



JOCCA



Dr G C Fettis of ICI Paints Division giving the Keynote address at the Association's Edinburgh Conference.

This address is published in this issue.

Also in this issue are further papers from the Conference

- **Recent advances in vinylidene chloride copolymers for surface coatings**
- **Metals and metal ions in pigmentary systems**



CHLORINATED RUBBER TYPE

**CHLORINATED POLYETHYLENE
CHLORINATED POLYPROPYLENE
CHLORINATED RUBBERS
etc.**

APPLICATION

- Anticorrosive coatings
- Road marking paints
- Gravure printing inks
- Adhesives

**ADHESIVE GRADES
(Low Chlorine Type)**

**CHLORINATED POLYPROPYLENE
CHLORINATED ETHYLENE VINYL
ACETATE COPOLYMERS
etc.**

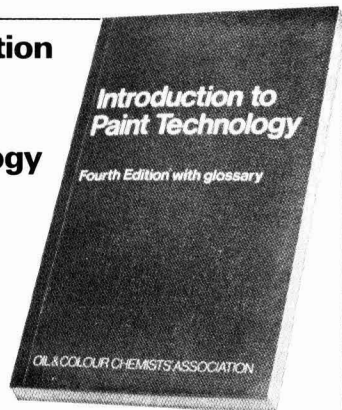
APPLICATION

- Gravure printing inks, adhesives for untreated Polypropylenes
- Primer for plastics



SANYO-KOKUSAKU PULP CO., LTD.
CHEMICALS TRADING DEPT.
 1-4-5 Marunouchi, Chiyoda-ku, Tokyo, Japan
 Telex: J 24279 SK PULP
 Cable: SANKOKUPA TOKYO

**Introduction
to
Paint
Technology**



The Introduction to Paint Technology, of which over 25,000 copies have been sold, forms an excellent introduction to the whole field of surface coatings and related technologies.

To: OCCA, 967 Harrow Road, Wembley, Middlesex HA0 2SF, UK

Please send copies of Introduction to Paint Technology at £10.00 each (inc. p&p) to the following address (BLOCK CAPITALS):

.....

I enclose remittance (payable to OCCA) for £

**A Fair Deal For
Our Advertisers**

No guesses, no wishful thinking – the circulation of this journal is audited to the strict professional standards administered by the Audit Bureau of Circulations



The Hallmark of Audited Circulation

First Announcement and Call for Papers

The use of Synthetic Environments for Corrosion Testing Co-sponsored by NPL and ASTM 10-12 February 1986

to be held at the National Physical Laboratory, Teddington, UK

The aim of the conference is to provide a forum for the discussion of the effectiveness of synthetic environments in enabling users to predict material performance.

The conference will encompass the use of any synthetic environment used for corrosion performance testing, and will include the following:

- Test solutions for studying specific corrosion phenomena such as pitting and stress corrosion cracking
- Synthetic versus natural marine and potable waters for corrosion testing
- Simulated environments for the assessment of microbial corrosion
- Synthetic 'pore solutions' to study the corrosion of metals buried in concrete
- Cabinet tests, eg salt spray
- High temperature corrosion, eg burner rigs.

Contributions

Proposals for contributions are now invited. Prospective authors are requested to submit a 200-300 word abstract by 30 September 1985, with final manuscript due by 10 January 1986, to one of the following:

Dr P E Francis
National Physical Laboratory
Teddington
Middlesex TW11 0LW
England
Tel: 01-977 3222

Dr T S Lee
LaQue Center for Corrosion Technology
P.O. Box 656
Wrightsville Beach
N.C. 28480
U.S.A.

It is anticipated that an ASTM special technical publication on the conference proceedings will be published. The papers offered should contain unpublished material, and if accepted for publication should not be submitted for publication elsewhere without the consent of ASTM. Acceptance for publication is contingent upon peer review.

JOURNAL of the OIL AND COLOUR CHEMISTS' ASSOCIATION

Hon. Editor: D. S. Newton, AMCT
CGIA, FICorrST, FIMF, FTSC

Publications Committee:

B. R. Bailey
D. B. Bannington, ATSC
P. A. Bentley, BSc
J. Bravey, CChem, MRSC
L. J. Brooke, ATSC
H. J. Clarke, FTSC
J. Coy, BA
C. N. Finlay, ATSC
S. R. Finn, BSc, CChem, FRSC, FTSC
B. F. Gilliam, ATSC
J. A. Gant, LRSC
R. G. Handley
A. C. Jolly, BSc, FTSC
P. Marr, PhD
J. S. Mason, BA
B. E. Myatt
A. J. Newbould, BSc, CChem, MRSC
R. H. Philbrick
C. Prouse
F. B. Redman, FTSC
R. C. Somerville
A. Sheath
J. R. Taylor, BSc, CChem, FRSC, FICorrST,
FTSC
G. Warman, FPISA

Editorial correspondence should be
addressed to the Hon. Editor, JOCCA,
Oil and Colour Chemists' Association
at the address below.

