

JOCCA

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Forthcoming Features: August — Additives, September — Coatings for Plastics/R&P Preview, October — Marine & Offshore Coatings. Contributions are welcomed at least five weeks prior to publication date.

Cover: Printing ink manufacture at Coates Lorilleux, St Mary Cray, Kent (Photo by courtesy of Coates Lorilleux Ltd).

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SWADA gains 1989 Queen's Award

SWADA (London) Ltd and its subsidiary Sterling Industrial Colours Ltd have received the 1989 Queen's Award for Export Achievement. Both companies market daylight fluorescent pigments and bases produced by their associated company Pigments Ltd with exports going to over 50 countries.

Hays Chemical gains BS 5750

The Bulk Products Division of Hays Chemical Distribution Ltd, a Hays plc company, one of the UK's largest distributors of chemicals, has gained BS 5750. Registration has been approved for the division's three sites at St Helens, Sandbach and Rawdon House.

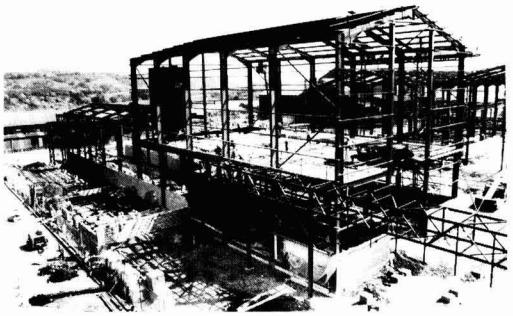
Microfine's mica gains BS 5750

Continuing its commitment to supplying high quality products, the Derby plant of Microfine Minerals Limited has become the first mica plant in Europe to gain approval under BS 5750 part 2 (1987) and ISO 9002(1987) for its wide manufactured product range.

Cookson acquire Heubach Inc.

Richard M. Oster, President and Chief Executive Officer of Cookson America, announced that Cookson has now acquired 100% interest in Heubach Inc. In June 1988, Cookson America obtained a 50% interest in the manufacturer of speciality colour pigments. "Heubach has unique and patented technologies which will considerably strengthen Cookson's position in the speciality chemical business," said Oster. "The acquisition will also provide Heubach with a strong equity position for accelerated expansion in the future." Heubach Inc's name will be changed to Cookson Pigments, Inc., The company is among the six largest pigment producers in the US and will join the Ceramics and Chemicals sector of Cookson America.

The world's biggest Zirconium plant expands



Expansion at Magnesium Elektron's Manchester Zirconium plant

Construction of $30 million of extensions to Magnesium Elektron (MEL) plants has commenced with a 1990 target completion date. The existing MEL plant at Manchester, England is already the world's largest producer of zirconium (Zr) chemicals for industry having a capacity of several thousand tonnes per annum. This is being increased by one third. Courtaulds Engineering of Coventry, England are the main contractors.

The expansion will meet the growing world demand for zirconium chemicals. Zr chemicals are used in over 30 industrial applications, including paint, paper, polymers and inks. Zirconium chemicals are often chosen by industry because of their good environmental reputation, for example MEL's paper coating chemicals have US, German and Dutch government approval for use in foodstuffs packaging. They are widely chosen as environmentally acceptable additives in paints and inks. There is a developing new Zr market in water-based adhesives as an alternative to solvent-based products.

The new plant will use the alkali solution chemical process route developed by MEL, which has zircon sand as its main raw material. Zircon sand is mined from beach sand deposits in Australia, India, South Africa and the US. Over 60% of the Zr products will be exported from the UK to every major industrial country in the world.

Becker launch VIC Process in the UK

Becker Industrial Coatings has launched a new application process for polyurethane paint which gives dramatic energy savings and reduced production costs. Secured on patent from Ashland Chemical Company in the US, the VIC (Vapour Injection Curing) Process offers the advantage of coating any three-dimensional object regardless of substrate (plastic, steel, aluminium, wood) using conventional methods of spray-application including most notably, air-spray. The atomising air carries a tertiary amine gas catalyst, which mixes with the polyurethane paint on release from the gun head, greatly accelerating paint curing speeds to as little as ten minutes.

The VIC Engineering Company has been set up by Beckers with two primary objectives: To promote and distribute the VIC (Vapour Injection Curing) Process in Europe and to award licences to paint manufacturers. This new subsidiary of the Becker Group will be headed by M. Victor Moreau formerly head of the European Coil Coating Association (ECCA), who will oversee the promotion and distribution of the new process across Europe.

John Lyon, Sales Director of Beckers in Speke said: "These are very exciting times for us. This new technique considerably reduces drying times for polyurethane paints, and its market potential is therefore enormous."

Collaboration

Collaboration between firms is increasingly being recognised as one means whereby they can gain access to vital information, skills and expertise that they need to innovate but cannot generate alone. UK firms are recognising the competitive edge that collaboration can bring and there are various initiatives underway to improve the ability of firms to collaborate. Firms involved in the production and use of new materials could particularly benefit from different forms of collaboration. Effective application of new manterials calls for close liaison and shared knowledge between design and production, and between the end user, the processor and the materials supplier. Suppliers, processors and users operate in very distinct sectors and, the processing sector is made up of large numbers of small and medium sized companies.

The LINK scheme, run by the Department of Trade and Industry, aims to encourage firms to work jointly with universities and polytechnics on pre-competitive research relevant to industrial needs. Both projects and programmes are developed via LINK, with programmes involving a number of firms and educational bodies. For individual projects there must be at least one industrial and one academic participant. Currently, among other areas of technology, LINK are dealing with proposals in the field of advanced structural composites.

For further information on Link contact: Mr G. Crewe, DTI, Ashdown House, 123 Victoria Street, London SW1E 6RB. Tel 01-215 6305.

EUREKA aims to ensure that UK firms form part of a European technological capability through European wide industrially led research projects. The Department of Trade and Industry may help UK firms to find partners in the UK and the rest of Europe to take part in such collaborative research projects.

For further information on EUREKA contact: Mr S. Hewitt at the DTI on 01-215 6612.

BASF plc — a new UK chemical force

BASF is merging its main UK production company, BASF Chemicals Limited, with its main trading company, BASF United Kingdom Limited, which as from 1 July will be known as BASF plc. The new company will have a combined annual turnover of £600 million and 1130 employees.

Speaking about the merger, Bryan Rigby, BASF Regional Managing Director for Northern Europe said: "We needed a stronger base for the future development of our activities in the UK. The larger corporation with a full range of skills will improve our control of our operations in the UK. It will also provide a better career structure and give managers an opportunity of wider experience as well as an organisation better prepared to absorb any future acquisitions."

BASF plc will operate from four existing sites at Cheadle Hulme, Hadleigh, Seal Sands and Wembley. The Chief Executive, Bryan Rigby will be based at the Wembley headquarters. John East, will be Deputy Managing Director with responsibility at Cheadle for chemicals, colours and specialities, plastics and printing plate systems.

Sachtleben TiO_2 expansion approval

Sachtleben Chemie GmbH, of Duisburg, a subsidiary of Metallgesellschaft AG, Frankfurt/Main, with 1650 employees and annual sales of around DM 500 million, has been granted by the state government in Düsseldorf the permit for the expansion of its titanium dioxide production facilities. After an approval procedure period of only twelve months, the company can now increase the total output of its titanium dioxide production plant, commissioned in 1962, to 85,000 t per annum. Achievement of this capacity is anticipated between December 1990 and January 1991.

The construction permit has been granted in conjunction with the company's waste acid recovery plant, presently under construction at the Duisburg site, which is to go on stream before the end of 1989: the acid recovery and recycling plant will put an end to dumping of waste acid in the North Sea by West German titanium dioxide producers; the commissioning of the new plant will therefore remove the restriction on titanium dioxide production represented by the legal limitation on the quantities of waste acid, a by-product of titanium dioxide production, which could be discharged into the North Sea.

Sachtleben will achieve the new production levels principally by means of streamlining of existing production routes and improvement of existing equipment. Despite increased production, Sachtleben's environmental emissions balance sheet will continue to improve dynamically, thanks to the implementation of further measures for the prevention of pollution.

Bayer new corporate identity

Bayer is updating its corporate identity to reflect the company's commitment to technical expertise and an awareness of its responsibility for safety and the environment. The present corporate colour scheme of dark and light green is being replaced by green and blue. Recent research has shown that the public associate the colour green with ecology and the colour blue with technology.

Mercury opens new colour centre

Mercury Plastics Plc has opened a new 'Colour Centre' at its headquarters in Watford.

Production Chemicals on the move

Production Chemicals new address is Dalton Way, Middlewich Motorway Estate, Middlewich Cheshire, CW10 0HS.

Products

New resins from Cray Valley

Cray Valley Products Limited have recently introduced two new resins for use in flexographic printing inks:

Versamid 737 is a 100% non-volatile, alcohol reducible, thermoplastic polyamide. Features include complete solubility in isopropanol and excellent gelation resistance.

Versamid 941 is a co-solvent polyamide, also supplied at 100% non-volatile. Specific attributes include excellent gelation resistance while still retaining the high performance of conventional co-solvent polyamides.

Cray Valley have also added six new interesting resins to their short oil industrial alkyd range. Five are based on linoleic and range in oil length from 33% to 40%, while the sixth resin is 38% soya. Recommended applications for these versatile new alkyds are for quick air drying and stoving enamels, acid catalysed, and N/C combination lacquers.

For further information Enter G199

Equipment

Supermills

OBS has installed their sixth Supermill at Antonine Inks, manufacturer of flexographic and gravure printing inks. The latest addition has a 50 litre capacity with both water and spirit based printing inks being produced in standard 1000 kg batches. To provide the many shear surfaces necessary to achieve the ultra fine pigment milling and dispersion demanded by the Antonine ink range, the Supermills are equipped with special grinding discs which rotate at peripheral speeds up to 15 metres per second. Together with the shear provided by the grinding media (up to 85% of the shell volume) sufficient particle size reduction and

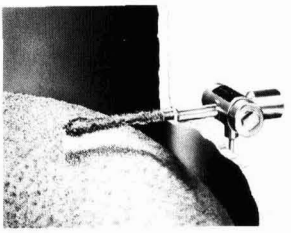
OBS Supermills at Antonine

dispersion can be completed in just one pass. To ensure rapid changeover between pigment colours typically changed two or three times a day, solvent is simply pumped around the machine and discharged through a drain valve.

For further information Enter G200

Bulk solids level switch

The Type CL-10DJ Dynatrol® Detector from Automation Products is designed for applications to either high or low-point level detection for bulk solids. Suitable for a wide range of bulk densities, from low density fluffs to heavy granulars and pellets, the level detector tolerates material build-up and can be used in vessels equipped with vibrators. Reliable operation can be achieved with this control in problem applications, where other types of controls may fail to operate.



For further information Enter G201

New FT-IR spectrometers

Perkin-Elmer have introduced two new low-cost FT-IR spectrometers — the Model 1620 and the Model 1650. Both instruments have 2 cm^{-1} resolution, integrated external beam and method creation software.

For further information Enter G202

Multi-angle glossmeter

Macbeth's Lab-Gloss multi-angle glossmeter system provides a new standard in gloss measurement, permitting single measurements or a complete profile of surface gloss to be collected by the sensing head and stored in the associated display unit. Up to 999 readings can be stored and statistically analysed for display or downloading to a computer or printer. The models have 20, 45, 60, 75 or 85 degrees geometry. Measurement accuracy is 0.5GU (gloss units) with a resolution of 0.1GU and a repeatability of 0.5GU over 48 hours.

For further information Enter G203

New pH meter

A new pH meter in the Beckman "pHI" Series has been introduced with a choice of automatic or manual operation. The PHI 72 is set up to operate from simple menus with full help screens, making advanced features easily accessible. The RS-232-C interface allows output of measurement results to a printer when readings stabilise, at timed intervals or on demand. It automatically recognises nine widely used programmes.

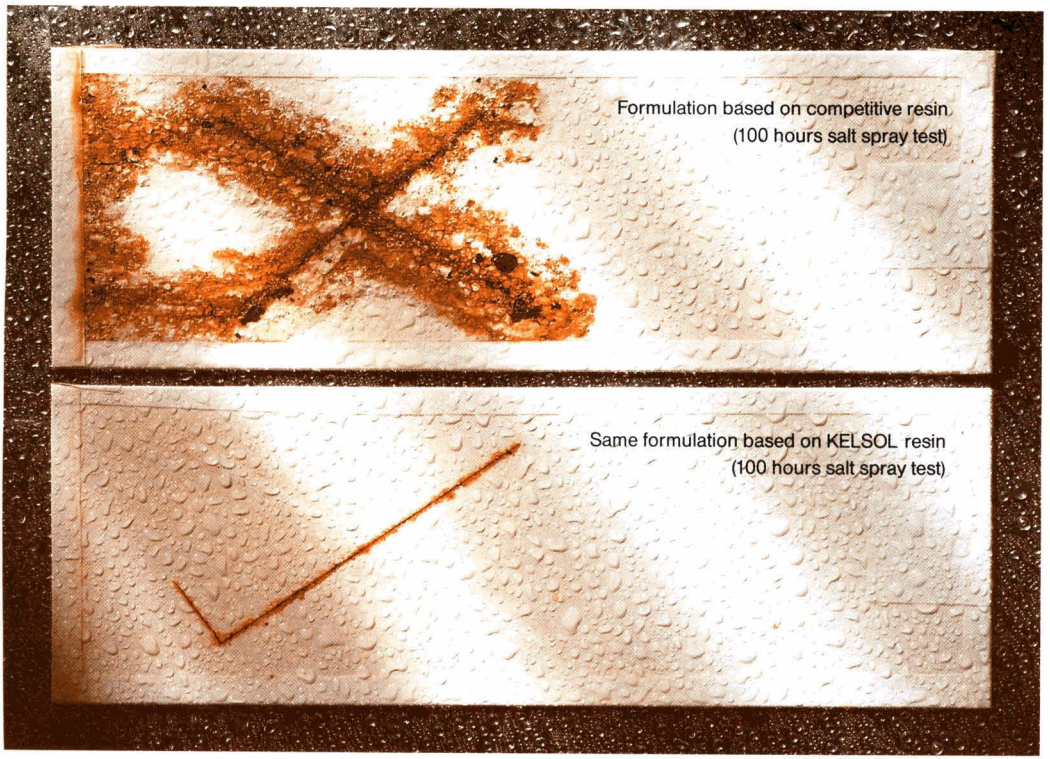
For further information Enter G204

Oven temperature recording

Grant Instruments' latest system for conveyor oven temperature recording provides the complete solution to temperature profiling and quality control in the coatings industry.

Based on the tried and tested Squirrel portable data logger, the system comprises a range of rugged temperature probes, and insulated container to maintain the logger at a safe temperature, dedicated analysis software, and an optional IBM PC compatible lap-top plus 6-colour printer/plotter for on-site analysis. The loggers themselves are available with 4, 6, 8 or 16 temperature channels.

Enclosed in its insulated



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Telephone: 0625 529511. Telex: 669055. Fax: 0625 533123.

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Please send me:
☐ Full details of KELSOL water-borne resins.
☐ A wet paint sample.
Or:
☐ Please arrange for a representative to contact me.
Name .....
Company .....
Position .....
Address .....
.....
.....
..... Postcode: .....

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container, the Squirrel passes through the oven with the probes attached to the painted object being heated. Readings from all probes, taken at user-set intervals of one or more seconds, are stored in the Squirrel and is downloaded to an IBM PC or compatible computer for analysis using Grant's special program.

For further information Enter G205

Literature

To assist customers in initial choice of grades, **Wolstenholme Bronze Powders** have published a Grade Selection Chart with a Shade Chart which indicates the wide range of colours available and typical applications.

For further information Enter G206

Technical data on Colte Colourants are detailed in a comprehensive booklet from **Winter-Bouts B. V.,** outlining their 10 solvent-borne base paints and their 5 base dispersion paints.

For further information Enter G207

A comprehensive booklet from **DSM Resins** details the full range of their resins, with physical properties, applications, product data and test results.

For further information Enter G208

ICS-Texicon has produced a brochure on their colour management systems, MM2000 and MM3000 which obtained the Queen's Award for Technological Achievement.

For further information Enter G209

Joyce-Loebl Ltd has produced a new 4pp leaflet on its high performance disc centrifuge, DCf4 used in particle size analysis (0.01 to 60μ). *For further information Enter G210*

Meetings

Polymer Science

The annual Short Course on the "Principles of Polymer Science" will be held at Loughborough University on 4-8 September 1989. For further information contact: Prof. J. V. Dawkins, Department of Chemistry, Loughborough University, Loughborough, Leics. LE11 3TU.

Filtech Europa '89

The international filtration and separation exhibition will be held on 12-14 September at Karlsruhe, Germany. For further information call 0403 59419.

Inter Action '89

Inter Action '89 — which takes place from 18-22 September 1989 at the NEC, Birmingham — draws together over 1000 exhibiting companies in the world's largest single indoor event dealing with materials movement and control. For further information contact: Lorna Wells, Inter Action Information Officer, The Trinity Group, Trinity House, Hercies Road, Hillingdon, Middlesex UB10 9NA. Tel: 0895 58431.

Fluid Rheology Course

The Warren Spring Laboratory will hold a Fluid Rheology Course from 25-29 September 1989. Course fee: £1492.65. For further information contact: Miss P. Madhvi on (0438) 741122 ext 438.

Additives

An international conference on additives for water-based coatings will be held at the University of Liverpool on 27-29 September 1989. For further information contact: Dr D. Karsa, Lankro Chemicals Ltd, PO Box 1, Eccles, Manchester M30 0BH.

Finishing '89

Over 60 companies will be demonstrating paint and powder coating technology, electroplating chemicals and systems at Finishing '89 which will be held on 26-27 September at the Telford Exhibition Centre, Telford, Shropshire. For further information contact: Nicola Botting, Turret Group plc, Turret House, 171 High Street, Rickmansworth, Herts, WD3 1SN. Tel: 0923 777000.