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

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

Assistant Editor: J. C. Setton, BSc
Annual subscription to non-members:
£65.00 (\$120), post free by surface mail,
payable in advance.

Single copies £5.50 (\$12), post free by
surface mail, payable in advance.

© Copyright 1985



Member of the
Audit Bureau of
Circulations

Contents

Vol. 68 No. 7

July 1985

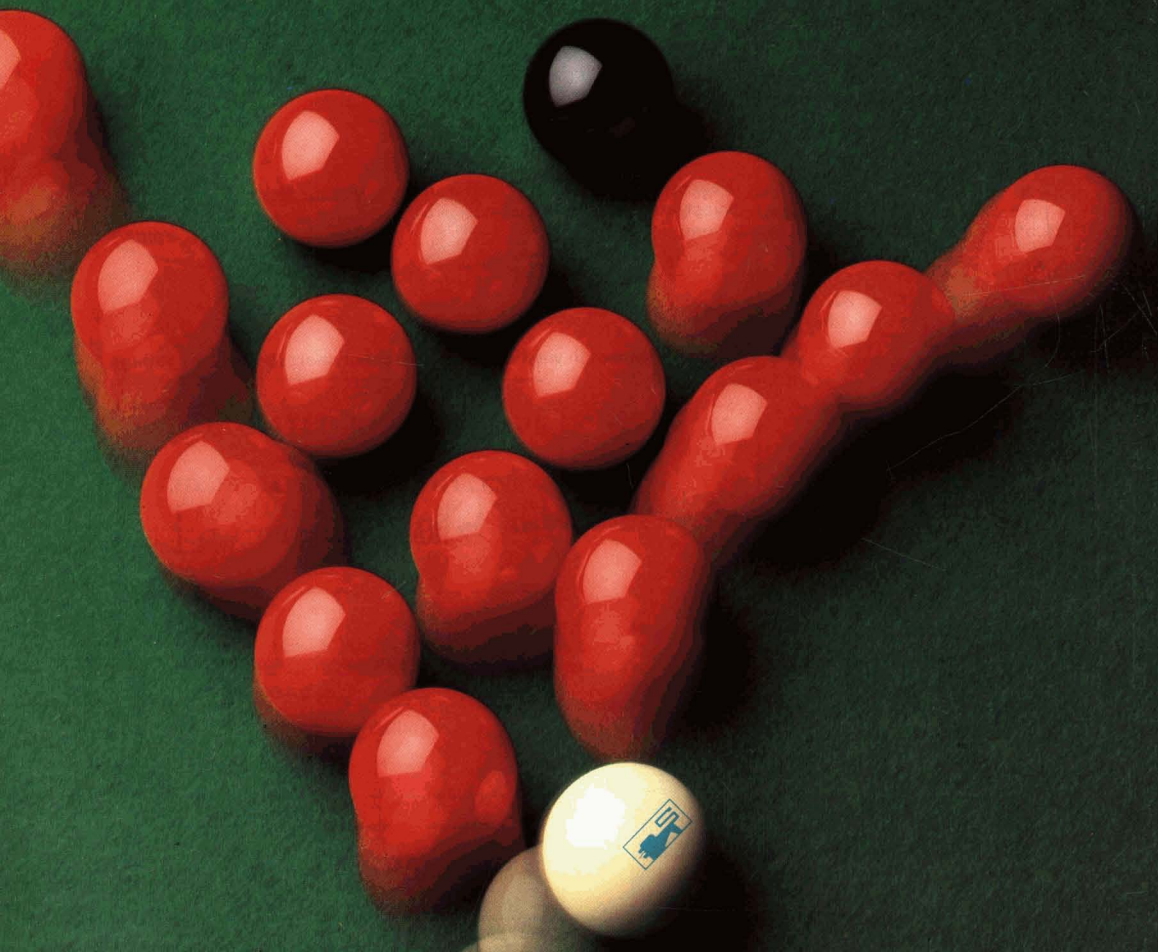
Transactions and Communications – Papers from the OCCA Conference