People

Tor Coatings sales appointments

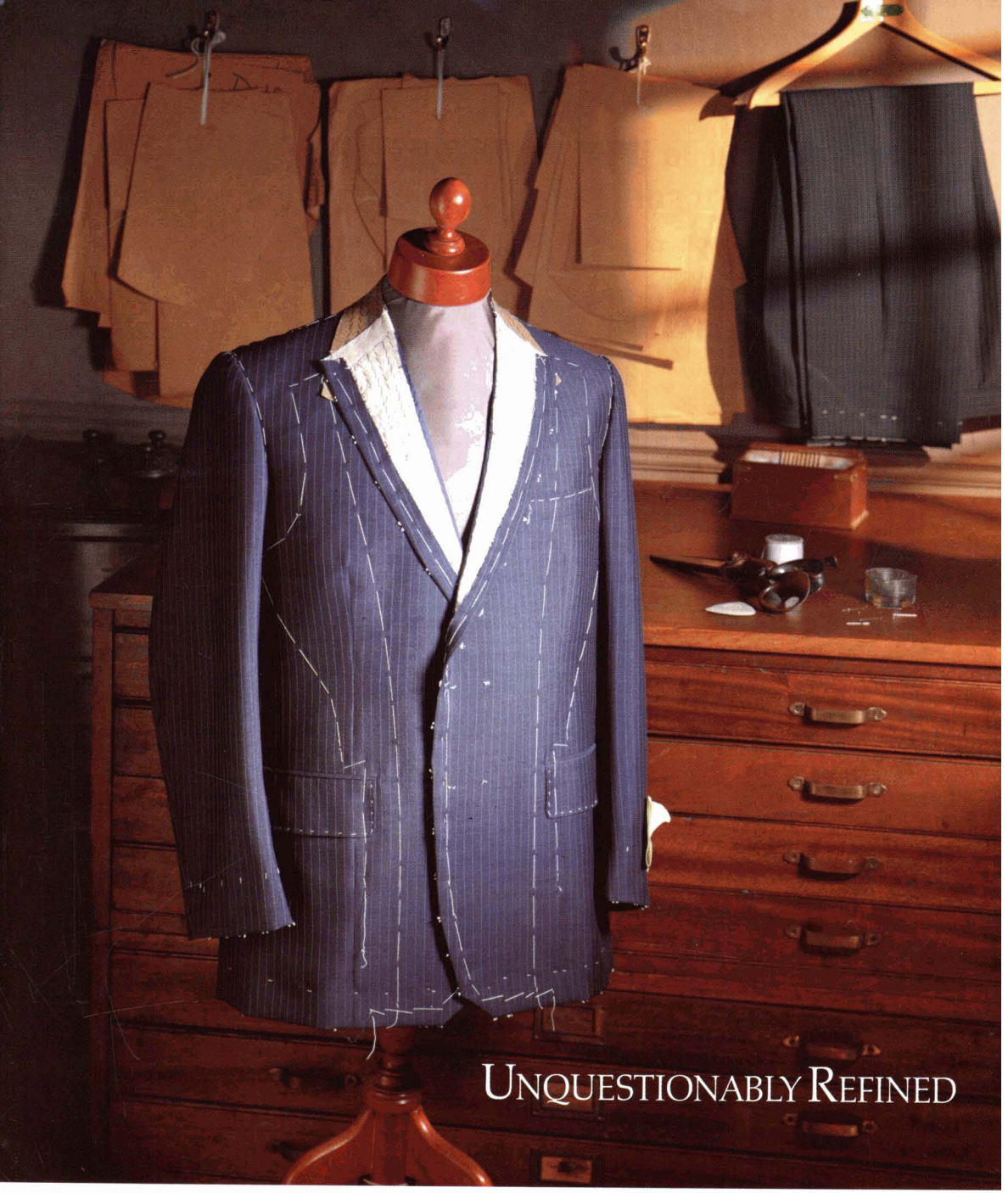
Tor Coatings Ltd. has strengthened its national sales network with the appointment of three new Area Sales Executives: **Roy Vinter, Bob Earle** and **Robin Middleton.**

NL Chemicals appointments

Fred J. M. De Jong has been appointed President, NL Chemicals Europe Inc and Vice President for NL Chemicals Sales & Marketing. Mr De Jong joins NL Chemicals from Akzo Coatings, where — after a 30-year career in Research, Marketing and Sales — his last position was Director, Purchasing and Suppliers Relations. He will be located at NL Chemicals Europe Inc., Brussels.

Thomas Cerny, a Vice-President of NL Chemicals Europe, has been appointed Director of NL Chemicals' Kronos Export organization in Leverkusen, W. Germany, in addition to his responsibilities for sales of NL Chemicals products in France, Italy, Spain, Portugal, Algeria, Tunisia and Morocco. Mr Cerny will remain located in Paris.

Philippe Carel has been appointed to succeed Thomas Cerny as Manager of NL Chemicals' French subsidiary. Société Industrielle Du Titane. Before joining NL Chemicals, Mr Carel was departmental head for Pigments and Fine Chemicals at ICI France.



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

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SBPIM Conference

The Bull Hotel at Gerrards Cross was again the venue for the Conference of the Society of British Printing Ink Manufacturers on 19 May. Some 60 delegates from member companies and Affiliates attended the Conference whilst their wives visited Woburn Abbey. The Society now has 26 full members and 11 Affiliates including OCCA.

Much of the debate at the previous year's conference was devoted to consideration of the Society's image and how the Society could be promoted within the sector it served. President Tony Welton was able to report on the initial response to the promotion campaign and the number of companies now being processed for full membership. The Conference was also the occasion for the launch of the Society's poster and a tie.

The morning session had as its subject "The Environmental Issue – What do we Mean?" and the three principal speakers addressed this important subject from the viewpoint of the management challenge, practical solutions and legislation, particularly as it affects printing ink manufacture. Denis Boatfield challenged member companies to be pre-empt in their policy towards environmental issues and demonstrated his philosophy that "Pollution Prevention Pays" with examples from the very successful 3Ms Energy Efficiency and Environmental & Safety Programme which had seen a very significant reduction in company overheads and hence more profitable production through a management based approach to energy saving, safety and the environment.

Alan Thorpe described his company's approach to the development of driers for heat set printing and the equipment available to recover solvent or reduce its emission into the atmosphere. Dr Martin Bigg, principal inspector within the local authority unit of HMIP, described the legislative framework for pollution control with the establishment of industrial sector based standards for pollution control. Some concern was expressed that different standards might be adopted through this approach for paint and printing ink production which could take place on the same site and that industrial sectors who historically were more environmentally conscious may have imposed on them more rigorous standards for pollution control than for those industries which historically had been less concerned about the impact of their end processes on the environment.

After lunch, Margaret Goldstone of PAPIS presented an interesting review on the demand for print consumption during the next three years and the likely changes that would be brought about by 1992 and the Single Market.

Delegates at the SBPIM Conference

The prospects for growth in print consumption and hence printing ink use were favourable for the years under review, although it was noted that the distribution of print within the major sectors was changing. The principal challenge of the European Single Market was an increase in the strength of the pan European buyer and the attendant pressure on prices demanded of the paper producers and raw material suppliers, principally the ink manufacturers.

The formal afternoon session concluded with presentations by the Chairmen of the Society's major committees, Finance, Work Management, Technical Training Board and Technical, presentations which demonstrated the wide range of services for member companies, given the limited resources of the Society.The Chairman of the Technical Committee, Ray Pierce, was pleased to announce that the Society's request to CEPE, the European paint and printing ink trade association, to change the structure and terms of reference of its Technical Committee had been successful and that the new CEPE Committee to a large extent mirrored the Society's own Technical Committee's terms of reference.

It was noted that legislation would require a standard form for health and safety data sheets and that this would require the Society to review the format of data sheets currently used by the ink sector. Concern which had first been raised at the previous year's conference over the implications of the new Toy Regulations was again raised by members and it was suggested that the implications of the Regulations, which would have an equal bearing on paint companies, could lead to companies withdrawing from supplying materials for "Toys" given the very stringent conditions in the Regulations over the digestion of heavy metals by young persons.

The Society's AGM followed the final session of the Conference and the day concluded with a well supported Dinner for delegates and their wives at which the guest speaker was Eric Dehn, a part-time lecturer at Bristol University.

Colourgen Second Colour Conference

Manchester's Midland Hotel was the venue for the Second Colour Conference organised by Colorgen Ltd, the Warrington based subsidiary of colour matching specialists Colourgen Inc. The Conference on 26 April followed on from the very successful First Conference held in September 1987 and brought together a good cross section of end users, academics, manufacturers and others interested in the whole field of colour matching technology and its applications.

The Conference was Chaired by Peter Wall, Managing Director of Colourgen Ltd, and included papers presented by Dr Jim Knox, Leeds University and Colourgen's Technical Director, Dr Edward Atherton of Swinley Business Systems and a pioneer in the development and instrumental approach to colour matching, John O'Brien the Founder and President of Colourgen, Steve Mallen of Tootle, Dr Brian Rigg a recognised expert on the CMC equation and Dr S Westland of Courtaulds Research.

The theme of the Conference was Novel Applications of Colour Matching Techniques and how the associated instrumentation must be developed to meet the twin challenges of accuracy and novel applications. Significant advances in spectrometer design were forecast continuing the trend to move instruments from an expensive laboratory facility to a low cost end user tool with specific applications in such diverse areas as vehicle refinishing and the DIY warehouse. Colourgen are to be congratulated on their initiative in promoting public debate and discussion in the development of these important support services for industry. ■

Recent developments in printing of newspapers in Europe and their effect on printing ink technology

C. D. Norgate, Coates Lorilleux International Ltd, Cray Avenue, St Mary Cray, Orpington, Kent BR5 3PP, UK

Summary

The aim of this paper is to provide an inkmakers view on what has happened to the European newspaper printing industry in the last few years and the profound affect it has had on ink formulating skills and approaches as a result. It is intended where possible to comment about the future trends.

What has happened 'technically' in the European newspaper printing industry in recent times? The main factors as I see them are:

1. A move away from rotary letterpress to other "more advanced" processes: a. web-offset, b. flexo, c. anilox letterpress and d. anilox offset.
2. Increase in press speeds
3. Increase in print quality
4. Increase in colour
5. Increased demand to compete effectively with electronic media to maintain/increase sales turnover a. through more copies sold and b. through increased advertising
6. Trends to lower grammage newsprint
7. Increased ecological awareness

All these factors listed here have a direct bearing on ink formulating.

Looking at each of these points in turn and examining them further:

1. Press Trends

Figure 1 gives you a "most likely" forecast for the types of presses in newspaper printing between 1985-1995. These figures relate specifically to UK, W. Germany, Italy and France only, but do give a good cross-section for the rest of the countries.

There is and will continue to be tremendous growth in web-offset press installations at the expense of rotary letterpress. It also shows a small but finite increase in the flexo market share. What it doesn't show is the presence of anilox letterpress and anilox offset press installations.

Both of these are already with us and could grow significantly — but to what extent — people are still not speculating about.

Why should these "new" printing processes cause so much concern to ink makers? The reasons are many.

Looking at the various print process involved will answer this:

Figure 1

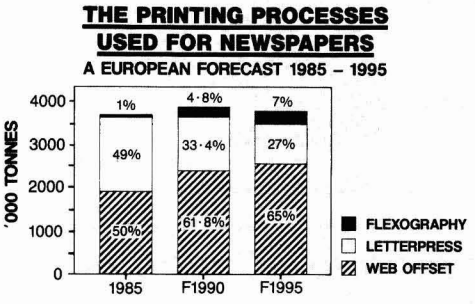
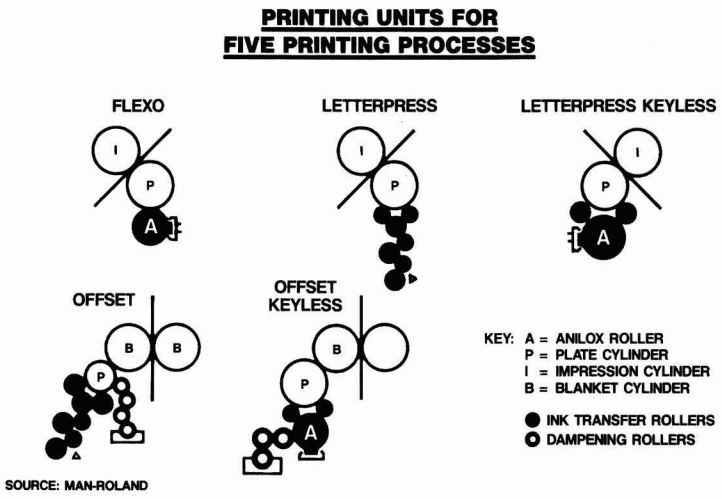


Figure 2



a) Rotary letterpress

The rotary letterpress process (Figure 2) simply requires ink to transfer down an inking system to a plate cylinder and thence to the paper a 'direct' process. The only criteria laid down are that:
i) The ink should have a good on-press density (i.e. it transfers well)
ii) It must be stable to avoid drying on the inking rollers etc.
iii) It should mist as little as possible
iv) It should be of the correct rheology to be fed to the ink duct

Traditionally rotary letterpress inks have been simple pigment, printing ink oil and distillate mixes, sometimes with a low percentage of resin to aid binding, but nothing sophisticated.

b) Anilox/Keyless letterpress

This unit (Figure 2) comprises an anilox roller, an ink chamber and two inking rollers. The very short roller train means the ink must distribute quickly, and to do this an ink of lower viscosity and yield value (i.e. less thixotropic) compared with standard rotary letterpress inks must be used.

However, this shorter inking train means that solvents and other materials which are not inherently press stable can be used, always bearing in mind that during press stoppages, the press remains in its printing configuration, and a degree of non-drying of the ink must remain.

However, anilox letterpress does provide us with 2 alternative approaches to ink formulating.
i) A modified conventional rotary letterpress ink (Lower viscosity and free-flowing).
ii) Emulsion ink. These are inks which are water in oil emulsions and can contain up to 40% water.

They can also include resins and other polymers, and are fast setting. As a result they also give better strike through and rub resistance properties. However, emulsion inks usage is limited to printing plates that are water resistant.

At this stage, rub resistance will not be dealt with as a specific subject but will be covered later.

c) Web-offset

With web-offset, comes a whole new situation. The main factors regarding criteria affecting litho ink formulating are well-known:
i) Water present in the form of fount solution
ii) Inks must form stable ink/water emulsions rapidly
iii) Emulsion rheology must be satisfactory — i.e. have good flow and viscosity
iv) Inks must respond rapidly to changes in fount conditions
v) Inks must not cause tinting or scumming in non-image areas
vi) Inks must transfer well
vii)Inks must not mist

However, formulating such inks for newspaper presses is an area where a lot is still being learnt. In other words, much more background work in laboratory and on the press needs to be done to ensure that the ink runs well lithographically. The ink has to be correctly formulated to meet these new demands. Although web-offset newspaper printing is well established in Australia, it is as well to understand what ink makers need to consider in formulating approaches.

d) Flexography

Without doubt this is one of the buzz topics in the newspaper industry, particularly in the USA where by the end of 1988, 139 units had been installed printing 171,000 T of newsprint for 18 different newspaper publishers. At the time of writing, something like 7% of the US market is now flexo—although current orders for flexo newspaper presses are running neck and neck with offset!

The European situation is much less developed. As you know Italy has led the way through Cerutti, but it is very limited elsewhere. The Daily Mail has now overcome its teething problems and is now producing its entire 1.5M copies daily in monochrome flexo from its London pressroom. 4-colour work is due to commence during the latter part of this year.

Why isn't flexo newspaper printing growing more rapidly in Europe? I would say for 3 reasons:
i) The reticance to move to a 'new' print process until it is fully understood (many people cite the Daily Mail as the example of this 'learning curve').
ii) The fact that much re-equipping of presses has taken place in recent years, meaning that there isn't the physical scope for new sales available just now.
iii) A continued reluctance by printers to accept that flexo print quality is as good as web-offset.

I have no doubt however, that for all the advantages well-known for choosing flexo, it will grow, but be only a small sector of the market. But, what about ink formulating for flexo?

The flexographic printing unit (Figure 2), although superficially similar to the anilox letterpress printing unit, has a number of features which means the ink maker has to produce inks which are substantially different to all other types of newspaper printing inks.

Flexo newspaper printing transfers ink to the stereo direct from the Anilox roller, and from there to the substrate.

A list of criteria set for suitable flexo inks is as follows:
i) Fully water-based systems
ii) Fast drying (to avoid second impression set-off)
iii) Compatible with photopolymer plates
iv) Of low odour (particularly on press)
v) Good print density
vi) Non-hazardous
vii) No filling-in of anilox or stereo (particularly ½ tone)
viii) good wet and dry resistance
ix) Good rewettability

Coates/Lorilleux is one of the leading experts of water flexo inks for newspapers in Europe, supplying 50% of the Italian market and being one of the main suppliers to the Daily Mail.

There is still work to be done on flexo to further improve:
i) ½ tone filling in or plugging
ii) Rewettability
iii) De-inkability (by flotation process)

e) Keyless offset

Finally there is anilox offset. It is very difficult to gauge just how successful this is going to be. Much has been made by the Japanese of their successes, in this field, and K&B/Albert Frankenthal have now sold 3 lines into Europe. (W. Germany : Finland : Switzerland).

The European view appears to be — Yes, it has great potential and if a major customer placed orders for the system it could take off even more. I happen to be one of those who feel that Keyless offset does have a great future — if the problems can be overcome.

What are the key features of anilox or Keyless offset? I stress Keyless because the final design of the inking system do not yet appear to have been made (Figure 2).

The use of fount solution is the same as conventional offset litho, but like other anilox processes, the inking system is much shorter.

This is a problem for litho ink formulators—It means in order to obtain the rapid distribution necessary, you must

lower the ink rheology (viscosity etc.). Normally, by doing this you increase the risk of the ink emulsifying (and taking up more water) therefore you must make the ink more hydrophobic. This in turn makes ink/water balance more difficult to control.

What is clear from all the published articles is that the range of "acceptable" ink/fount balance and condition to get good copy is much smaller than with conventional offset, and that the maximum ink water take-up must also be lower. Indeed TKS, when they showed their new 4-colour press at ANPA '88 they had to ensure the inks didn't go above 82°F.

In other words, if the inks increased in temperature too much, their rheology would have changed which in turn could adversely affect their litho properties.

What is also worrying is that because you pre-set the ink filmweight and cannot adjust on press, you can have situations across one plate of high and low ink offtake. If it is difficult to alter the damping settings as well you can have a situation of excess water in a low offtake area — which the ink cannot take up. How do you get rid of the excess? A question that is under review now.

2. Increase in press speeds

Whereas a few years ago press speeds of 50-55,000 c.p.h. were the norm, we have Goss Headliners and Colorliners; MAN-Roland Colorman 35's and Wifag OF7 presses all capable of 70,000 cph and the latest MAN-Roland addition, the NewsMan 40 for the News Corp. is claimed to run at 80,000 cph.

These sorts of speeds — in excess of 2,000 fpm, place tremendous demands on the inks.

As well as all the other factors already listed, the inkmaker now has to consider the following:

i) Greater shear splitting forces — more risk of ink mist/fling
ii) Temperature build-up on inking rollers
iii) Shorter times between printing and folding
iv) Rapid ink/water balance requirements at high press speeds
v) More sophisticated *ink* feed systems

In other words, much work is being done in lab. and on press to ensure that all the likely press conditions are recognised and understood. This means that the rheology; rheological stability and litho performance under high shear must be clearly established and checked to confirm controlled ink performance on press. You cannot simply take an ink that runs on a press at 40,000 cph and automatically assume that the same ink will run at 80,000 cph on an extended run. It isn't that simple.

The inkmaker has to devise new test methods to simulate these conditions, working in conjunction with lab, equipment manufacturers. This is something that we welcome.

If I may make a contentious point here. The press manufacturers in particular seem to come up with newer faster presses with new inking configuration — to suit end use requirements. Then the inkmaker has to produce the goods — often at a stage when the press is already at the customer. This is not an ideal situation, but it has happened in the past. As a result we now maintain very close ties with all the major press manufacturers to ensure that we are able to meet new demands as they arise.

3. Increase in newspaper print quality

There is an increased awareness by the newspaper reader that he/she wants a quality product, not only from the point of view of actual content, but also from the aspect of actual appearance.

Specifically trends of the following:

i) Increased rub resistance is becoming a more prevalent feature in newspaper printing. There is still reistance in some parts to having to pay the higher price that inevitably comes with these inks but by replacing a proportion of the mineral oil in the conventional formulation with specific resins and polymers, a much better rub and smear resistance result i.e. less ink on hands.
ii) If a print copy looks "clean" this is also a plus as far as the publisher is concerned. Printers want inks that set quickly and don't mark on turner/guide bars or build-up on the kite or mark in the folder. Any of these can give a poor appearance which in turn will discourage the reader to buy.
iii) Less paper wastage is an increasing important factor to the printer.

Inkmakers can produce ink with rapid ink/water balance attainment. This means quicker make ready —less paper wastage. It also means that the level of uniformity of each copy is much better. This of course is where the Keyless inking systems score against conventional ones.

All this formulating skill does cost money it's true, but if the printer really wants to upgrade his image, then this is the way to go and many European newspapers are doing just that.

4. Increase in colour

It obviously depends where in Europe you look, but it is quite clear that there is and will continue to be an explosion in the use of colour.

Why is there such an increase in ROP 4-colour work?:

i) Due to increase in web-offset
ii) Developments in repro making print deadlines easier to achieve
iii) Increase in colour awareness by both advertisers and consumers

Estimates predict that between 1985 - 1995 there will be between a 3 & 5 fold growth in ROP colour in Europe!

Most of this increase has and will be in 4-colour process work. The key thing above anything else to establish is colour standardisation. Without this, it is impossible to get reproducibility of print.

Much work is going on in colour standardisation in newsprint. Efforts in W. Germany and UK are ongoing. Holland has a spec. and in Australia a similar project is underway.

All the points I have made before irrespective of the print process apply equally well to process colours as to black.

The key points as far as inkmakers are concerned, if we are to achieve this colour reproducibility are:

i) Colormetric definition of process colour shades
ii) Agreement of on-press densities at prescribed ink filmweights
iii) Establishment of required 'standard' substrates
iv) Agreement on dot gain parameters
v) Establishment of trapping parameters in multicolour solids work

The inkmaker can produce inks to meet these specifications — the other members of the newsprint industry must jointly decide with the inkmaker what those parameters are.

In order to improve the quality of 4-colour work on press, many newspaper houses are now using pre-press proofing techniques. There are now systems based on ink-jet printing and reprographic systems, and our own company has a system which relies on photoimaging called Truproof.

The point is that if you can see a realistic proof prior to going to press, which printer, client and advertising agent alike agree on, everyone has a better idea of what the final outcome will be. If the proof is as realistic as possible to the on-press result so much the better, and if you can link proofing densities; ½-tone dot gains, trapping levels and

colour-shade/brightness to what you can achieve on press this is even better still. It is already being done at major UK newspapers (e.g. Daily Telegraph : Daily Mirror) — and others will follow. This means not only colour standardisation, but colour reproducibility from copy to copy. I would cite these two papers as currently producing the best process colour work in the UK.

5. Increased demand to compete effectively with electronic media to maintain/increase turnover

This is a logical extension of previous sections, but it is very important to the newspapers in Europe if they are to survive.

The importance of advertising expenditure to newspapers is undeniable. As a % of total expenditure it makes very interesting reading. (Figure 3).

Like it or not the market share of advertising held by newspapers is under major threat from TV/electronic media advertising. To check this, the newspapers must:

i) Convince advertisers they can give them the best value for money through high quality 4-colour advertising on newsprint — if its done well it is the most cost effective way of getting the message across.

ii) Produce a newspaper of such quality that will encourage more readers.

Use of colour alone whether for advertising or editorial doesn't seem to increase sales (UK Daily Mirror is a very good example of this).

But if the quality can be increased, the advertisers can see that their advert is the same from one copy to another; one edition to another, even one paper to another — then the growth in newspaper advertising must come. In 1988 there has been a 13% increase in newspaper advertising in UK National newspapers.

Only by standardisation of colour will this be truly possible, coupled with the highest quality origination; pre-press; proofing and on-press techniques. (See my earlier comments on this).

The inkmaker obviously has an important part to play in this.

6. Trends in newsprint

This is a very interesting point for discussion.

Figures 4 and 5 highlight quite clearly what is happening in Europe, in reducing average grammage.

Obviously newspaper publishers in some European countries (particularly in the Nordic countries) have reduced newsprint grammage further than others, but the trend is nevertheless there across the whole of Europe.

The main reasons are simply:

i) Lower unit cost at lower grammage.

ii) Increased pagination and the need for ease of handleability of the final printed newspaper.

Some Nordic countries have newspapers of 40 gsm caliper, but the main trend is from 48.8 - 45.5 gsm.

At 45.5 gsm problems of strike through (particularly with web-offset) will be minimised. If we go lower and we go more to 4-colour, the two main problems that can occur are:

i) increased strike through

ii) more difficult to register 4-colour work because of the volume of water take-up. (Paper expansion).

Figure 4

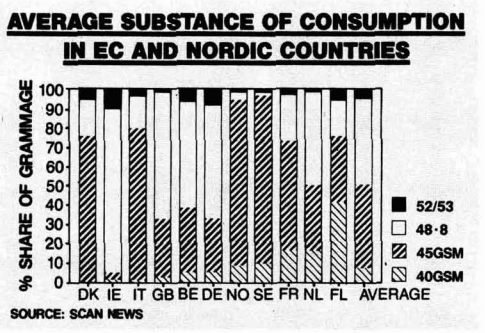
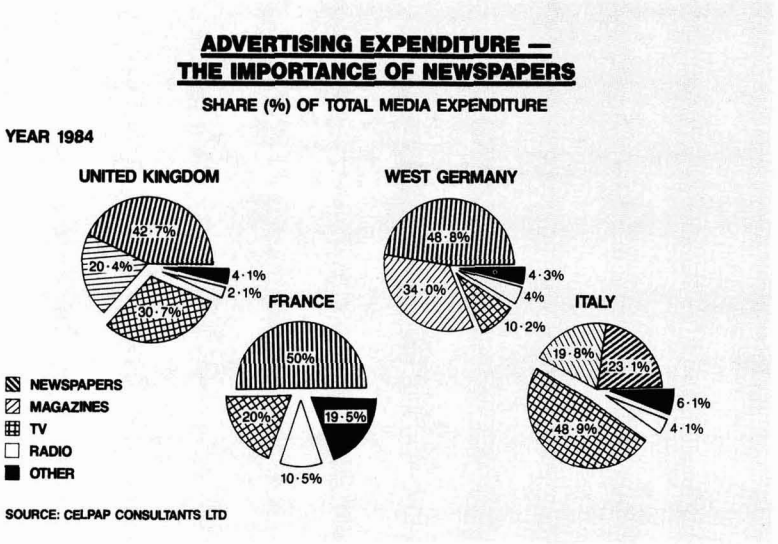


Figure 3



However, in Finland 40 gsm is the norm for morning newspapers running 4-colour work. The ink technology necessary to run at these grammages has been developed.

The increase in 4-colour work may also necessitate an increase in demand for higher levels of brightness in newsprint. Whether this can be achieved at current costs remains to be seen.

Recently the Scandinavian's have also changed their colour standard of their newsprint, making it 'warmer' and brighter. This is in line with requirements to optimise 4-colour printing particularly flesh tones.

This helps the inkmaker, because if it is possible to print on a "standard" sheet it makes life far easier in trying to control colour.

7. Ecology

Much has been made recently in the USA of the use of soya bean oil as an alternative to mineral oil when that product finally runs out.

Claims that vegetable oil based inks (particularly in process colours) give cleaner printing, less dot gain, better trapping, better print contrast and better solid density have been widely reported.

These claims have provoked a lot of work in Europe and inks of this nature are being trialled commercially in certain areas now.

Our own group is very much involved in this project and we are at commercial trials stage as well.

The following seem to be real advantages in these type of inks. (I say these types because there is more than one type of vegetable oil other than soya bean): Faster setting, better rub-resistance, cleaner printing and better print contrast. Other benefits such as better ½ tone sharpness, better trapping and better solid density at same pigmentation have yet to be proven.

However we are sufficiently encouraged by what we have seen to want to pursue this further.

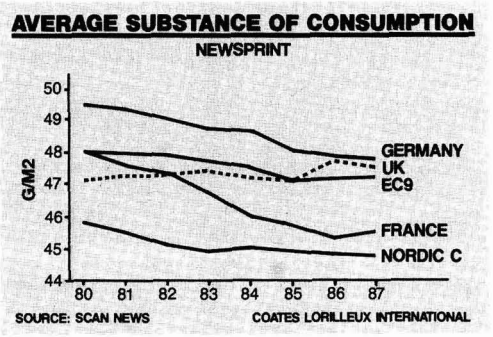
The cleaner sharper printing in 4-colour work must be good news for the printer trying to encourage the advertiser to advertise in his paper.

The raw material cost of these vegetable oil colours are higher than mineral oil based grades, but not significantly so. It is difficult to pin-point a figure due to fluctuating prices of the vegetable oils themselves.

Work on black is also proceeding but here the oil makes a much higher RMC contribution than in the colours and therefore the cost penalties here are higher.

However, an accurate assessment of its overall print quality benefits is necessary to see if they outweigh cost disadvantages.

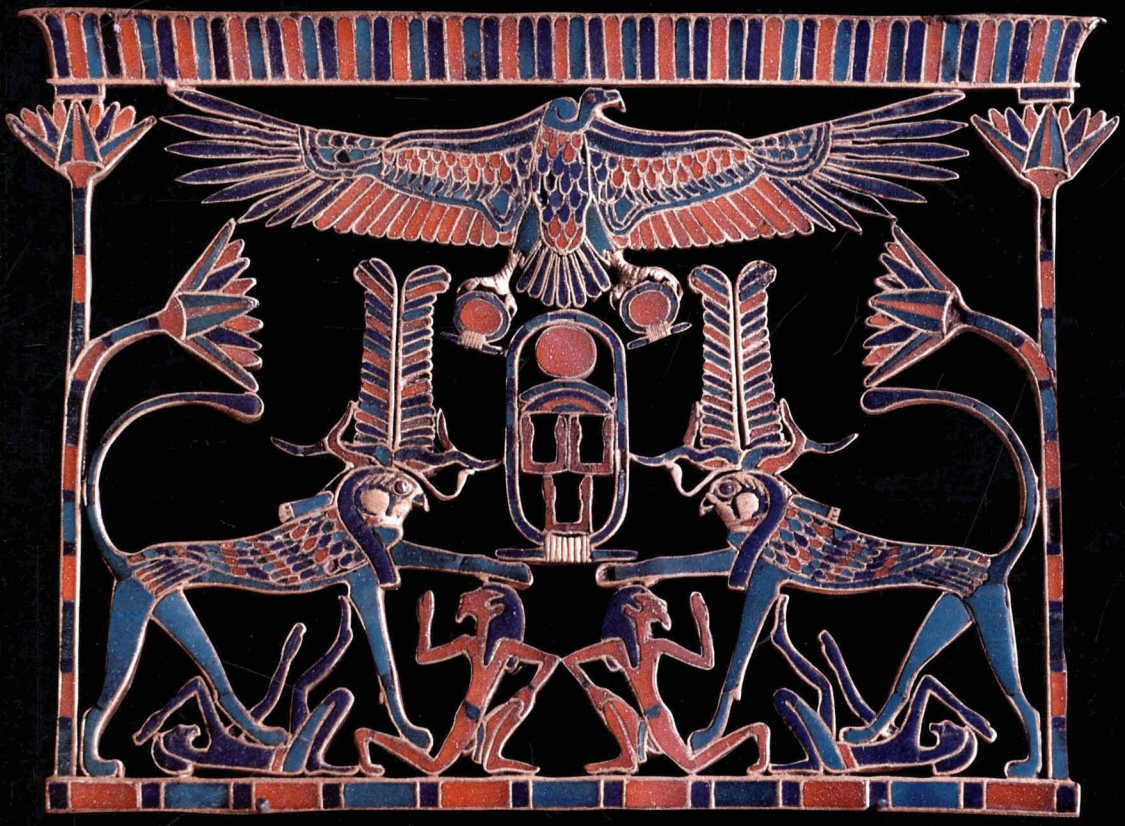
Figure 5



8. Conclusion

I have tried in this paper to show you just how important a role the inkmaker has to play in newspaper printing, and how this role is becoming more technically sophisticated as the demands placed by presses; printers and publishers alike increases. What is absolutely clear to me is that we the inkmaker, cannot work in isolation. What is also clear is that there has been and will continue to be a radical change in view by our customers about what the inkmaker has to do to achieve optimum printability on the new generation presses. It's no longer a simple case of "bucket" chemistry. — News ink technology in Europe is reaching the degree of sophistication of its more established offset litho brothers "heatset" and "sheetfed commercial and packaging", and will continue to develop with them. ■

Paper presented at the Pacific Area Newspaper Publishers Association Conference at Hobart, Tasmania on 12 May 1989.



From the History of Binders: Egypt

Binders can look back on a long tradition. Very early on, Man succeeded in producing the first adhesive raw materials and substances from whatever he found at hand. Even thousands of years ago, the Egyptians were able to stick objects together by processing asphalt to form different types of glue.

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  RE 530 Z, RI 538 Z,
  RE 543 Z, RE 545 Z,
  RE 546 Z and RI 551 Z

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Printing inks for the '90s

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Summary

Developing ink technology is a continuous process, keeping pace with press design and substrate changes. Environmentally friendly products are also being developed.

The article discusses general developments which are taking place in various printing ink applications.

Computerised technology is helping both the printing industry and the ink makers to produce prints of infinite design and variety, consistently and of high quality. The art and science of the ink maker though is still required to develop new inks, formulate new ideas and solve the day to day ink queries, all computer unaided.

Generally speaking computerised colour matching has benefited the ink industry by efficient use of base colours, improving the ease of achieving the correct shade and producing less waste. The wide range of substrates used, particularly in the flexo/gravure area however, has given many problems, some of which remain to be resolved. Producing databases for specific substrates is one solution and gradually this approach is gaining acceptance. Compared to the dyeing and paint industries, computerised colour matching in our industry is still in its infancy.

Developments in inks continue to keep up with press designs and significant progress in being made in some areas worthy of comment.

Today *heat set web offset inks* print at much higher press speeds than two years ago, achieving 2000+ fpm with 2500 fpm inevitably predicted for the future. The choice of the resin/solvent combination is critical in order to achieve the balance of ink stability on the press rollers, drying and low solvent retention in the print, whilst still achieving rapid ink-water equilibrium. The latter is essential to reduce paper wastage and significantly effects dot sharpness.

With pre-press conditions now highly computerised, dot sharpness at the final printing stage is predictable, but very substrate dependent.

Improving dot sharpness is part of the art of ink formulation, and developments in fount solution technology are closely interrelated with those of the ink vehicle technology.

The retention of solvent in a print can lead to problems at the collating end of the web press. Increasing the web temperature to reduce retained solvent, is not the simple answer because of paper ripple effects (fluting) while reducing web temperature increases solvent retention in the print.

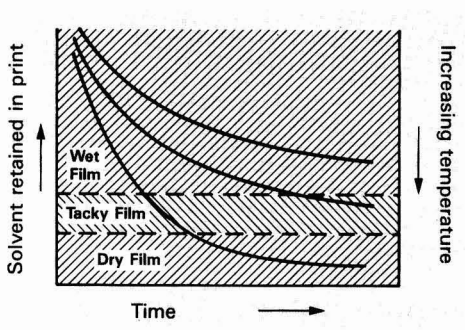
The balance required can be summarised in Figure 1 where the state of the ink film is given.

The use of lower aromatic and lower odour distillate solvents in formulations together with significant reduction in effluent from the printing process are helping the environment we live in. The industry is well aware of the social implications and developments taking place in this area.

The wide range of substrates used today means that ink development is a continuous process.

The printing of newspapers has undergone significant change in the past few years. The *web offset cold set process* has expanded and the use of letterpress printing has declined. A dramatic increase in 4 colour process printing has taken place and ink technology has also changed to meet the challenges.

Figure 1



As with heat set printing, cold set printing is done at high press speeds, with high quality of colour reproduction being of prime importance. Development of formulations which give sharp dot reproduction with reduced ink fly (misting) has been achieved. At the same time low rub inks, particularly for the black, have been developed to meet marketing pressures and further progress is likely to be achieved in this area.

Water containing inks are now also being used in the UK for the direct flexographic printing of newspapers. Here too improvements in print quality and rub resistance over conventional letterpress printing are being achieved.

The developments in inks for the sheetfed offset market are divided into two areas, for conventional and for UV curing inks. The use of overnight duct fresh inks is increasing. Here the conventional ink remains basically unoxidised in the duct overnight, enabling the printer to start printing next morning without cleaning up the previous evening. Nevertheless the inks are expected to reach a tack free stage quickly on printing. Developments in resin technology have enabled the formulator to produce very fast setting inks which print at high speeds with excellent printability. Many of the newer presses are fitted with infra-red driers and ink formulations can be modified to respond to this form of drying.

Developments in carton inks have also benefited from new resin technology, producing printed designs with very low odour and taint properties while the use of water emulsion varnishes, wet on wet, continues to expand with high gloss and good slip, being the properties most in demand.

The use of UV inks in offset printing is a continually expanding market and is discussed below.

The letterpress label market is producing interesting formulation developments in both the thermal paper and UV printing (mainly vinyl) areas. In the former case, water resistance and ease of thermal imaging are very important while on impervious substrates adhesion and gloss are the most significant properties. Again these are discussed below.

Radiation curing inks

Currently the primary use for radiation curing ink is in the offset printed packaging area. Despite the higher ink cost, the overall advantages for using UV ink, together with

anticipated improvements in the press performance of the vehicles, should ensure a steady growth in this area.

Recently developed novel resins, together with water compatible vehicles are pre-emptive of the possible future expansion of radiation curable systems in flexo and gravure printing. Already high performance, fast curing systems, allow radiation curing products to be used in reel to reel letterpress and offset printing technology. A substantial amount of label printing is carried out by this means. At present product performance does not meet the standards which would allow UV curable ink to gain a foothold in the web offset market.

Turning to more speciality areas, UV radiation is an ideal energy source to initiate cure of inks on, heat sensitive plastic substrates. Improvements in adhesion are still sought, but potential usage in, for example, rigid packaging, labelling, and security card printing are considerable. More speculative, future application may be cited for example, UV induced polymerisation might be used as the means of ink curing in the production of instant hard copy for electronic photography.

Radiation sources

The medium pressure mercury lamp should continue to be the dominant source of radiation for effecting photochemical polymerisation. Doping this type of lamp with various transition metals can change the emission spectrum. The possibility thus exists to enhance output in regions specific to the initiator absorption bands. Currently this approach to source improvements is hampered by a reduction in lamp life. Electron beam sources at present have found very limited application in the printing industry. Despite the advantages of using photoinitiator free formulations this technology will require a reduction in capital cost of the beam generator before it can become a common means of curing inks. Gamma radiation may play an important role in future food and food packaging sterilization. Source screening and equipment cost are likely to prevent this technology being used to initiate ink curing generally in the printing industry, nevertheless possibilities may exist, for example, to print and cure indicator labelling in-line with sterilization.

Resin and monomer

Radiation curable inks have predominantly been formulated on resins and monomers containing acrylic unsaturation. It is unlikely that the acrylated group will be displaced from its position as the only species which undergoes free radical polymerisation at a rate appropriate to printing applications. Future trends in acrylate resin technology must be towards products which give improved press performance and print quality.

Some water reducible and emulsified acrylated resins have become available in the past few years. While water as a viscosity reducer has the desirable properties of being cheap, environmentally safe and free from odour, the resin components are often expensive, have comparatively poor film forming properties and may impart unacceptable level of residual odour to the cured print.

Photoinitiators

Innovation is still producing a steady supply of new potential UV curing initiator compounds. The ideal compound provides effective initiation at low concentration while being safe, colourless and odourless. The majority of products induce free radical polymerisation in acrylated resin systems. A few of the more recently developed initiators provide for the photochemical generation of cations and have been used to induce chain polymerisation in inks containing vehicles formulated from resins containing the epoxide functional group.

Developments in flexo-gravure inks

The development and improvement of novel ink systems is heavily dependent on market trends and demands. This was seen in the 1970s with the advent of heat resistant inks on coextruded polypropylene films and also in the introduction of the cold seal confectionery wrapper. In the 1980s the trend has been to produce inks free from potentially hazardous materials. Pigment and solvent selection particularly have been closely monitored.

Although stringent anti-emission legislation has been in force in the United States for the past twenty years, Europe has been slow to implement similar laws. To a large extent this has been due to a lack of legislative pressure and also to the potential cost of installing the necessary equipment. Today, however, the consumer public has become aware of their deteriorating environment and are now actively seeking to defend it. Consumer power has rapidly reduced the use of CFC's in aerosol propellants and we can expect the weight of public opinion to focus on a number of possible causes for the destruction of the ozone layer. The burning of fossil fuels is currently being scrutinized and since the solvent constituents of flexographic and gravure inks are mainly derived from fossil fuels a question mark will undoubtedly hang over these products.

If we examine a typical modified nitrocellulose ink for printing paper.

Organic pigment	11
Damped Nitrocellulose Resin	20
Gum Resin	5
Plasticizer	5
Wax	1
Solvent	58
	100

the major constituent part is normally solvent. Before printing, the product is reduced with more solvent to an application viscosity. This results in a duct solution often containing over 80% of volatile material which must be removed from the printed material.

Traditionally this volatile component has been exhausted via chimney stacks into the atmosphere. Whereas previously the public were concerned only when directly affected by the emission, now the concern is on the indirect effects of the emission.