Keynote address to the Edinburgh Conference – New substrates, new materials, new problems?	159
<i>by G. C. Fettis</i>	
Recent advances in vinylidene chloride copolymers for surface coatings	164
<i>by B. Ellgood</i>	
Metals and metal ions in pigmentary systems	170
<i>by W. E. Smith</i>	
Next month's issue	169
OCCA meetings	174
Company visits	176
News	177
OCCA news	179

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

The Honorary Editor, the Council and the Oil and Colour Chemists' Association do not accept responsibility for opinions expressed by correspondents or contributors to this Journal. The contents of the Journal are copyright and permission to reproduce Transactions and Communications, in full or in part, must first be obtained from the Honorary Editor

Blanc Fixe Micro.[®] Brilliant. And not just in its speed of dispersion.



The remarkable Blanc Fixe Micro, by Sachtleben, performs brilliantly to reduce costs and enhance the finished product.

This new micronised extender is unique in its speed and ease of dispersion. Excellent gloss values can be obtained at a low

binder requirement and at an average particle size of only 0.7 μ m. It augments titanium dioxide, and other pigments, without the slightest reduction in opacity, gloss or covering power. And its weathering ability has been tested to the limit under widely-differing conditions worldwide.

Use Blanc Fixe Micro to save time and energy in the manufacture of primers, stoving enamels, gloss paints, powder coatings, artists' colours and printing inks. Just contact us for today's best cover story.



»SACHTLEBEN«

UK Sales Offices: 56 High Street, Edenbridge, Kent TN8 5AJ.
Tel: (0732) 863694 Telex: 95297

38A Bury Old Road, Whitefield, Manchester M25 5TL. Tel: (061) 773 2000

Sachtleben products include Hombitan[®] TiO₂, Sachtolith[®], Lithopone, Blanc Fixe, Albaryt[®] and EWO[®] grades of Barytes.

Keynote Address—New Substrates, New Materials, New Problems?

G.C. Fettis

ICI Paints Division, Wexham Road, Slough, England

Precis

The coatings industry has been faced with new problems due to the introduction of new substrates and new materials, particularly in the last five years. The changes should be viewed as beneficial because the challenge they present is leading to the development of new technologies and helping revitalise the industry.

The need for new products has brought fresh impetus on research spending which is on the increase. In part this is the reason behind the growth by acquisition of a number of paint companies which are becoming increasingly internationally based to maximise market place benefit from the research spend.

Introduction

I am very pleased to be giving the keynote address today, particularly as it marks the 50th anniversary of the founding of the Scottish Section of the Association and it gives me the opportunity of returning to my Alma Mater.

The theme of my talk—new substrates, new materials, new problems?—highlights the importance of technology in the changing environment faced by the coatings industry today. What better place to give such a talk than Edinburgh, the capital of a land which can be justly proud of the contribution its sons and daughters have made to the technological age. It is, however, worth remembering that technology alone is not enough; there must be a business initiative to go with it.

James Watt's invention of the steam engine here in Scotland, and the industrial revolution it heralded, would not have been possible without the industrialists who backed him. Alfred Nobel, perhaps the father of innovation as marked by the Nobel prizes, was fortunate enough to be both a successful inventor and industrialist. He was farsighted in his exploitation of nitroglycerine which was achieved by establishing plants around the world to gain access to world markets; his largest plant was located in Scotland. Little was he to know how this would be a lynchpin in the foundation in 1926 of my own company, ICI, and indeed through the connection with nitrocellulose, the formation of the Paints Division of ICI for whom I work.

The traditional modern day image of the innovator in the UK is of a backroom boy whose inventions are being exploited by other companies in foreign lands, particularly the USA and Japan. I hope as I develop my talk that I shall dispel that view as far as our coatings industry is concerned. Admittedly the USA has done a good job in ensuring the technology used in the industry is treated as a science, but I believe the Europeans have more than held their own in the production and commercial exploitations of inventions.

Before I go on to talk about changes in technological materials and substrates, let me say a little about their social and organisational equivalent, i.e. the people.

We are entering a new era in society at large, and in

industry in particular. The period of rationalisation is by no means over, but it has been superceded by a period of development and innovation, that makes Sir Alistair Pilkington's words¹ even more applicable today, than in 1980:

"For a company to survive it must cope with the future. For a company to prosper, it must create the future."