The printer is therefore faced with three options:

1. To recover and recycle the volatile components

This process is both expensive and is not as straightforward as would first appear. There is not currently a sufficiently large enough market to cater for the potential volume of recovered solvent.

2. To recover and dispose of the volatile component

Recovery of the solvent is expensive and disposal of waste material adds to the cost. Restrictions on disposal procedure whilst being morally correct, have added to the printers problems. Incineration provides a partial answer to the disposal problems but is extremely costly.

3. To change to a solventless printing system

Solventless systems are not new but they have traditionally tended to be comparatively more expensive or require additional equipment to be installed on the printing press. This has resulted in solventless systems only being used where an otherwise unobtainable functional property is required, eg high gloss varnish requirements on paper-foil-polythene laminates for various powdered food products.

However we believe that as increased legislative pressure and increased insurance premiums for handling inks containing flammable volatiles are imposed, the printer will be forced to consider this option as a viable and economic alternative to solvent based systems.

Solventless systems can be in one of the following forms:

a) 100% solids system eg 2 pack curing systems

b) A cross linking or curing system where the carrier "solvent" becomes integrally bound in the final coating, eg UV initiated systems.

c) A water based system where the volatile flammable solvents are replaced with our most abundant raw material.

Traditionally water-borne coatings have been viewed as suitable only for the cheap end of the printed market, eg paper sacks or kraft liners. Their use has been further restricted by the increased energy required to remove the water from the vehicle. Table 1 shows the relative evaporation rates and latent heats of vaporisation of commonly used solvents.

Table 1

Solvent	Evaporation time in seconds for 1 cc	Latent heat of vaporisation J/kg (15°C)
Water	1102	2449
Ethanol	240	864
Toluene	180	416
MEK	100	427
Ethyl Acetate	85	432

Clearly more energy is required for the removal of water from a coating, however, recent developments in infrared and radio frequency driers have increased the efficiency and rate of water vaporisation, which has led to increased press speeds. However, the use of this type of drier has imposed limitations on certain shades, ie blacks and metallics.

Other criticisms levelled against water based coatings are that they exhibit inferior gloss and printability compared to solvent based products. These criticisms were true but the continual development of improved water based resins by the resin manufacturer is lessening the disparity between the two types of system.

If we look at the various areas where water based products are used we may be surprised to find that these products have been printed or trialled on most commercial printing substrates. In addition to the traditionally printed stocks: coated and uncoated papers, kraft liners and label papers, many interesting applications have been made.

Pre-print and post print

The print quality required from corrugated cases has increased greatly in recent years, changing this type of packing from a warehouse container to a point of sale commodity. At the 1988 EFTA print awards a flexo pre-print liner used on a display case for the Black & Decker GX mower won the Stanley Blackledge "Best in Show" trophy. Developments in resin vehicles and printing presses have made higher quality possible.

Newspapers

Newsprint has been printed with flexo water based inks at 700-800 m/min and whilst not reproducing the excellent dot quality of web offset, nevertheless provides an acceptable quality. Make ready time is reduced and less wastage achieved. Newspapers with short circulations or which require several editions are particularly suited for this type of ink.

Wallcoverings

For a number of years high quality clay coated papers have been printed with high fastness water based inks to produce spongeable wallpapers. Today we are also seeing vinyl wallcoverings being printed with waterbased inks in combination with a solvent based overprint lacquer. The lacquer is still required to give adhesive resistance and good heat embossing.

PVC floor tiles

Water based inks have been used to print PVC floor tiles which have a subsequent PVC extrusion coating applied.

High and low pressure laminates

Water based products have been used for some time in high pressure "work surface" laminates and in conjunction with a cross-linking overlacquer for paper furniture foil printing.

Polyethylene

Water based coatings have been applied to both LDPE and HDPE films. Good quality half tone work is possible and the goal of the excellent quality obtained from a solvent based polyamide system is getting ever nearer.

Future applications

With the development of increased efficiency driers the possibilities of printing aluminium foils and plastic films with waterbased inks are increasing. Film laminating systems offer not only ecological advantages but laminates with lower retained solvent levels. ■

Tall oil rosin derivatives for printing inks

by H. Alalauri and M. Luttinen, Veitsiluoto Oy Chemical Division, P.O. Box 196, SF-90101 OULU, Finland

Abstract

During 1988 about 390,000 metric tons of crude tall oil were distilled in Europe out of which roughly 100,000 - 120,000 metric tons of tall oil rosin (TOR) were obtained. this renewable raw material is becoming more important in the production of printing ink resins. Reasons for this are good availability and the chemical structure of rosin which gives possibilities for several modifications. In the experimental part of this paper comparison will be made between gum rosin and tall oil rosin in sheet fed offset inks.

Origin and applications of rosin

Rosin is still today obtained from three different sources: gum rosin is collected by tapping living pine trees, wood rosin is obtained by solvent extraction from old pine stumps and tall oil rosin is a by-product of the sulphate pulp process (Figure 1).

We estimate that during 1988 about 390,000 metric tons of crude tall oil were distilled in Europe and about 100,000 - 120,000 metric tons of tall oil rosin were obtained.

The most important use for tall oil rosin has been in paper size production but nowadays TOR derivatives are widely used in adhesives, surface coatings, polymerisation emulsifiers and more and more in printing ink resins.

Basic rosin chemistry

When we take a look at the structure of the abietic acid molecule (Figure 2) we notice two reactive sites: carboxyl acid function and conjugated double bonds. These groups are used to modify tall oil rosin.

Reaction of resin acid with:

- ☐ alcohols

gives resin esters which are mainly used as adhesive tackifiers.

- ☐ metal oxides

gives resinates which are used in gravure printing inks.

- ☐ maleic anhydride

forms maleic adduct which can be used in flexographic inks.

- ☐ ammonia

gives possibilities for amide production.

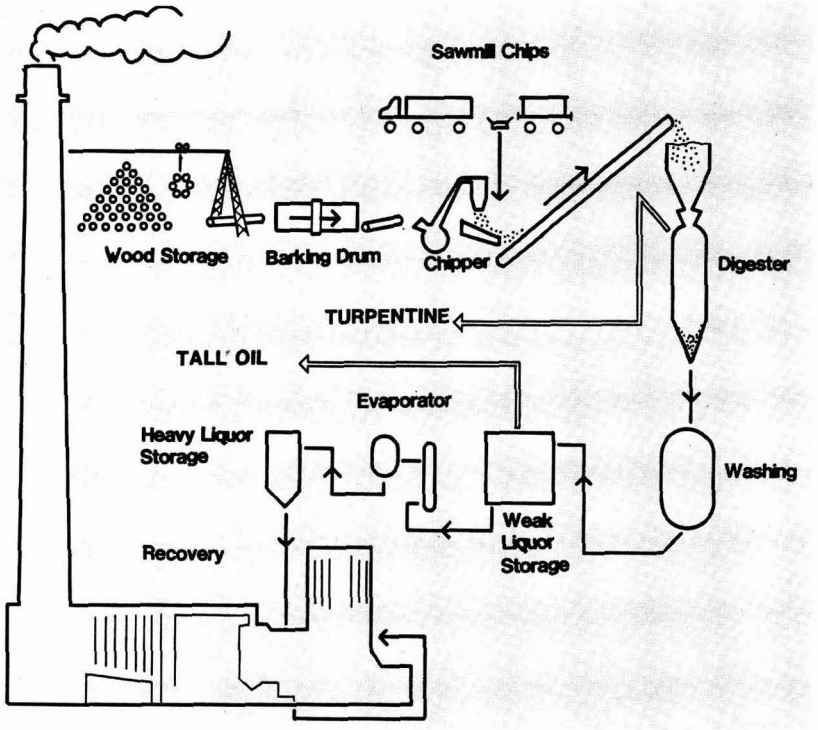
Through conjugated double bonds:

- ☐ dimerization or polymerisation can occur
- ☐ hydrogenation can take place

The reaction between rosin and phenolic resin has not been fully elucidated. According to Dr Oldring it is believed to occur between the double bond of rosin acid and the methylol group of the phenolic resin (Figure 3)[1].

After esterification of the resin acids these rosin modified phenolic resins find use especially in offset printing inks.

Figure 1
Tall oil recovery

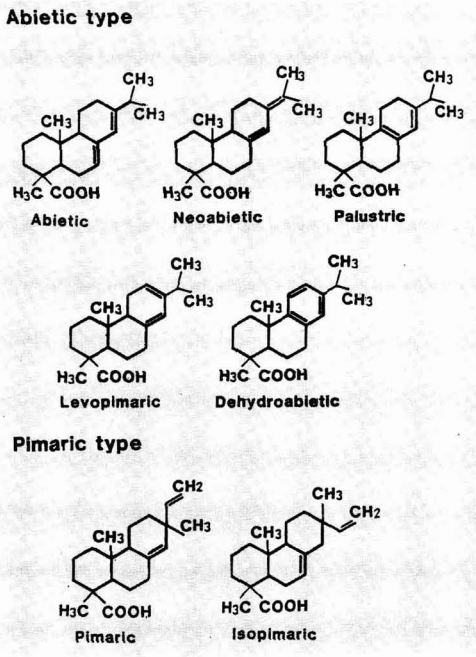


Composition of various rosins

Rosin is composed of abietic type and pimaric type resin acids (Figure 2). Typically there are differences in the composition between gum rosin and tall oil rosin but also differences in distilling technology may cause changes in the resin acid composition. Table 1 illustrates this. It shows that with the latest technology more uniform rosin can be produced. This is reflected also in the physical properties. For example softening point, colour, resin acid content with low fatty acid content of OULU 331H© makes it ideal as a starting rosin for printing ink resins.

The physical properties of various rosins are collected in the Table 2.

Figure 2



Experimental

The aim of this study was to compare tall oil rosin (A) and gum rosin (B) as starting materials for sheet fed offset ink resin preparation. Resins were prepared by using the processing expertise of Veitsiluoto Oy. After the resin preparation inks were made using the same formulation. We used as a reference commercial rosin modified phenolic resin (C) which is claimed to be gum rosin based and also in test prints commercial sheet fed ink (D) which is claimed to give high gloss.

The physical properties of rosin modified phenolic resins A, B and C are shown in Table 3.

Varnishes were prepared by using resins A, B and C together with linseed oil based alkyd, mineral oil (boiling point 280-310°C) and a gelling agent.

The viscosity of each varnish was adjusted to 250-300 Pa.s.

After viscosity adjustment of the varnishes, sheet fed printing inks were prepared according to formulation which is shown in Table 4.

IGT prints of each ink were prepared and the properties of inks A, B, C and D are summarised in the Table 5.

Each ink was further tested on a Roland Favorit pilot sheet fed printing machine (speed 5500 c/h). We followed closely the density, gloss, oxidation time and penetration of the ink film. The results are summarised in Table 6.

Results

As shown in Table 3 there are no remarkable differences in the physical properties of gum rosin based rosin modified phenolics B and C if compared to our tall oil rosin based resin A. At this stage it appeared that each resin could be used in sheet fed ink preparation.

In the final inks, resins A, C and D gave comparable results but we had problems with the gum rosin based resin B. Short flow together with high viscosity and high yield value in the case of resin B indicates poor solvent compatibility. In the IGT prints this gives poor gloss. In the case of resin A which is tall oil based very high gloss and good solvent compatibility was noticed. It was also quite easy to prepare ink by using resin C which was claimed to be gum rosin based commercial resin for sheet fed inks. However gloss in IGT print as well as on the test print was poorer. Also the oxidation time was found to be remarkably longer with resin C than with the others.

Figure 3

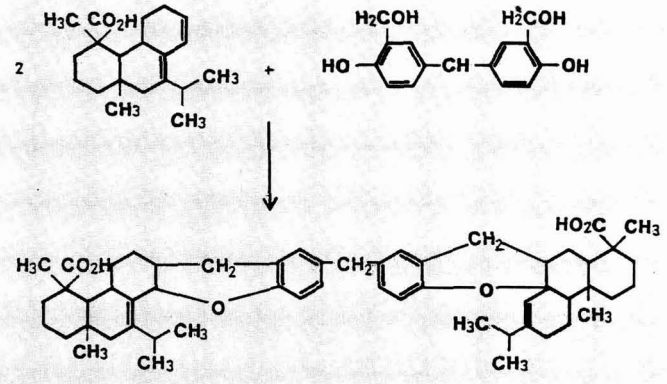


Table 1
Resin acid composition in various rosins

%	TOR OULU 331	TOR OULU 331H	TOR OULU 331H 1989-	Chinese Gum Rosin	Portuguese Gum Rosin
Abietic	38	42	45	45	32
Dehyroabietic	21	21	20	4	7
Neoabietic	4	4	5	13	17
Palustric	6	12	15	18	20
Isopimaric	3	3	3	1	4
Pimaric	2	1	1	7	10

Table 2
Properties of various rosins

	TOR OULU 331	TOR OULU 331H	TOR OULU 331H 1989-	Chinese Gum Rosin	Portuguese Gum Rosin
Acid Number (mgKOH/g	168	173	173	170	174
Softening Point (dC)	64	70-75	75-80	70	75
Colour (USDA rosin scale)	X-WG	XA-WW	XC-XA	X-WW	WW
Resin Acids (%)	87	90	95	92	93
Fatty Acids (%)	5	3.5	0.5-2	0	0
Unsaponifiables	5-6	4.5	<3	6	4.5

Table 3

Properties	Resin A	Resin B	Resin C
Colour (Gardner)	10-11	10-11	10-11
Softening Point (°C, R&B)	145	150	140-150
Acid Number (mg KOH/g)	<25	<25	<30
Viscosity (mPas, 25°C, 50% resin in toluene)	590	1655	1925
MOT* (ml, 50% resin in toluene)			
PKWF 4/7 af new	25	21	23
PKWF 28/30	20	30	21

* M.O.T. = Mineral oil tolerance, measured by titrating 10g of 50% solution of the resin in toluene at 20°C until the solution becomes hazy

Table 4
Ink formulation

Antioxidant	0.3
Alkyd resin	4.0
Linseed oil	1.0
Pigment	18.0
PE Wax	2.0
Mineral oil	4.7
Driers	2.0
Varnish	68.0
	100.0

Table 5

Ink	Viscosity (P)	Yield Value (dyne/cm^2)	Flow (mm)	Tack Stability	Gloss D=1.5/D=2.0
A	151.9	3137	33/43	170-210	18.2/28.4
B	464.3	7885	10/15	90-110	-8.2/-2.6
C	181.8	2386	33/45	136-156	3.8/14.6
D	311.9	2921	15/19	202-254	17.6/20.8

Viscosity and Yield Value measured by Laray viscometer, 25°C
Flow angle 45°, room temperature
Tack measured by Tack-o-Scope, 200 m/min, 10 min, 25°C
Gloss measured by Byk gloss meter, angle 60°
Density measured by Macbeth RT 918

Table 6

Ink	Density	Gloss	Oxidation Time	Penetration of the Ink Film
A	1.09	45.0	2 h	0.14/24 h
B	1.18	27.7	2 h 30 min	0.14-24 h
C	1.03	41.8	> 3 h	0.17/24 h
D	1.11	42.8	2 h 45 min	0.17/24 h

Conclusions

If compared to the reference ink we can say that tall oil rosin can be used in sheet fed printing ink applications when it is properly modified. The nature of the starting rosin seems to have a great effect upon the final performance although the differences in the physical properties between resins are small. In the case of gum and tall oil rosin this may be due to different resin acid composition or due to differences in the amount of unsaponifiables and fatty acids. After this test we can not yet specify the reason for the different performance.

In future more and more tall oil rosin will be used in printing inks because with the novel distilling technology purer rosin will be obtained. This gives possibilities to further improve the quality of tall oil based resins and keep their quality uniform.

References

1. Oldring, P. and Hayward, G., "Resins for surface coatings", vol. 1, *SITA Technology*, London, 1989, p.100. ■

Paper presented to OCCA London Section on 19 January 1989.

Prospects and problems in printing ink technology

by G. H. Hutchinson *, Consultant, Croda International Plc

Printing ink technology has kept pace with the growth and technical progress of the printing and packaging industries worldwide. Press speeds have increased to meet the requirements of a diversity of substrates — paper, board, plastic films, foils and metals. All this has placed more exacting demands on the inks. There have been constraints brought about by uncertainties in the economics of ink materials, the impact of health and safety legislation and the growing attention to environmental pollution problems. How is the ink manufacturer coping with these restrictions and how will they effect future progress?

Some trends in ink manufacture

The need to reduce manufacturing costs in a highly competitive market worldwide has influenced development priorities. Thus in paste ink manufacture there has been emphasis on improving pigment dispersion techniques through the use of easier to disperse pigments, novel dispersing agents and flushed pigments. Of more significance has been the use of improved methods of paste and liquid inks manufacture at the pre-mixing, milling and refining stages. For paste inks this has involved, for example, pre-mixing under vacuum followed by the use of high energy bead mills to replace, in part, the triple-roll milling stages.

Automatic canning of finished products is now more frequently practised. For liquid inks manufacture, various types of bead mill are available to help improve gloss and printability properties, although chips and chip dispersions have dominated the formulations of high quality inks for flexible packaging substrates. More attention is being given to streamlining storage and handling of raw materials and for bulk ink manufacture, automated and semi-automated plant is now of greater interest.

Helping the printer to exercise maximum economy and efficiency in the use of materials and energy is a continuing theme. Examples are colour concentrates of liquid inks supplied in bulk tanks for in-plant blending with the appropriate varnishes, solvents and additives to suit the particular printing requirement. Paste ink colour matching systems such as Pantone and ink makers colour finder ranges can help the printer to match a particular shade without the expense of purchasing a special matching.

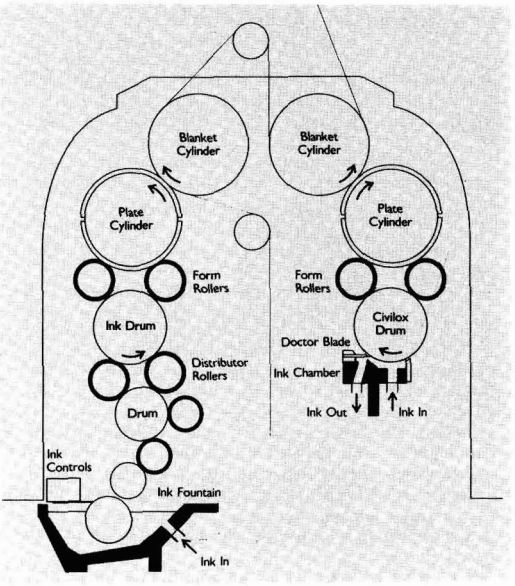
Developments in inks and some outstanding problems

Newspaper printing

Traditionally this field used letterpress inks, essentially carbon black and mineral oil dispersions, for rotary presses printing, for example, the large circulation daily newspapers. In the UK, there has been a trend towards a more extensive use of web offset lithographic printing that was started some thirty years ago for small circulation newspapers. This process is now being used to print an increasing amount of 4-Colour process work in daily newspapers. The quality of rotary letterpress printing is improved through the introduction of photopolymer relief plates. A significant development of the early 1980's has been the so-called keyless inking system in which the conventional letterpress machine is modified by the reduction of the ink roller train and the insertion of an indirect anilox system (Figure 1). Reduced waste, less power requirement, less noise and the reduction of ink misting are advantages claimed for this process. The flexographic printing of newspapers (Figure 2) is another relatively new trend.

Figure 1

Conventional inking system (left side): Civilox™ inking system (right side) (with acknowledgement to Crabtree Vickers, Leeds, England).



Concerning progress in the inks, the field of cold-set web offset lithographic inks is well developed. Like rotary letterpress inks they dry rapidly, without the aid of heat, by absorption into the open porous structure of newsprint. Cost is a very important consideration which limits the choice of vehicle components although the process colours depend on relatively high priced organic pigments. Process mineral oils are used in large proportion to facilitate penetration "setting" along with petrochemical derived hydrocarbon resins which aid pigment wetting and lithographic properties. Rheological control is paramount as the relatively low viscosity ink has to be distributed by a roller train rotating at high speed and high shear.

There is considerable scope for development in inks for the indirect anilox and direct (flexographic) anilox process. Reducing the roller train in the former process suggests that different formulation techniques could be adopted e.g. use of water-based inks.

For some years emulsion inks in which water is incorporated in the internal phase in a predominantly carbon black and mineral oil dispersion have been investigated and used. Emulsion inks containing ca.20% water have been printed successfully on conventional rotary letterpress

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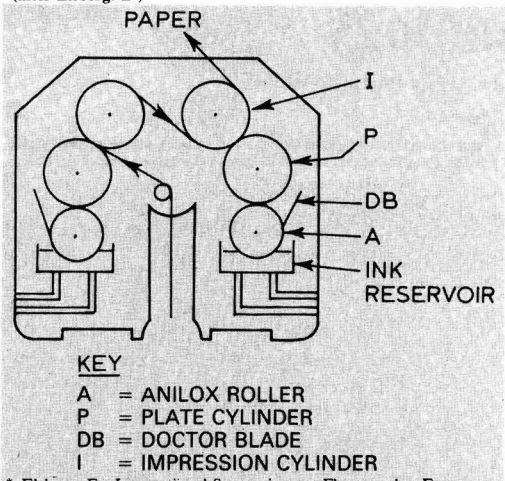
Figure 2

Direct Anilox inking system, flexographic printing of newspapers (after Elsberg. E*)



* Elsberg, E., International Symposium on Flexography, European Flexographic Technical Association, Birmingham, England (February) 1984, 10:1 to 10:11

machines. Advantages of these inks were the reduced print-through and less ink rub-off. On indirect anilox systems these advantages are combined with the elimination of ink misting problems, less paper waste, less noise and reduced power consumption. The reduced roller train would imply that higher water content inks could be used. This is true but control of emulsion droplet size and stability is more difficult as the water content increases. The direct anilox process would appear to be an outlet for suitably modified water-based flexographic inks, the technology of which is well advanced for corrugated box printing. In fact, the quality of 4-Colour printing of water-based inks considering the rough and porous nature of newsprint looks remarkably good and the level of rub-resistance obtainable is excellent. Unfortunately the problems inherent in the water-based news inks that were investigated in the early 1960's, namely, premature ink drying on the machine and second impression "set-off" have not been entirely solved, but attention to machinery design is helping to overcome some of these problems. An advantage of conventional oil-based inks is their ability to cope with paper dust whereas the interaction of dust and debris with the water systems can create linting problems. Print quality is adversely affected. Photopolymer plates are being continually investigated for suitability of printing with water-based ink systems.

Offset lithographic printing sheet-fed processes

Presses have increased in productive capacity now up to a delivery of some 15,000 printed sheets per hour. Over the past thirty years a constant aim in printing has been to reduce or eliminate spray powder usage. Here a stream of fine starch particles is projected onto the wet print as the sheet is delivered to the pile. This prevents the printed ink film from "setting off" (marking or sticking to the underside of the sheet above it in the pile).

Spray powder in the printed surface gives it a rough appearance and can adversely affect subsequent overprinting and lamination processing. In carton printing the worst manifestation of excess spray powder application is the sandpaper character of the print surface which can cause severe "rub-off" problems in handling and transit of the packages. Spray powder can also contaminate the press-room environment. To meet the high speed requirement in a 4-Colour process, with the minimum or zero spray powder application, means the superimposed ink films have to set to a smudge free condition almost immediately after printing impression and then dry by final autoxidation polymerisation without any intervening "sticky" stage or surface tackiness. Offset lithographic ink vehicles utilise high melting synthetic resins and modified drying oil polymers dissolved in high boiling petroleum distillate. Controlled amounts of organic aluminium compounds may be used to increase molecular complexity of the resinous component and induce desired rheological changes. Hard resins have progressed to the availability of types suitable for cold-cut or high temperature varnish preparation-yielding the fast setting properties combined with the essential gloss promoting properties. Improvements in organic pigments and pigment preparations have been towards obtaining maximum colour strength from pigment and vehicle dispersions. If this allows the minimum possible film-weight of ink to be applied without detracting from print gloss and print quality there are less likely to be problems of "set-off" or sheets sticking in the pile. Of course, for a high quality result the china clay coating of the paper or board must have high smoothness and freedom from imperfections and also adequate but not too much absorbency, to aid the penetration phase of the ink drying mechanism. Developments in offset lithographic ink technology, outstanding problems and likely future trends have been discussed in a previous review[1]. Another aid to higher productivity is to produce inks that do not oxidise (skin) in a partially filled container or in the machine duct during a working shift. Here the balancing of the activity of the driers with the antioxidant is important. Another approach in the quest to eliminate spray powder is the use of heat to accelerate drying of conventional quick-setting gloss inks by means of short to medium wave-length Infra-Red heating modules that are inserted in the delivery of the press.

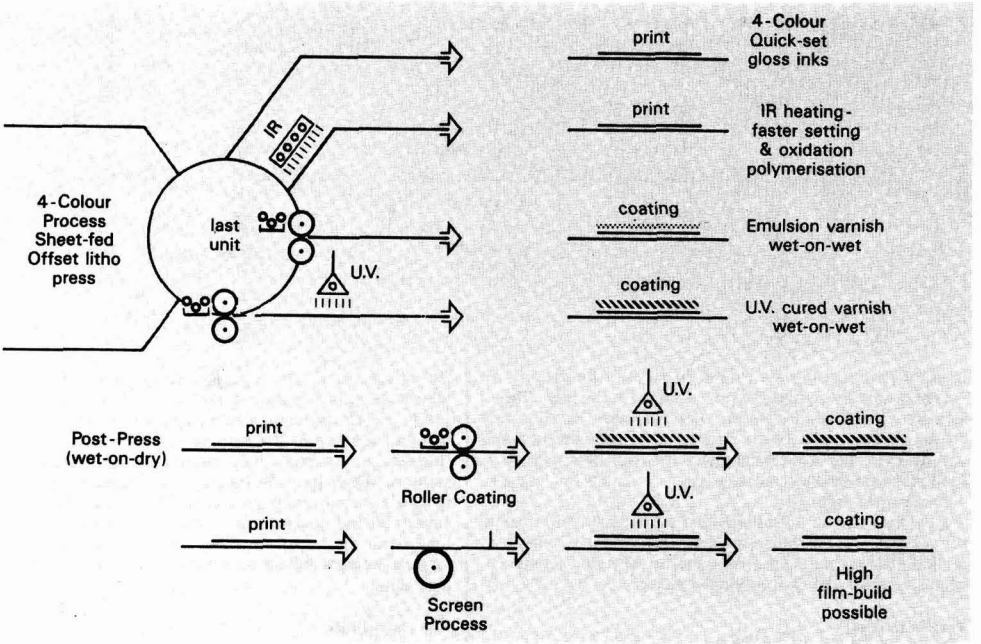
Application of water-based emulsion varnishes, wet-on-wet over freshly printed offset lithographic ink films has been an increasing trend especially in carton printing. The emulsion varnish dries rapidly, sealing the print, while the underlying ink films can still dry by autoxidation when the sheet is in the pile. Complete elimination of spray powder should be possible with added benefits of print protection and gloss enhancement.

The varnish coating units may be fitted to replace the last printing unit of a multi-colour press, or after the last unit. Coating units of the various types available can also be used to apply Ultra-Violet curable varnishes, (wet-on-wet or wet-on-dry) over the lithographic printed sheets. Post-press operations for the application of UV varnishes over the fully dried printed sheets, involve roller-coating devices and screen printing process. The finish obtainable in these operations, can approach that of film lamination.

Figure 3 outlines some of the approaches discussed above and a number of aspects need careful study by the ink manufacturer. In certain circumstances, wax compounds used in inks to impart "slip" properties and abrasion resistance, may cause refusal problems in subsequent varnishing or the varnish may not key to the underlying ink films. In wet-on-dry varnishing, trace volatile oxidative degradation products (aldehydes, ketones, alcohols, etc) from the ink films can cause refusal of overprinting UV curable varnishes. So can the exudation of trace hydrocarbon solvent components from the ink films.

Infra-red heating can induce certain types of wax component of the ink films to migrate to the surface in such a manner as to inhibit the receptivity of the overprinting varnish. Information for determining the receptivity of substrates (printed and unprinted) can be obtained through the use of the critical surface tension concept[2]. In this

Figure 3
Sheet fed offset lithographic printing (In-line and post-press techniques)



connection the use of a droplet technique for the measurement of contact angles was discussed in the previous review[1]. Some further information on this technique is given in the Appendix.

Heatset web offset inks

The latest web presses for printing 4-Colour heatset web offset lithographic inks can achieve web speeds of ca.2000 feet per minute. Inks based on a high melting resins dissolved in close-cut high boiling petroleum fractions (230-250°C, 250-270°C etc.) are formulated to dry at the lowest practicable web temperatures to conserve energy and improve print quality.

The use in the inks of "low pollution" solvents of reduced aromaticity has been one trend. On anti-pollution measures, heat set web installations may incorporate units to incinerate solvent vapour from the drying oven exhaust, by thermal or catalytic oxidation. For thermal combustion, energy saving at the burner could be through the use of a pre-heat exchanger to raise the temperature of the exhaust gases, prior to their incineration.

A recent development is to install a UV varnish coating unit and associated UV curing unit on a heat set web offset press (Figure 4). This may be sited between the chill rolls and the folder or after the folder and before the sheeter. The high gloss finish obtained with UV curable coatings is a feature. this is useful for magazine covers and the coating gives added protection against rubbing or smearing. As with the overprinting of sheet fed offset lithographic ink films, due account should be taken of the fact that conventional heat set inks are of an entirely different chemistry to that of overprinting UV curable coatings.

Ultra-Violet curable inks and varnishes

This field constitutes a major advance in printing ink technology. UV inks are now used in sheet and web fed lithographic and letterpress printing and screen printing processes. Applications include self-adhesive labels, paper wrappers, carton boards, metallic foils, plastics and metal decoration. One major field for UV inks has been the printing of food and confectionery wrappers and cartons. The choice of the vehicle-acrylated monomers and oligomers etc. and photoinitiators takes into account the need for the lowest odour materials. Conventional oxidation drying inks are prone to evolve autoxidative degradation products which can contaminate the wrapped food or confectionery product. No such mechanism is operative with the UV inks.

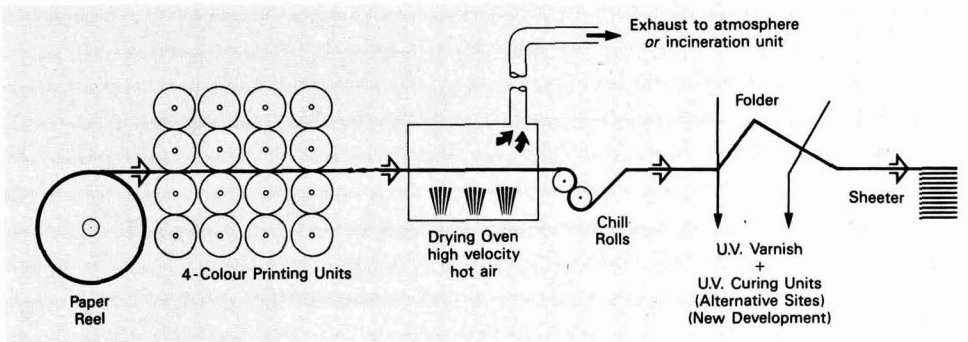
Electron Beam Curing processes use inks of a similar chemistry to that of UV curing inks but no photoinitiator is needed. The EBC equipment is very expensive, so the investment will take into consideration the productivity level required in a web printing operation. It will surely be a technique of increasing interest in the future. The relatively high cost of UV curing inks is still a barrier to their more extensive use. Nevertheless there is continuing growth. For inks and coatings applications, research is active on new and improved acrylated compounds and in the field of photoinitiators and related materials.

Liquid inks

Flexographic and gravure inks find extensive outlets in the printing of a wide variety of packaging substrates. It would be impossible, in a general review to cover all the significant developments but aspects dealing with problems of odour in packaging, environmental pollution issues and progress in the field of water-based inks are of current interest. The comprehensive range of synthetic resins and organic solvents that can be used in flexographic and gravure inks contrasts with the limited range available for offset lithographic and letterpress inks. Paste inks have to be distributed by a long

Figure 4

Heat-set web-offset press



train of rotating rubber rollers hence the limitations on volatility and strength of the solvents used in the inks. Liquid inks dry principally by solvent evaporation. The choice of colourant, resin and solvent is dictated by the substrate and end-uses (carton board, film and foil; soap, detergent, fats, food and confectionery packaging.)

Some trends are:

Developments in polyolefine and other plastic films called for inks with a combination of properties-gloss, adhesion, crinkle and tape resistance, wet and dry abrasion resistance, product, water and deep freeze resistance.

Trends in media

Nitrocellulose resin dissolved in predominantly alcohol solvent is a versatile film-former.

Polyamide resins for adhesion of inks to a range of plastic films.

New systems were needed for co-extruded polypropylene film used for snack food packaging. Gloss inks with grease and heat-resistance (sealing over the print area). Two-component systems for the best combination of film-forming properties but the pot-life is limited and solvents have strong odour.

Polyamide-based inks had insufficient heat-resistance.

Nitrocellulose was lacking in adhesion properties. Nitrocellulose resins with adhesion promoters (e.g. organo-titanium compounds) and urethane polymers were combined to give desirable properties.

Acrylic resins with modified cellulosic resins were used in inks for PVDC coated cellulose and oriented polypropylene film.

The use of alcohol-soluble resin media in food packaging inks eliminates the more odorous solvents such as aromatics and ketones.

Coldseal adhesives

These are water-based coatings used for sealing wrap-around wrappers such as used in chocolate confectionery. They were developed because heat sealing can damage the chocolate causing rejection of the wrapped product. These adhesives are normally applied by the gravure process usually in-line with the gravure or flexographic printing process on the reverse side of the print which is often coated with a release lacquer to prevent blocking in the reel.

Problems relating to environmental pollution factors

Anti-pollution legislation in West Germany, Austria and Switzerland restricts solvent emissions to the atmosphere in terms of concentration (mgms/cu.metre) and mass flow (kgms/hr), the precise limits depending on the classification of the solvent used in the inks or coatings. One solution to the problem is to use an effective solvent recovery system, another is the incineration of solvent vapour by thermal or catalytic combustion using "after-burner" systems. Water-based flexographic and gravure inks with zero to low concentrations of alcohol co-solvent, would be an answer to the atmospheric pollution problem, at the same time reducing the fire risk and solving problems relating to retained solvent odours in print on food and confectionery packaging.

The constraints

Solvent recovery (carbon adsorption technique for example) is not practicable for the smaller sized installation if a combination of different ink solvents has to be recovered and fractionally distilled in a quality suitable for re-use. Single solvent systems have been investigated e.g. ethyl acetate based gravure inks but they do not suit all technical requirements and the odour of any retained solvent in the print can be a problem. Table 1 lists solvents used in flexographic and gravure inks comparing data such as detectable levels of solvents in the air and occupational

Table 1

Solvents in liquid inks

SOLVENT	ODOUR	DLS	OEL	EV	BP°C
Ethanol	W	500	1000	330	78
Isopropanol	M	400	400	230	82
n-propanol	n.d.	n.d.	200	94	98
Acetone	S	1000	1000	1000	56
MEK	S	150	200	460	80
MIBK	S	25	50	140	116
Acetates					
Ethyl	M	100	400	620	77
Isopropyl	n.d.	n.d.	250	500	88
n-propyl	n.d.	n.d.	200	280	102
n-butyl	M	50	150	100	126
SBP/2	W	n.d.	125	540	70/90
SBP/3	W	n.d.	300	200	100/120
Toluene	S	100	100	210	111

DLS — Detectable Level of Solvent in Air-ppm
OEL — Occupational Exposure Limits-ppm(8 hour TWA)
EV — Evaporation Rate, Butyl Acetate=100
Odour — S=Strong, M=Medium, W=Weak
Odour and DLS data from "Solvent Problems in Industry" Editor Kakabadse, G, Elsevier Appl. Science Pub., Ltd, 1984, Andrews C. W., Role of solvents in industry, p41-51.

exposure standards. Ethyl alcohol seems to be the most acceptable of the organic solvents for use in inks to print the non-contact surfaces of food and confectionery packaging.

Water-based inks have in fact progressed quite well over the last decade or so but they still have some shortcomings.

To dry the inks, more energy is needed to evaporate the water than for organic solvents of comparable boiling point. Adhesion, mechanical abrasion, heat, water and product resistance properties of water-based inks on impermeable packaging substrates are generally inferior to those from the best available organic solvent based counterparts. On new techniques for recovering solvent vapours from exhaust systems there are some interesting developments in the use of membrane technology[3,4] which have been used in the recovery of solvent emissions from paint shops in the car industry[3] and hydrocarbon vapours from petrochemical processes[4]. These methods adopt a semi-permeable membrane to filter the solvent from exhaust streams. It is too early to forecast their applicability to printing plants.

On thermal or catalytic combustion of solvent effluent, one new system of emission control saves energy needed for the incineration by re-circulating the exhaust air in the drying oven section of the printing press thereby enriching the concentration. Therefore after initial start up, the incineration should be supported by energy from the solvent-enriched exhaust stream. Also the reduced volume of air needed for the drying allows more compact equipment to be used.

Some aspects of water-based flexographic and gravure inks

Recent reviews[5-7] on this subject are worthy of note. For the USA statistics show increasing sales for water-based inks[6] and the use of water-based flexographic and gravure inks to print impermeable packaging substrates (polyethylene, polyethylene-coated board, metallised films etc.) are expanding. In the UK and Europe water-based flexographic inks are used in large quantities for printing the kraft lined boards for the corrugated box industry. This includes the high quality 4-colour half-tone printing of white liners prior to the corrugating process (pre-printing liners).

There has been increasing use of water-based flexographic and gravure varnishes to overprint alcohol-based inks on food and confectionery wrappers and boards exploiting the very low residual odour of the dried varnish films. The incentive to use water-based inks for a wider range of substrates has been much less in the UK and Europe than in the USA where the Environmental Protection Agency (EPA) legislation enforced limits on organic solvent emissions.

Figure 5 taken from a previous review[8] outlines suggested drying mechanisms for water-based inks. On developments in materials, Figure 6 outlines trends in water-based ink media.

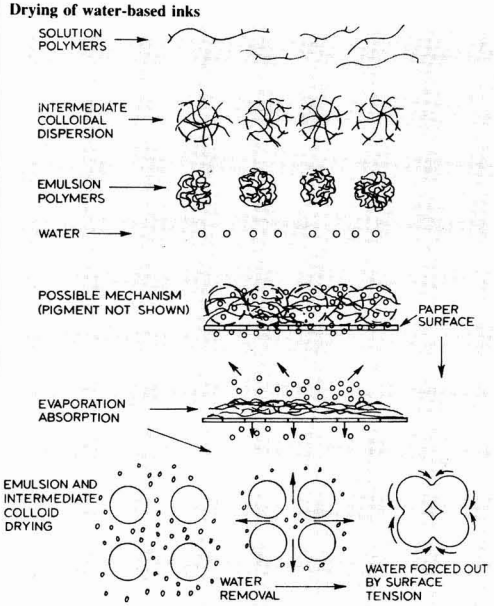
Concerning pigments, there is an adequate range, but care has to be exercised in the use of some alkali sensitive types. Pigmented chips are available and concentrated pastes for ease of dispersion in appropriate media. Additives include surfactants, anti-foaming agents, slip and rub-resistance compounds, alkali-solubilising agents and cross-linking agents.

Regarding the problems in formulating inks for the impermeable substrates. One difficulty is the sensitivity of alkali-solubilised polymeric media, in which the carboxyl group is a site for attack by water and chemicals. Emulsion polymers may be more protective but surfactants used to lower the surface tension of water-based inks to improve printing performance on plastic films, may adversely affect water resistance of the dried ink film. Table 2 compares properties of water-based inks with solvent-based products.