Futures are not created by technology alone. It takes technology and people both as employees and as customers, to make innovation happen. The approach that the new high tech companies are taking is simple. They recruit the best technical brains in the country and provide them with the right challenges and opportunities. Such companies are greatly helped by the pioneering spirit that is in the air, and the aura of excitement, mystery, as well as profitability that surrounds modern electronics and informational technology.

In our maturer businesses and technologies, it does not come so easy. That is precisely why we are faced with a particular challenge and opportunity. For we have consciously to develop our people and our culture, as well as our technology, or else we shall not have the innovation. It is as simple as that. As a business matures from its pioneering days, and passes through an era of structured management control, it then moves on to a third stage of orchestrated development—personal and cultural, as well as technological and commercial.

This is a challenge that our company has taken on. We are re-writing, and therefore creating, history. We are making research and development, figuratively, if not literally, more "colourful". Not only are we making our young researchers more familiar with the innovators in their past—Nobel is a good case in point—but we are helping them direct themselves towards their innovative futures. Through a combination of Action Learning "Innovation Workshops" and developmental groups, we are enabling them to get to grips with multi-coloured nature of business and organisational life². Also, by exposing them to new and exciting developments in the worlds of colour and design, as well as in electronics and materials sciences, we are aiming to develop the kind of magnetic attraction that pervades the high tech industry. If you like, we are paying the same kind of attention to the new substrates and materials of organisational culture, as we are giving to their development in technological terms.

Well, having ventured into realms of culture, let me return to realms of technology. What are the changes in materials and substrates that give rise to the title of my talk, and are there problems associated with the new developments?

Major Trends in New Substrates and Materials

I should like to analyse the present situation taking new

substrates and materials to be coated as one theme and then go on to talk about the new materials being developed as coatings themselves.

I should like to draw your attention to studies of The Materials Research Advisory Committee who have recently published a summary on trends in materials research³. This attempts to describe the state of the science from the perspective of workers in the field.

Relating macroscopic phenomena to microscope properties is the main scientific push. More quantitative understanding of alloying is enabling metallic and polymeric alloys to be tailored for specific purposes. New structural materials such as high modulus reinforced polymers and toughened ceramics are being developed for applications in industries such as automotive and aerospace. New techniques are being found for producing ceramics which are stable for high temperature applications replacing metals and extending the working range into temperatures higher than metals can currently operate.

The development of ferroelectric polymers is an exciting new area especially their use in the electronics industry where the trend is to build more and more powerful capabilities into smaller and smaller areas by the use of ceramics and polymeric surface coatings such as photoresists.

The development of optical fibres, firstly in glass and more recently in organic polymers, enhances the possibilities of speeding up signal transmissions in communications and other electronic applications.

Polymers with controlled, molecular weight distribution, microstructure and branching are becoming available so enabling greater control of rheology and assisting the art of polymer processing in fibre, bulk, e.g. material composites, and coatings applications, e.g. video tapes.

Much of these are in highly specialised applications requiring special coatings technology, either for creating the new materials as such or to protect them once made.

On the more mundane front, conventional plastics and more highly developed composites are being further used to replace metal in automotive and general industrial applications such as cans, bottles, computer housing, garden furnishing, etc. There are a number of driving forces for this but energy saving is the main one.

The metal-based industry and its customers are not sitting idly by either in finding improved, cost effective use for metals. For example, the use of tin-free steel for can production, wider use for Galvalume, for coil applications and galvanised metal for automotive production. Also development of cold forming from coil steel and stamping from coil. Not least there is the evolution of new alloys, e.g. lithium aluminium for aircraft.

In considering trends, one cannot ignore the market for decorative paint which accounts for about half of the paint industry. Here, as we all know, the construction industry has tended to move away from surfaces requiring paint to unpainted plastic, brick and concrete. The latter has of course been widely used in construction not only of buildings, but bridges and other civil applications. It is ironic that widespread failure of such structures has begun

to happen, in some cases due to the additives used in the concrete, but in many other cases due to atmospheric attack which can be prevented by coatings.

Also, given the reduction in painted areas, there has been a trend to highlight those painted surfaces that remain either by movement from whites to colours, or to textured paints or novel decorative effects.

Finally, environmental pressures cannot be ignored, from the legislation against solvent pollution due to smogs and smell or, more recently, accusations of killing off Europe's forests. There are the dangers to human life from lead, chromium and solvents such as glycol ethers, and even white spirit is coming under the spotlight. These pressures are leading to the development of new driers for paint, new lead- and chrome-free anticorrosive pigments and a push towards the use of waterborne systems requiring the development of new resins for binders and curing agents.