Concerning the "re-wetting" phenomenon. Loss of the ammonia or alkanolamine by evaporation, could result in an

Figure 5

Drying of water-based inks



insoluble deposit of ink in the gravure cell or on the flexo anilox roller and this will not re-dissolve in the fresh ink as the cylinder rotates. Solvent-based inks are not so prone to this defect. For water-based gravure inks, cylinders with fine screens and shallower than normal cells are used to reduce the "drying in" problem and assist the smooth transfer of ink to the substrate. Water-based flexographic inks have less problems when used to print absorbent papers and boards. In fact the increase in viscosity of the ink, after the printing impression, which is due to water absorption by the substrate, is favourable for clean half-tone printing. There should be less squash of the dots and less "halos".

There is no doubt that the more experience in the use of water-based inks, the better will be our understanding of the shortcomings. Future developments in water-based surface coatings and paints may well have implications for inks,

Table 2

Comparison of solvent and water-based inks

Solvent-based inks	Water-based inks
pH not involved	pH affects stability viscosity, flow
Low surface tension	Higher surface tension
Faster drying	Slower drying
Lower latent heat requirement	Higher latent heat requirement
Should redissolve	Loss of alkanolamine etc, produces insolubility
Machine stability	
Wide choice of resin media	Limited choice
	Saponifiable group on water-soluble polymers site for attack
Lower solids in gravure inks	Higher solids inks
	More colour strength thinner films possible
Fire Hazard	Reduced Fire Hazard
Most have odour	Very low odour possible

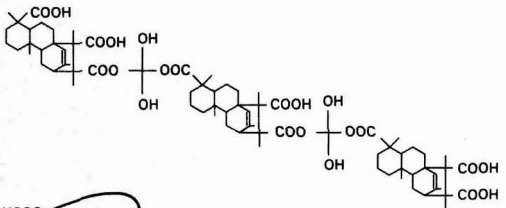
although the applications and end-use requirements are so different. Research into water-based polymers that will have adequate drying and film-forming properties on plastic and other impermeable substrates will continue. One major consideration is reactivity, for example, when using cross-linking mechanisms for film-formation. Balancing reactivity with the stability required in inks for high speed printing machines will be a continuing challenge.

Figure 6

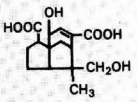
Some trends in water-based ink media

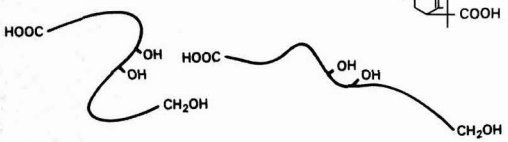
Pre 1970's

Maleic or fumaric modified rosin partial esters.
(a molecular species)



Shellac (molecular species)

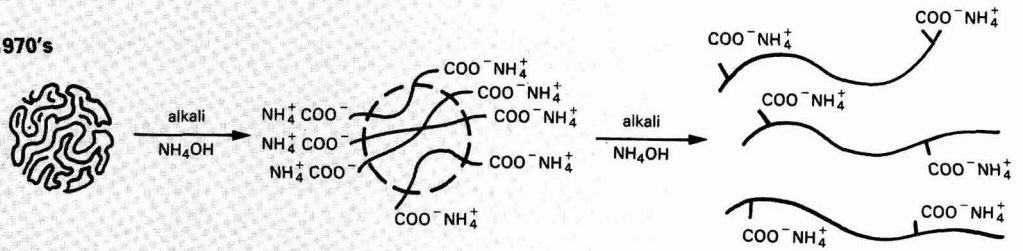




Protein Resins (complex structure, not shown here)

Water-based media from the alkali-solubilisation of the above natural and modified natural resins.
Inks are rather slow drying with only fair wet and dry rub resistance properties. Varnish films have low gloss on porous substrates.

1970's



Emulsion Polymer
(Carboxylated co-polymer) Intermediate Colloid

These water-based media derived from petrochemical sources lead to faster drying inks; good pigment wetting properties; improved wet and dry rub resistance; improved gloss of varnish films.

1980's

Higher molecular weight polymer emulsions

Combinations of these higher molecular weight polymer emulsions with intermediate colloid media and/or solution polymers lead to faster drying varnishes and inks; improved gloss of varnish and ink films; improvements in resistance to heat, grease, water and alkalis; improved adhesion to plastic substrates.

Cross-linking systems — Heat, solvent and chemical resistance properties are increased through interaction of carboxylated polymers with cross-linking agents, e.g. zirconium or zinc complexes; titanates.

Two-component systems involving e.g. melamine formaldehyde are of increasing interest but pot-life and machine stability may be variable for some printing applications.

Appendix

The measurement of contact angles

The critical surface tension concept is used to investigate problems such as non-spreading of overprinting varnishes on ink surfaces, pinholing, refusal in wet-on-wet printing and surface treatment of packaging films to make them printable[2]. Using a series of test liquids of known surface tension γ and measuring the contact angle of each liquid on a given substrate provides the data to plot a graph of cos θ versus γ. If a straight line plot is obtained, this is extrapolated to the line. Cosθ=1(θ = O). This gives a corresponding value for γ known as the critical surface tensionγ_c.

γ_c is an empirical value which depends on the test liquids used and on the slope of the cos θ versus γ curve. For an overprinting varnish to spread evenly to a smooth coating with satisfactory adhesion to the underlying ink film it is essential that γ_c be equal or higher than the surface tension of the varnish.

The technique devised by the present author measures the contact angle of droplets of liquid on a substrate. Carré and Schreiber[9] determined γ_c to characterise polymethyl methacrylate films by applying droplets of different test liquids. Droplets were photographed in a plane parallel to the film surface. The photographs gave a 60x enlargement of the droplet profile, permitting a measurement of height h and radius r the contact angle was obtained from

$$\tan \frac{\theta}{2} = \frac{h}{r} \qquad (1)$$

Ewane-Ebele and Schrieber[10] applied droplets of test liquid to the surface of the polymer under investigation and measured the area of the deposited droplets (plan view) either directly or by photographing the assembly. The contact area of the droplet was measured accurately from the photographs, using a planimeter. The contact area of the droplet is proportional to the contact angle. An estimation of γ_c was obtained by plotting a graph of the contact area versus γ for the series of test liquids used. In a paper[11] Fisher described an apparatus which allows the estimation of drop volume and radius of contact circle at the surface. The drop is photographed by a camera directed horizontally at a mirror placed at an angle of 45° to the horizontal solid surface, so the photograph gives a plan view of the drop. Diameters can be calculated from enlargement.

The present author used a simple apparatus constructed from a linen (magnifying) glass and transparent plastic ruler assembled as shown in the photograph and diagram (Figures 7 and 8).

Droplets of test liquid (distilled water and distilled water/methylated spirit mixtures) were applied by means of a hypodermic syringe, to the paper and board substrates. The volume of droplet was 50ul (0.05 mls).

The test liquids were coloured with a trace of water-soluble red dye so as to obtain a clearer definition of the droplet periphery. The droplet was viewed immediately after deposition.

The contact diameter d is measured with the centimetre scale of the ruler, which is fixed to the base of the linen glass, as shown. From d we get contact radius r.

The contact angle θ is obtained from Equation 1 and the height of the droplet, h from the equation.

$$6V = \pi h (3r^2 + h^2) \qquad (2)$$

where V = droplet volume.

This expression is calculated from the equation for the volume of a spherical cap (from a sphere of radius a).

$$V = \pi h (a h - \tfrac{1}{3}h^2)$$

Carré and Schreiber used an expression:

Figure 7

Examination of drop diameter on printed polyethylene coated board

$$\frac{V}{V_o} = \frac{h\,(3r^2 + h^2)}{h_o\,(3r_o^2 + h_o^2)} \qquad (3)$$

where V_o = volume of droplet at time t_o = O

V = volume of droplet at time t.

The expression

$$\frac{6V}{6V_o} = \frac{\pi h\,(3r^2 + h^2}{\pi h_o\,(3r_o^2 + h_o^2)}$$ cancels out to Equation 3.

Example — Distilled water on coated carton board

Volume =0.05 mls.

d =0.7 cms r =0.35

From Equation 2

$$6 \times 0.05 = \pi h\,(0.3675 + h^2)$$

$$0.0955 = 0.3675\,h + h^3$$

As the relationship depends on the accuracy of the droplet volume, various values of h are substituted in the equation choosing the one that most closely solves the equation.

$$h^3 + 0.3675\,h = 0.0955$$

Thus when h = 0.228

$$h^3 + 0.3675\,h = 0.09564$$

Subst. h = 0.228 ;r = 0.35 in Equation 1

$$\tan \frac{\theta}{2} = \frac{0.228}{0.35} = 0.6514$$

from which $\theta/2$ = 33°5′ and θ = 66° 10′

The inaccuracies of the technique, including the variability in droplet volume and shape are acknowledged. Several determinations are needed with each liquid to check repeatability, realising also that the γ_c of the surface may vary from point to point. But experience has shown that the technique can give some useful indications of problems that could arise on overprinting. Because of its simplicity it could be a useful method for investigating various types of test liquids for the assessment of γ_c values.

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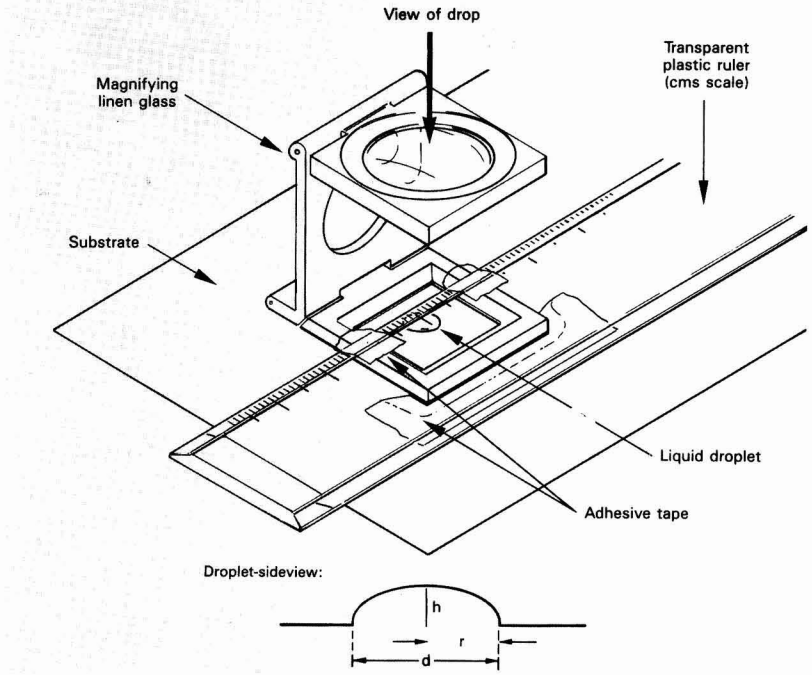
Figure 8

Outline of apparatus as shown in Figure 7



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Synthesis of monodisperse film forming latexes

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Abstract

An experimental **technique** bas heen developed to synthesize **film** rorming copolymer latexes by emulsion polymerization. The two copolymers produced are typical examples or those used in water based coatings.

A semi-batch reaction **technique** was used to synthesize both monodisperse vinyl acetatelbutyl acrylate and methyl methacrylatelbutyl acrylatelmethacrylic acid latexes having solids concentrations comparable to those produced industrially. These latexes runction as seed latexes in subsequent polymerizations. This reaction scheme makes it possible to synthesize monodisperse latexes with a range or diameters.

Introduction

The two polymers that are most widely used as vehicles for water-based coatings are vinyl acrylic and all acrylic copolymers. Typical examples are 85/15 vinyl acetate/ butyl acrylate and SO/50 methyl methacrylate/butyl acrylate copolymers.

Commercial latexes are all polydisperse with respect to particle size and little hard information is available as to the effects of particle size and particle size distribution on properties of coatings, adhesives, and similar products.

Synthesis of monodisperse latexes from a wide variety of monomer systems has been documented. Such products are generally unsuitable for further processing into commercial products because they have low solids contents or are inadequately stabilized. The authors are not aware of procedures for the synthesis of monodisperse versions of the common film-forming latexes. This article reports a semi-batch procedure for the synthesis of vinyl acetate/butyl acrylate and methyl methacrylatelbutyl acrylate/ methacrylic acid latexes with monodisperse particle size distributions. Particle size can be readily varied within the range of diameters common to such latexes. The polymer concentration that can be achieved is similar to that of commercial products, at about 50 weight per cent, and the latexes are shear stable.

These monodisperse latexes can be used directly to formulate coatings and adhesives or they can be blended to provide mixtures with predetermined particle size distributions.

Most emulsion polymerizations employ mixed surfactant systems. Particle size and latex stability are controlled by the total amount and the ratio of anionic to nonionic emulsifiers. The technique reported here uses only anionic surfactant. Latex stability is achieved by post polymerization addition of surfactants.

Experimental

I. Latex preparation·

The latexes were synthesized using two different semi-continuous reaction schemes; both unseeded and seeded polymerizations were performed. In order to eliminate the effect of compositional variation, the proportions of all reagents save water were kept uniform between the various recipes. Typical emulsion recipes are shown in Table 1. Particle sizes of the latexes produced are listed in Table 2.

All **reactions** were carried out in

Table I

Emulsion recipes

Recipe Al(VAC/BuA)	
Unseeded Emulsion Polymerization	Wt(g).
reactor charge:	
distilled water	226.46
ammonium persulphate initiator	0.35
monomer emulsion:	
vinyl acetate	180.67
butyl acrylate	31.88
distilled water	70
sodium dodecyl benzene sulfonate (Siponate DS-I0, Alcolac Inc)	0.50
initiator solution:	
distilled water	20.00
ammonium persulphate initiator	1.00
Recipe A2 (VAclBuA)	
Seeded Emulsion Polymerization	
reactor charge:	
distilled water	226.46
seed latex Al	150.00
ammonium persulphate initiator	0.35
monomer emulsion:	
vinyl acetate	180.67
butyl acrylate	31.88
distilled water	70.00
sodium dodecyl benzene sulphonate	0.50.

Recipe B6 (MMA/BuA/MAA) Unseeded Emulsion Polymerization	
reactor charge:	
distilled water	267.5
ammonium persulphate initiator	1.35
monomer emulsion:	
methyl methacrylate	105
butyl acrylate	105
methacrylic acid	2.55
distilled water	70
sodium dodecyl benzene sulfonate	0.16

Recipe B11 (MMA/BuA/MAA) Seeded Emulsion Polymerization	
reactor charge:	
seed latex	230
27% solids, D_n=788nm, D_w=798nm)	
ammonium persulphate initiator	1.08
distilled water	60
monomer emulsion:	
methyl methacrylate	84
butyl acrylate	84
distilled water	56
sodium dodecyl benzene sulfonate	0.19

a 1L kettle reactor equipped with an overhead condenser and a jacketed stirrer. The apparatus was immersed in a thermostatted water bath.

The water, initiator, and seed latex (if required) were charged to the reactor and maintained at a temperature of 80°C with continuous stirring. The monomer emulsion was fed to the reactor at a rate of approximately 1mL.min^{-1}. No monomer accumulation was observed at any time. Hence, it was assumed that the reaction was starve fed, and the composition of the polymer was uniform through the latex particle. In the case of vinyl acetate/butyl acrylate polymerizations, the initiator solution was fed concurrently with the monomer emulsion. When monomer emulsion and initiator solution addition was complete, the polymerization was continued undisturbed for one hour. The temperature was then reduced to 55°C and approximately 2mL of 70% t-butyl hydroperoxide was charged to the reactor. The temperature was maintained at 55°C for fifteen minutes. Subsequently, the latex was gradually cooled to ambient temperature. The latex was filtered through a 100-mesh screen to remove the minimal amount of coagulum formed during the reaction.

As can be seen, the basic procedure consists of production of a monodisperse latex to produce a given particle size. This is used, if needed, as the seed for subsequent polymerization to a larger sized emulsion.

2. Latex post stabilization

Latexes having low surfactant content have poor shear stability. Post stabilization of the high solids content latexes was required. Shear stabilization was accomplished by the addition of mixed surfactant. Aqueous DS-10 was added to a concentration of 0.0063 g DS-10/g latex, and 70% ethoxylated nonyl phenol (Alkasurf NP-40) solution was added to a concentration of 0.0267 g NP-40/g latex. The soap solutions were added gradually while stirring the latexes, in order to avoid "soap shock".

The shear stability of the latexes was defined operationally. The latexes underwent continuous high speed shearing in a household blender for ten minutes. The viscosity of each latex was determined before shearing. The latex was then filtered through a 100-mesh screen and the viscosity was measured again. A Contraves Rheomat 30 cup and bob viscometer operating at shear rate of 358 s^{-1} was used for the determination of all viscosities.

3. Latex characterization

Latex particle size measurements were obtained using an ICI-Joyce Loebl Disk Centrifuge. The rotational speed of the disk was selected so that the particles passed the detector between 3 and 25 minutes after injection. The output of the optical detector were recorded by a strip chart recorder operating at 2.5V full scale. The data were handled according to Rudin and Devon[1]. The latex samples were diluted to a concentration of between 0.25 and 0.50 weight per cent with a mixture of 80:20 water:methanol by volume. For the smaller particle size latexes, water was used as the spin fluid. The density gradient within the spin fluid was produced with methanol. A glycerol/water mixture was used as the spin fluid for the latexes having larger particle sizes. In these cases water was used to obtain the density gradient within the spin fluid.

Results and discussions

The latexes produced using this semi-continuous reaction technique were all found to be monodisperse. The pertinent information about the distributions is summarized in Table 1.

The shear stabilities of latexes were tested in the blender. Both latex types were found to be shear stable under the conditions given. Table 2 shows typical values for the viscosities of the latexes both before and after ten minutes shear. These results indicate that there was a minimal amount of coagulum produced.

Table 2

Shear stability

Latex	η (cp) (before shear)	η (cp) (after shear)
VAc/BuA	16.00	15.88
MMA/BuA/MAA	10.06	9.56

Conclusions

The semi-continuous reaction technique used to produce the monodisperse latexes is both simple and effective. When a combination of both seeded and unseeded reaction schemes are used, monodisperse latexes can be produced having a wide range of particle sizes. Difficulties encountered with low surfactant content latexes can be easily overcome by post stabilization.

Monodisperse latexes represent model systems since particle size distribution is eliminated as a variable. Various properties of both latexes and water based paints can be investigated using these model systems. A subsequent paper will address the effect of particle size on the film forming behaviour of such latexes.

Reference

1. A. Rudin and M. Devon (submitted, 1987).

Acknowledgement

The authors thank the Natural Sciences and Engineering Council of Canada for financial support.

Table 1

Latex characteristics

Latex	D_n(nm)	D_w(nm)	D_w/D_n	Reaction Technique	pH	Surface Tension (dyne/cm)	Solids Conc (wt%)
A1	334	340	1.02	unseeded	1.90	—	42.8
A2	529	536	1.01	seeded w. A1	1.80	—	40.0
A3	772	774	1.00	seeded w.A2	1.80	—	39.2
A4	1056	1062	1.01	seeded w.A3	1.80	—	37.7
B1	~80	~95	—	unseeded	—	—	~5
B2	148	155	1.04	seeded w. B1	2.55	43.1	38
B3	150	153	1.01	seeded w. B1	—	—	47.6
B4	317	326	1.03	seeded w. B3	2.36	40.8	52.2
B5	501	509	1.01	unseeded	2.30	41.5	39
B6	530	537	1.01	unseeded	—	—	40.7
B7	571	590	1.03	unseeded	2.20	41.2	38
B9	816	834	1.02	seeded w. B5	2.05	41.9	49.9
B10	1125	1157	1.03	seeded w. B5	2.28	42.6	38
B11	1234	1235	1.00	seeded w. B8	—	39.4	54

* Poly (vinyl acetate) latexes are not stable indefinitely at acid or basic PH's. A modified and preferred method for production of such monodisperse latexes involves the addition of sodium bicarbonate to the aqueous phase at the beginning of the polymerization to produce latexes with pH's near neutral. ■

The choice of "Printing Inks" as the editorial theme for this issue of JOCCA represents more than the continuing evolution of the Journal's strong thematic approach to important sectors of the surface coating industry, its products, equipment and issues. It also represents a further development in the Association's commitment to the printing ink sector and the extension of its learned society and professional interests in this area.

Printing ink and associated technical lectures have always proved of great interest and popularity within Section programmes, are well supported and in much demand. The Manchester Section already has a parallel series of printing ink lectures in support of the Section's traditional programme of lectures and works visits and it is likely that other Sections may adopt this approach. The recognition of printing ink as an important area within the Association's development is recognised through the appointment of Mike Nixon, formerly Honorary Secretary of Manchester Section and organiser of its ink programme, to the Association's Technical Committee. Mike's appointment will ensure that printing ink issues are kept well to the fore in Committee and Council and that proper attention is given to printing ink matters within the Journal.

It has already been agreed that a printing ink issue of the Journal will feature in each year's editorial programme and that regular space will be provided throughout the year for articles, news reports and other matters of interest to the sector. I believe these developments will be particularly welcomed by the Association's Ontario Section and which has particularly focused its technical programme around the printing ink industry strongly represented within the province.

The Association is pleased to acknowledge the close co-operation that exists with the Society of British Printing Ink Manufactuers (SBPIM) and the Association is an affiliate member of the Society. A report on the annual meeting of the Society is carried in this issue of JOCCA and the Journal will continue to publicize the activities of the Society and its member companies.

One of the early results of the co-operation with the Society is the decision to hold a joint technical meeting in the spring of 1990 and it is hoped that this will be the first in a regular series of such meetings. The subject matter for the meeting is "Printing Inks for the 90's" and will include papers on water-based inks, newspaper inks, lithographic inks, photoreactive acrylates, developments in pigments and resins, and screen printing. The venue and date for the meeting have yet to be finalized, but it is likely to take place in a Midlands location during the second part of March or early in April 1990. Further details will be released as soon as they are available.

It is also anticipated that co-operative activities will be established in the education and training field in which the Association already holds regular meetings with the Paintmakers Association and the Paint Research Association to co-ordinate education and training activities within the surface coating sector. It is logical and proper that these discussions involve the printing ink sector.

This issue of JOCCA also contains a preliminary notice of a one day technical seminar organised by the Marine Paint Forum in conjunction with the Association on the important subject of "Organotin Anti-fouling Compositions — The Impact on Shipowners and Shiprepairers of Existing Legislation. The seminar will be held at the General Council of British Shipping on Wednesday 25 October 1989 and a specially reduced registration fee is available for OCCA members. Full registration details for this seminar will appear in the August issue of JOCCA and it is hoped that the seminar will provide a springboard for an expansion of the Association's activities into the small, but important, sector of Marine Coatings. ■

Forthcoming OCCA Symposia

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The Implications of Just-in-Time

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★ ★ ★

Thames Valley Section

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12 October 1989

Building Research Establishment, Watford
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Marine Paint Forum/OCCA

Organotin Anti-fouling Compositions

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25 October 1989

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IMF Conference and Exhibition — Brighton April 1989

Don Clement of the PA reports:

This year's conference attracted a larger number of delegates, up to 300, and an increase in the number of exhibitors than in previous years, primarily because of its International flavour. It was also supported by a number of associated bodies. The theme for the conference was 'Profit from new technology'.

The three and a half days of conference included civic, social, business and technical seminars and therefore catered for all attenders in various ways. For those specifically attending for the technical content, each day had a choice of main topics, which in turn were covered in a number of sessions. Of particular interest to the organic finishing industry, there were seven papers given on the Thursday, which although attracting very low numbers, ranging from eight to twenty-two, were all of very good quality and provided useful opportunities for discussion on the particular subjects. These included: Fusion bonded epoxy powder coatings for the protection of reinforcing steel by K. McKleod of International Paint, Anti-graffiti coatings by J Moore of T&R Williamson Ltd, A user's view of anti-graffiti coatings by C. Percival of BR Engineering, Electrochemical techniques for studying organic coatings by C. A. Florence of the PRA and Denaturing of paint by M. Cory of Androx Pyrene Ltd.

The exhibition, visited separately also by day visitors, had over sixty companies represented, of which only a handful were of particular interest to our industry, although it is always useful to be able to get a flavour of the wider finishing industry.

It is a pity that only a few paint manufacturers attended, when by their greater participation they could have a greater influence on the style of future events. Perhaps this will change next year.

Corrosion protection by organic coatings

Dr John Nicholson of the Laboratory of the Government Chemist reports:

"Corrosion Protection by Organic Coatings" was the title of a conference held from 10-14 April 1989 in the attractive surroundings of Christ's College, in the centre of Cambridge. The meeting was organised by Drs David Scantlebury of UMIST and Martin Kendig, of the Rockwell Science Center, California, and it was an international gathering, with over 100 delegates drawn from all over the world. Most if not all of the leading workers in this important branch of applied science were there, and the whole event was a remarkable tribute to Dr J. E. O. Mayne, of Cambridge University, who not only pioneered the scientific study of the anticorrosive action of paints, but had supervised the PhD studies of a number of the speakers at the conference. It was a pleasure to see him there, giving the opening paper ("The cross linking and adhesion to mild steel of epoxy polyamine films"), chairing a session later in the week, and being toasted at the conference banquet in honour of his forthcoming 80th birthday.

Delegates gathered in Cambridge on Monday, 10 April, and the serious scientific business began on the Tuesday morning. This opening day was dedicated to the theme of Adhesion Disbonding and Underfilm Corrosion, and involved some fourteen presentations. A notable feature of this area of scientific interest is the sophistication of the techniques being brought to bear on the problem of underfilm corrosion, including X-ray photoelectron spectroscopy, Auger and secondary ion mass spectroscopy for surface analysis, not to mention numerous electrochemical techniques.

Of particular practical interest was the paper of U. Steinsmo and E. Bardel of SINTEF, Trondheim, Norway, who described the relationship between the paint film resistance and its ability to protect steel substrates against corrosion. This work represented a valuable link between the more sophisticated theoretical studies described in some of the other papers, and the completely pragmatic testing work usually carried out in development laboratories in the paint industry. Other highly practical contributions came from Professor Henry Leidheiser, of Lehigh University, on "A modified pretreatment process involving electrodeposition of zinc after phosphating," and Professor van Ooij and A. Sabata of Colorado School of Mines on "An inorganic non-chromate post-rinse treatment for the stabilisation of phosphate conversion coatings on cold rolled and electrogalvanised steels".

Wednesday morning was devoted to Novel Polymers and Application Methods, and involved seven presentations. I had the honour of presenting my own paper in this section, an update on our studies of waterborne acrylic ionomer lacquers (for the early work on this topic, see *JOCCA*, 1987, **70** 157 and 189). Other papers described such coatings as Silicone Corrosion Barriers (J. S. Tong *et al.*, Dow Corning), Fluoropolymer topcoats (H. Tanabe *et al.*, Dai Nippon Paints, Japan) and Polyphenylene coatings produced by anodic electrodeposition (G. Mengoli and M. M. Musiani, University of Padova, Italy).

The rest of the day was free to be spent sampling the delights of Cambridge, for which the weather was very kind, and for me at least, the company extremely congenial.

Delegates reconvened on the Thursday morning to devote their attention to Electrochemical Techniques and Interpretation. It became increasingly clear during the day that it is the latter aspect which causes the difficulty. Obtaining the measurements is relatively straightforward, but deciding what they all mean is quite another story. Various studies of electrochemical impedance were reported, and much discussion stimulated. A most useful paper, which partly reviewed the problems posed by work in this area was the one entitled "The application and limitations of electrochemical test methods to the study of anticorrosive paints" by D. J. Mills of Paint Research Association. He pointed out that there is very little quantitative evidence that electrical resistance can be correlated with the amount of corrosion, a fact that was food for thought indeed.

At the end of the day there was a sherry reception, followed by a traditional and much enjoyed banquet in the Hall of the College. Despite this strenuous social event, delegates assembled bright-eyed on the final day to consider Pigments and Additives for Corrosion Performance, in which a further nine papers were read, including one on that old favourite, red lead. This material had been used as an anticorrosive pigment in alkyd paints applied to rusted mild steel in a study by N. L. Thomas of ICI Chemicals and Polymers. Her paper highlighted an interesting paradox: surely red lead will be well and truly obsolete as an anticorrosive pigment (on health and safety grounds) before we really understand how it works?

Other papers in this session of particular interest to those closely involved in the formulation of anticorrosive paints were "Factors affecting the action of inhibitive pigments" by S. Turgoose of UMIST, "Organic corrosion inhibitors" by A. Braig of Ciba-Geigy, Switzerland, and "A novel anti-corrosive pigment containing vanadate/phosphate" by T Yamamoto *et al.*, of Nippon Paints, Japan. All of these

papers demonstrated that, no matter how imperfect our understanding of the mechanism of action of anticorrosive pigments, there remains ample scope for new products in this field.

The conference closed at 3.30 pm on the Friday afternoon, with much sincere praise for the two organisers, who had produced a first class conference by a happy blend of high quality technical presentations and an excellent location.

In all, some 45 papers were presented in the four days. In addition to the volume of abstracts prepared before the conference began, there is to be a special conference proceedings volume published by the Electrochemical Society. If you are in any way involved professionally with the use and evaluation of paint for corrosion protection of metallic substrates, but were unlucky enough to miss the conference, I strongly recommend that you buy the book. I am sure you will not be disappointed. ■

OCCA Book Review

Ullmann's Encyclopaedia of Industrial Chemistry

Fifth, Completely Revised Edition
Vol.A.9: 1987. XV.653 pages. 223 figures. 189 tables.
Price: DM 465,-.
Vol.A.10: 1987 XV 655 pages. 364 figures. 176 tables
Price: DM 465,-.
VCH Verlagsgesellschaft, Weinheim; Basel; Cambridge; New York.

These two volumes are part of the fifth edition of a well established German standard work. What is however quite remarkable is that whilst the first four editions were written by German writers in German, the current edition is written by experts mostly from Germany but also from the USA, Great Britain and other countries in English! No German edition will be published so this surely recognises the status of English as the international language of science.

The fifth edition will comprise 28 volumes in the A series (A1-A28) containing alphabetically arranged articles and 8 volumes in the B series dealing with basic knowledge. So far 11 volumes of the A series and 2 of the B series have been published and it is intended to publish approximately 3 further volumes annually.

This reviewer is the possessor of the 20 volume third edition published between 1951 and 1967. The expansion to 39 volumes is a sign of the ever increasing amount of material that has to be covered by any encyclopaedia with a claim to completeness.

Each one of the two volumes submitted for review contains an introductory section with a list of symbols and description of SI units generally used throughout the encyclopaedia, conversion factors and abbreviations of the names of frequently cited companies. There is also a periodic table of elements.

Volume A9 contains 16 articles from 'Dithiocarbamic acid and derivatives' to 'Ethanol'. Each article is well organised and is headed by a detailed table of contents which facilitates the location of items of special interest to the user and at the end a comprehensive list of literature references is given.

The longest article in this volume (190 pages) deals with 'Enzymes' to which 18 authors have contributed and it concludes with a list of no fewer than 1600 literature references covering about 27 pages. Volume A9 presents several articles of interest to users seeking information about the surface coatings industry. A comprehensive 16 page survey of 'Drying Oils' will give the non-specialist most of what he is likely to want to know. In the chapter on 'Dyes' I found an excellent description of colour measurement (I am afraid American spelling usage prevails throughout the work) and colour formulation, the calculation of tristimulus values and colour differences. There is also a brief description of all chromatographic methods. The article headed 'Emulsions' makes only very brief reference to paints and coatings. What we — perhaps loosely — call emulsion paints are dealt with elsewhere in the encyclopaedia. In the case of 'Epoxy Resins' I can make a direct comparison with the third edition which dealt with the subject under the heading 'Synthetic Resins' in 6½ pages. It now occupies 17 pages with 81 literature references. All aspects such as manufacture, handling, storage, transport uses, economics and toxicology are given due attention. The preceding article has 14 pages on 'Epoxides'.

Volume A10 'Ethanolamine and Propanolamine' to 'Fibres, Synthetic Organic' presents on 125 pages a survey of 'Fats and Fatty Oils', 'Fatty Acids' and 'Fatty Alcohols', 'Ethylene', 'EDTA and Related Chelating Agents', 'Ethylene Glycol' and 'Ethylene Oxide' also fall into the purview of this volume. All the articles I have read (I cannot pretend to have read them all) are, taking into account the polyglot collection of authors, extremely well written and presented.

The publishers are to be congratulated on the uniformly excellent presentation, the lucid diagrams and tables and on the very clear printing. The existence of an international editorial advisory board has, no doubt, contributed a good deal to the final result. All in all this is an important work that could find a place on the shelves of all technical libraries.
I have been unable to compare this monumental work with the 26 volume third edition of the Kirk-Othmer 'Encyclopaedia of Chemical Technology' completed in 1983. I only possess the concise one volume version (1985) which does not offer a fair comparison.

H. R. Hamburg ■

Hull Section

Wood stains

The fifth meeting of the present session took place at the Duke of Cumberland Hotel, Cottingham at 7.00 pm on 6th February. Members and guests heard Mr F Sykes of Akzo Coatings give a talk entitled "Wood Stains".

Mr Sykes started by giving a brief history of stains, mentioning early types based on linseed oil, later alkyd resins and most recently, products with more evenly dispersed pigments with high UV resistance, exemplified by Sikkens' "Cetol" range. He compared the predominant characteristics of low build stains; low viscosity, high penetration and moderate durability with high build types; higher viscosity, substantial surface layer, improved protection and aesthetic appeal. Greater translucency upgraded appearance but tended to reveal faults which meant good preparation and correct application were essential. Protection was still less with translucents than with opaques although with recent developments the gap was closing.

Maintenance of stains, consisting of a simple wash down and recoat, was easy and cost effective provided it was not left too long.

The different requirements of hard and soft woods which depended on such factors as pore density, cell size and the presence of natural oils and extractives were explained and illustrated with many examples which included some beautiful wood samples.

The primary atmospheric influence on transulcents was UV radiation, capable of degrading both film and substrate if not absorbed. Amongst other adverse factors were moisture, temperature and the presence of tannin which was best removed from the surface. Mr Sykes went on to discuss biological factors such as moulds and bacteria and also insects. Impressive examples of exaggerated colour development resulting from previously undetected mould growth were passed round.

Design of components to be stained, ranging from cladding, windows, doors and exterior staircases to garden furniture and fencing was discussed. A complete window frame, demonstrating how correct design could help avoid the pitfalls which lead to decorating difficulties and breakdown, was available for close inspection.

No single system for staining could possibly meet all the different requirements which existed but Mr Sykes was able to demonstrate by means of slides how the Cetol range, incorporating four systems, each with a different balance of properties, attempted to cover these requirements. He then summarised the four product types in terms of film build, solids, elasticity, microporosity, transparency and pigmentation.

By means of further slides, Mr Sykes gave examples of good and bad staining results and related these to design and workmanship. The speaker closed with a short video concerning the great natural beauty of wood and the highly worthwhile aim of protection against its major enemies, moisture, moulds and UV radiation.

During a period of questioning, Mr Sykes expressed the view that in respect of wood staining operations, standards of professionalism in the UK had lagged behind those existing in say Holland and Germany where training was more extensive. However there were now signs that things were moving in the right direction in the UK and rising standards were to be expected.

The meeting closed with a vote of thanks proposed by Mr M. H. Gamon and endorsed by the audience.

D. Robinson ■

Midland Section

Colour presentation

The March Technical Meeting of the Midland Section was held at the Clarendon Suite, Stirling Road, Edgbaston, Birmingham.

Mr Martin Rudkin, of Martin Rudkin Associates, presented a lecture entitled "Colour Presentation as a Marketing Service". During the lecture he traced the development of the colour card from a document portraying colour and offering specialised technical information to a document illustrating colour concepts within the home.

The speaker introduced his subject by first discussing the methods of card production. Direct deposition of a cellulose based colour coat onto the printed card is one method. The second, for smaller numbers of cards, involves deposition of colour onto a card chip, then hand mounting the chip onto the colour card. This latter process was automated in the 60's when Matherson Selig developed machines to coat cards previously screen printed or sprayed, and to mount the chips on the final colour card.

Using decorative shade cards dating back twenty-five years, Mr Rudkin demonstrated the move away from large colour patterns and technical information to smaller screen printed colour patterns and a predominance of illustrated colour schemes.

The speaker then discussed trade cards, but showed how the trend towards scheme presentation had been reversed with the introduction of a larger, accurate colour chip presentation for use with the point-of-sale dispensing systems.

Mr Rudkin concluded by describing the use of wood, wood-veneer and card simulating wood for the wood finish colour cards and the use of leather and other surfaces for automotive upholstery shade cards.

M. J. Round ■

Natal Section

Corrosion protection in hot climates

New technology which was tailored for the highly industrialised regions north of the 35° parallel has not proved satisfactory for the sub-tropical and tropical regions.

This was stated by Dr Haertl of BASF held on 7 March 1989.

The use of high build chlorinated rubber coatings have proved their

worth in the temperate zones but failure of these coatings occurred in hot climates where temperatures often exceeded 35°C. While all organic binders chalk after approximately 2 years, these coatings started chalking at a very early stage.

Outdoor exposure tests are very important. However the lengthy time required was not suitable to find an answer to the problem. Accelerated testing yielded quicker results but are not as reliable as outdoor testing.

Dr Haertl then described a modification to the Sun Test by blowing air onto the test surfaces to control the temperature. The temperatue range was between 50 and 100°C and reproducible results were got at 80 to 90°C after about seven days.

Various formulating parameters were tested and Dr Haertl discussed the results. The extenders, carbonates barytes and talc, with talc being the worst, severely degraded the coatings at high temperatures. Pure pigments and micaceous iron oxide gave promising results. All chlorinated rubber binders, irrespective of composition, showed degradation with extenders at high temperatures. Confidence in chlorinated rubber on large structures at high temperatures was severely shaken.

In hot climates it is imperative to reduce or eliminate extenders to maintain the integrity of the coating. A feature is that titanium dioxide does stabilise chlorinated rubber coatings.

BASF has undertaken to develop more accurate test methods.

The lecture was illustrated by slides and an overhead projector.

Dr Haertl answered questions from the floor. Professor D. Williams-Wynn proposed a vote of thanks to Dr Haertl and thanked BASF for sponsoring the meeting.

Flame retarding of polymers

*F*ire in all aspects gives rise to emotional responses.

Alan Mackenzie of Cooksons Chemicals gave an absorbing lecture to a meeting held on 11 April 1989.

The proliferation of high-rise buildings and factories has increased the fire hazard to the occupants. The need then arises to make the building "fire-proof". However nothing is flame-proof. If wood was invented today, it would be banned. When discussing fire hazards the whole picture must be considered. All combustible materials, including plastics, carpets, cables etc must be considered. From a legal point of view the term "flame retardant" is preferable.

After discussing the mechanism of burning, Mr Mackenzie then discussed the two prime fire retarding materials, aluminium trihydrate and antimony trioxide. The mechanism of how these two chemicals work were discussed in detail. Aluminium trihydrate releases water and the reaction is endothermic. Antimony trioxide needs the introduction of halogen radicals usually chlorine and bromine to combine with the H and OH radicals to prevent the spread of the fire.

The lecturer then discussed what can be flame retarded. Most items can be flame retarded but a lot depends on the cost.

The most toxic by-product of burning is carbon monoxide. Flame retarded products can give more than ten times the time available to escape from conditions of fire.

Mr R. E. Eglington proposed the vote of thanks to Mr Mackenzie and expressed appreciation to Cooksons Chemicals for sponsoring the meeting.

E. Puterman ■

Newcastle section

OCCA and the future

*T*he sixth meeting of the 1988/9 Session was held at St Mary's College, University of Durham, on 2 March 1989 when Mr Chris Pacey-Day, General Secretary of OCCA, gave a talk on "OCCA, with particular respect to the future."

Mr Pacey-Day introduced himself by reviewing his earlier career, which included a period as Director-Membership services to the Institution of Chemical Engineering. His experience in that job had taught him the paramount necessity of maintaining good continual contact with membership for feedback of opinions and ideas.

He then took a brief look at OCCA — what it is and does, as well as ways forward. Originally founded as a learned society to advance scientific development of the industry, it took on other roles from this, e.g. as a Publishing House, with about 3,500 copies of JOCCA currently seen by some 22,000 people every month; as a Conference Organiser with its own biennial conference, and as an Exhibition Organiser, with Surfex as the up-to-date example. It is, also, a charity with all the benefits and obligations entailed and a Qualifying Body with professional grades. It is international, and, in difficult times with a shrinking industrial base it manages to remain solvent.

He put the question "Do we need change?" and, in his opinion, the answer must be "Yes!" The main strength of OCCA lies in its Regional structure and membership activity, which are more than favourable, in contrast to larger organisations such as the RSC. The Coatings Industry is closely-knit and friendly: within it OCCA, JOCCA and SURFEX are instantly recognisable. OCCA has shown weakness in not moving with the times within a much changed industry and is failing to attract enough of the fewer young people in the available pool — they see no obvious benefits in joining. A strategy is needed to bring OCCA to the forefront once more, with profitability to support the regions.

Some of the changes and innovations within recent years were steps in the right direction. Surfex was an example of a change in style which offers a model for the future. The modernisation of Priory House HQ with equipment and facilities has shown distinct benefits, as had changes in style and presentation of JOCCA and all stationery and promotions literature: on the latter, crisp professional design and typeset are used, with slogans such as "SURFEX — the showcase of the

Industry" or "JOCCA — the Voice of the Industry", giving a more dynamic image.

Mr Pacey-Day himself has been getting out and about, talking to various bodies within the Coatings Industry. One result is that JOCCA is now recognised as one of the official journals of the Paintmakers' Association and a copy goes to the Managing Director of every member company. Close contacts are being established with other trade associations, e.g. The Society of British Printing Ink Manufacturers, with a view to collaboration in such activities as conferences. OCCA has a good relationship with the PRA as shown by the joint conferences on specialised topics, such as "Fire Resistant Coatings". Such activities help to raise the public profile of OCCA.

Changes made in the presentation of JOCCA seem to have increased advertising income; obviously advertisers see the journal as a more attractive package and, in this connection, the advertising reply service is essential. An expansion in distribution is being developed via other journals, overseas libraries, etc. and a prerequisite of this is the maintenance of an acceptable scientific level in readable format. Changes in the style and publicity of SURFEX are continually under review and one current aim is to increase the proportion of people attending from outside the UK.

One interesting development has been the setting up of a trust fund based upon a substantial sum of money donated by a lady member to encourage technical enterprise. Ideas are now being sought from various sources, for the ways in which the fund can be presented and operated to the best advantage.

Returning to his original theme, Mr Pacey-Day emphasised that OCCA is a membership-based organisation and without members it dies. It follows that we must market membership and make OCCA attractive to industry. The possibility of having OCCA honoured with a Royal Charter in its 75th year was appealing, if, as yet, only an idea. He concluded by saying that many ideas are currently simmering and, with the right attitudes and decisions, OCCA has a bright future.

In question time afterwards he was pressed on the abbreviation for OCCA with a Royal Charter — surely not ROCCA!? Ideas on sub-criticality of membership and the charitable nature of OCCA were fully explored, as were the dangers of over-commercialization. Changes in the structure of OCCA were discussed and ways of attracting younger members in the UK, such as free membership, certificates of competence and more basic lectures.

The vote of thanks for an interesting and thought-provoking lecture was given by the Chairman, Mr S. Lynn, after which Mr Pacey-Day joined members and guests in enjoying the usual high standard of buffet repast prepared at St Mary's.

J. Bravey ■

Ontario Section

Fumed silica and AGM

At the Technical Meeting on 19 April, a most interesting and much appreciated presentation was given by Steven P. Jesseph (Cab-O-Sil Division, Cabot Corporation, Tuscola Illinois).

Mr Jesseph described the chemistry of silica compounds, and elaborated on the methods of manufacturing fumed silica that produce its specific structure and physical properties. He then showed how those properties are functional attributes in the various applications for which the product is used; for example, to build viscosity in oil systems and greases, to add dimensional stability to reinforced plastics, and to give liquid-like flow to poorly flowing powders.

Prior to Mr Jesseph's presentation, the Annual General Meeting was conducted. A new slate of officers was presented and was elected by acclamation. The ceremonial gavel and the chain of office were presented to the incoming Chairman, Douglas E. Pratt, by outgoing chairman John Ambury. Mr Pratt presented Mr Ambury with the Chairman's pin of the Association. Short addresses by both officers were followed by the annual report of the Treasurer, Mr Tom Crooks.

Mr Pratt exercised his new office by introducing the guest speaker, and afterwards by moving a vote of thanks that was seconded with enthusiasm.

J. F. Ambury ■

Transvaal Section

New wet bead mill

The first technical meeting of the 1989-1990 period consisted of a lecture entitled "Focus on the CoBall Mill" delivered by Mr H. Burri of Stag Bulk Equipment (Pty) Ltd, South African agents for Fryma-Maschinen AG of Rheinfelden in Switzerland.

Mr Burri introduced his lecture with a short review of Fryma covering various types of mills for application in the chemical, pharmaceutical, cosmetic, food and paint industries.

The CoBall mill consists of a conical stator and rotor with smooth surfaces. The grinding chamber comprises several zones arranged in the annular gap through which the suspension of material and grinding media is forced with the kinetic energy of the media increasing from zone to zone.

The rotor, stator and cover are all cooled and the width of grinding gap, rotor speed, volume and diameter of grinding medium and through-put may be individually varied thus optimizing conditions for each product.

The design ensures a small particle size with a narrow distribution, small temperature rise, low power consumption, low rate of wear of grinding media and the machine, and easy cleaning. This results in lower manufacturing time per ton of product, lower costs and higher output. The greatest saving result from the low consumption of grinding media.

After an active question and answer session Mr R. E. Cromarty proposed the vote of thanks which was endorsed by the audience who went on to enjoy a buffet sponsored by Stag Bulk Equipment.

OCCA Meetings

Polysulphide resins

The meeting scheduled for 17 May was to have been addressed by Dr T. Lee of 'Morton Thiokol' on the 'Application of Polysulphide Resins in Modern Coating Technology'. Unfortunately Dr Lee took ill and was hospitalised. In the absence of Dr Lee, Mr Arthur Engelbrecht of 'Technichem Sales', the local agent of 'Morton Thiokol' spoke on three applications of polysulphide resins in coating technology.

The first application covered the modification of epoxy resins with liquid polysulphides.

Epoxy resin based coatings have many excellent characteristics, some of which may be improved by the incorporation of a polysulphide component. This addition does not detract from other properties of the epoxy resin. The structure of the polysulphide resin endows the polymer with good resistance to a range of chemicals and to outdoor weathering.

Earlier modification of epoxy resins with polysulphides had resulted in opposition to their use because of the mercaptan odour and the need to use tertiary amines as curing agents. Recent advances in polysulphide-epoxy technology have overcome these disadvantages and these systems are now being considered as specialist coatings.

The benefits of the new system are:

1. Viscosity reduction.
2. Control of the rate of cure.
3. Enhancement of the adhesive characteristics.
4. Improved flexibility.
5. Higher impact resistance.
6. Increased resistance to chemicals.
7. Reduced susceptibility to weathering.

The second application of polysulphide resin in the coatings industry covered the use of sprayable coatings toughened with reinforcing fillers. These coatings may be applied by brush, roller or spray. In addition, preformed sheets may be manufactured from 100% solids resins or manufactured in moulds or the material may be coated onto fabric.

The advantages of the material are:

1. Good chemical resistance.
2. Low permeability.
3. Good resistance to weathering.
4. High toughness.

The material is also approved for use in potable water applications.

The third development covered was that of a water dispersable polymer.

Due to the large latex particles size of the polysulphide polymer it must be blended with another latex. Vinyl/acrylic polymers have been found suitable as co resins.

The material was developed as a radon barrier but its low permeability to gases has proved beneficial in many applications including coatings on concrete, masonry and wood.

After an active question and answer period the vote of thanks proposed by Mr G Munro was heartily endorsed by the audience.

R. E. Cromarty ■

OCCA News

Obituaries

L. E. Field, BSc, FTSC — 1938-89

Elisha Puterman of OCCA Natal writes:

A highly respected and widely travelled Fellow of our Association, Lawrence Edward Field, BSc FTSC, died suddenly in Durban on 20 March 1989 aged 51.

Having matriculated, Lawrie Field worked for United Paints and at the same time studied part-time for his BSc degree at the University of Natal, Durban. Graduating in 1959 with Chemistry and Physics as his major subjects he was one of the few graduates who studied part-time and still managed to complete his studies in the required time.

On graduating from university, Lawrie joined Buffalo Paints as a chemist. In 1970 he was appointed Chief Chemist at African Bitumen Emulsions where he was subsequently appointed Technical Director, a position he held until his untimely death.

He joined OCCA in 1963 and in the past few years was an adjudicator for OCCA gradings.

Lawrie Field's work included structural and underwater adhesives, coatings and flooring compounds based on epoxies, powder coatings and surface coatings. He presented a number of papers at OCCA symposia and some of these papers were published in *JOCCA*. He lectured extensively in the user field of the products he promoted. He was a member of a number of South African Bureau of Standards committees and he was a valued member of the South African Corrosion Institute and the South African Chemical Institute.

In his church, Lawrie Field was a senior lay preacher and was always very active. Among his lesser known activities was that of an active radio ham and he had a comprehensive knowledge of electronics.

Lawrie Field will be missed both as an expert in his discipline and as a friend.

He is survived by his wife Kay and his mother. ■

F. N. Reckless, BSc, MRIC, CChem — 1922-89

John Ambury of OCCA Ontario writes:

Frank Reckless died suddenly on 9 May, 1989, in the laboratory of his consulting firm, Chem Film Enterprises, in Mississauga Canada.

Frank was born and raised in the Midlands. He met and married his beloved Joyce in London during the war, and brought her to Canada in 1957. Here he further developed his already vast knowledge of chemical applications in the service of several industries, all of which he considered to be variations of coatings: paints, varnishes, adhesives and cosmetics. Over the years he authored a number of published and unpublished papers on a wide range of topics.

He joined the Ontario Section in 1975 and was active as an Ordinary member until his death. He was also active in the Toronto Society for Coatings Technology, which he served as

Technical Chairman in 1979, and as Chairman for By-Laws — later By-laws and Specifications — since 1982. As well, he was a founding Chartered Chemist.

Never one to stop doing what he liked best, Frank retired from the employ of others in 1983 and started up his own consulting firm for coatings—the term to be applied in the broadest sense. A short time ago he moved the operation from his home in Brampton to "real premises"; a self-contained industrial unit with plenty of room for his laboratory, his bulging sample shelves, his office and his extensive (and eclectic) technical library.

Frank Reckless will be sadly missed and fondly remembered by everyone who was fortunate enough to have known him. He will be remembered as a reliable source of ideas and answers whose store of information seemed endless, whose work was always thorough and whose recommendations were completely dependable. He will be remembered as a man whose opinions, which were strongly held and were not always popular, were expressed with both unassailable logic and engaging humour. Above all he will be remembered as a worthy mentor, a fine companion and a loyal friend. ■

Hull Section

Ladies' evening

This years ladies' evening, held on the 6 April, took the form of a visit to the river Hull Tidal Surge Barrier. The duty engineer, a Mr Robinson, conducted the party around the site and to the top of the 100ft structure from where fine views of Kingston-upon-Hull and the Humber estuary were apparent.

The barrier which stands at the junction of the river Hull with the Humber, protects the low lying city and surrounding district from tidal surges which have in the past caused many millions of pounds worth of damage. Our guide punctuated the tour with interesting explanations concerning the building and use of the barrier and answered a variety of questions which perhaps surprisingly did not include any on painting the structure!

At the end of the visit, Mr Robinson was warmly thanked on behalf of the visitors by the Section Secretary, Mr Philip Bentley.

D. Robinson ■

Scottish Section

Golf Outing

The weather forecast was ominous. High winds and rain were predicted for Friday, 12th May, the date of the Scottish Section Annual Golf Outing to Aberdour Golf Club. Previously, participants had always enjoyed sunshine. Nevertheless, 24 intrepid devotees made their way to the start. As if by some Divine intervention, the rain ceased and the wind dropped. The odd glimpse of sunshine spurred the players on. Some excellent scoring resulted. The list of prizewinners is as follows:

Members

1st Prize	Whittaker Trophy	Brian Donaldson	— Nett 62
2nd Prize		T. Kirkwood	— Nett 69
3rd Prize	Joint Winners	A. Hunter	— Nett 70
		H. Munro	

Morris Ashby Quaich — Best Scratch Score
T. Kirkwood — 79

Tioxide Trophy — Most Improved Golfer — R. F. Hill

Visitors

1st Prize	Visitors' Shield	J. Watson	— Nett 64
2nd Prize		S. McWhirter	— Nett 66
3rd Prize	Joint Winners	A. Cameron	— Nett 67
		C. Marshall	

Best Scratch Score — 3-Way Tie — Gross 77 between
S. McWhirter,
C. Marshall
I. Webster.

Prize awarded to I. Webster with a best inward half of 35.

Thanks are due to the following for the donation of prizes:

Ciba-Geigy
Tioxide
AKZO
Hays Chemicals
Craig & Rose
M. Bowring
Durham Raw Materials
Standard Chemicals
Samual Banner
P. W. Hall
W. McWhirter

Our thanks are also due to Aberdour golf Club, for allowing us the use of their facilities, and their excellent catering arrangements."

R. F. Hill ■

News of Members

Mr W. M. Morgans, formerly a member of the London Section, has now retired to Spain. Former friends and colleagues visiting Spain are invited to visit him at Bellavista 1029, Urbanizacion La Siesta, E-031880 La Siesta, Alicante, Spain.

Professional Grade

The Professional Grade Committee confirmed the following admission:

Ungraded from Associateship to Fellowship

Byrns, Arthur Robin *(Cape)*

New members

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

Ordinary Members

Bawcutt, F. E. *(Ontario)*
Bester, J. A. (Transvaal)
Caserta, M. *(Transvaal)*
Chetty, R., BSc *(Transvaal)*
Dare-Edwards, M. P., MA, DPhil, *(Manchester)*
Edwards, D. L. *(Newcastle)*
Finn, S., BSc. *(West Riding)*
Peters, C. G. *(Thames Valley)*
Sweeney, D. A., BSc. *(Scotland)*
Walker, M. J. *(West Riding)*
Wallen, A. W., BSc. *(Manchester)*
Whelan, D. M. *(Thames Valley)* ■

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Dr J Toole
European Colour plc
Customer Services
Bankfield Street
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Cheshire SK5 7PB

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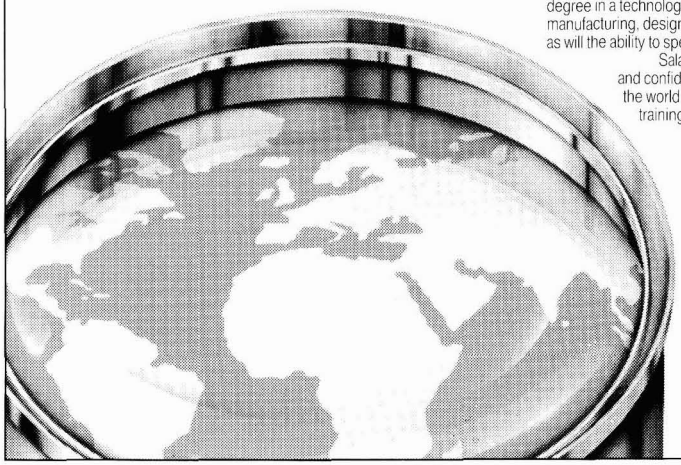

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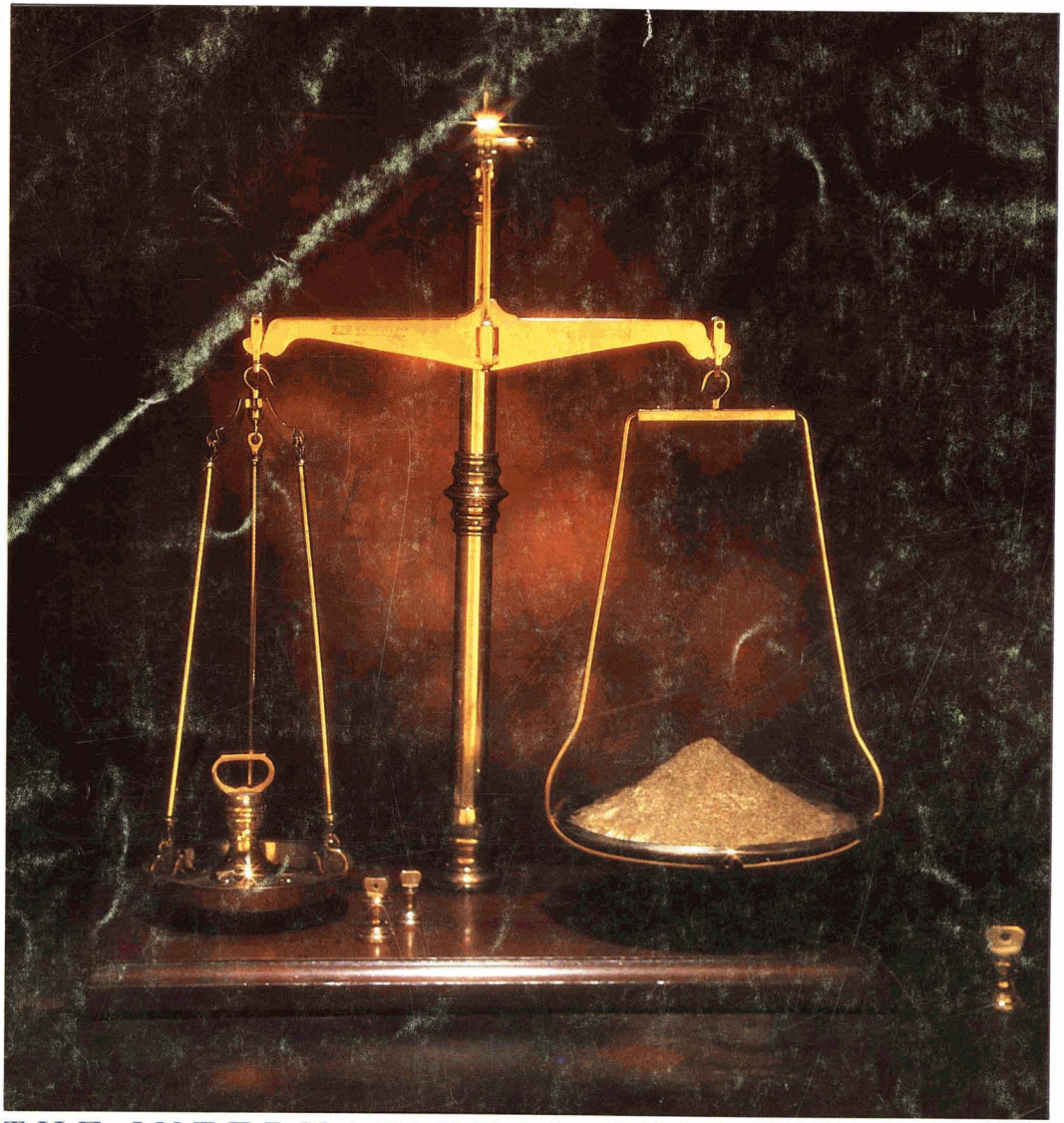

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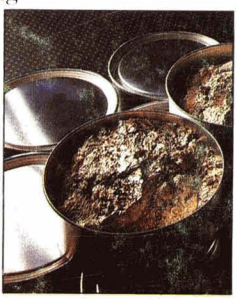

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