New Coatings Technologies

I shall concentrate on paint applications with some mention of related fields such as inks, adhesives, packaging and electronics.

Decorative Paint Market

After a period of comparative stagnation, there is now a definite upswing in innovation in this market driven by the modest growth prospects of the market and paint producers fighting against the trend towards products becoming commodities. Undoubtedly, here in the UK, Berger's Paintmate and Crown's Matchpots gave a fresh awakening to the market. My own company, ICI, has had unprecedented success in the last three years with the introduction of natural whites, i.e. pale shades of white which successfully persuaded a significant sector of the market to use coloured rather than white paint. Furthermore, on a more practical note, ICI's introduction of solid emulsion as a new convenience paint has created another new market sector in the UK and elsewhere.

Woodstains, widely used in Europe, particularly Germany, are on the upswing in the UK with aesthetic appeal and natural look as the selling points in addition to the more traditional wood preservation theme.

Elimination of lead in paints must not go unnoticed since this is seen as an important step in preserving the public image of paint as a desirable substance which upgrades the standard of life rather than detracting from it.

On a more deeply technical note, developments in emulsion paints particularly gloss paints need special mention. Countries such as the USA and Australia moved to emulsion systems some years ago, away from traditional solventborne alkyds. This trend is beginning to gather momentum in Europe because of worries about the toxicity of white spirit mainly stemming from Scandinavia. The use of emulsion paints for exterior applications requires adhesion promotion technology to ensure the paint continues to adhere in wet conditions. Rohm & Haas has for many years been a leader in this field in the USA. More recently, technologies have appeared from other companies such as Alcolac in the USA, and my own company and Hoechst in Europe. Simplicity is the key factor here as, increasingly, third world countries are moving into the

more sophisticated end of the decorative market and it is important that the technology will travel.

Starting from the solventborne end, Crown have patented a process for replacing some white spirit through emulsification with water⁴ and Scandinavian producers have developed mixed latex alkyd systems.

A wide variety of textured paints are now available, particularly in continental Europe and Japan. Most are for purely decorative applications, particularly for use on ceilings and walls of public buildings. Some are being used to cover cracks and damage on walls, including exterior use where extensibility of the paint film to avoid reformation of the cracks is one of the main selling points.

Protective paints for concrete are being more widely used, both by coating the reinforcing metal as well as the concrete itself.

Other developments in emulsion paints concerns the latex itself. Process developments include Crown's continuous loop process and pressure processes which enable the use of ethylene to plasticise the latex.

In recent times, there has been a move to upgrade PVA latex to achieve acrylic-like performance at lower prices both for interior and exterior applications.

Of course not all of these developments are driven by changes in the substrate as such, but many arise from a desire to make the substrate look different as well as the ever increasing pressure to reduce environmental pollution.

Industrial market

Automotive

Perhaps the focal point of the industrial market is the automotive industry. The industry worldwide has now almost completely adopted cathodic electrocoat led by PPG as a producer who has recently introduced a high build version called Uniprime. Cathodic electrocoat has won out over anodic because of better corrosion protection, thus extending vehicle lives and preserving energy and raw materials. Either directly or through licencees such as my own company, International Paint, BASF and Nippon Paint, PPG's technology has captured more than half the world's automotive primer market. Only Hoechst, and to some extent Kansai, have been able to develop a wholly independent technology of their own.

Pretreatment technology has also been on the move to develop systems suitable for use under cathodic electrocoat. Also the increased use of mixed metals has made the duty more demanding. In the UK, low temperature pretreatment has been adopted.

In the automotive topcoat area, the USA is moving down the road of adopting high solids paint systems to comply with environmental pollution regulations. My own company has countered with a waterborne basecoat which enables the regulations to be met whilst, at the same time, preserving the very good appearance of low solids solventborne paints, not possible with high solids solventborne systems. We are hoping for widespread use of the new system in Europe, and also in the USA through project Saturn, the new small car project of General

Motors. The new basecoat has been made possible by our understanding of factors affecting rheology in waterborne systems. The system can be used in both metallic and solid colours. The drying of the basecoat is not as sensitive to changes in atmospheric humidity as the conventional one-coat systems developed some years ago for use in the Western United States. The development of a new drying technique which uses a hot air blow across the profile of the vehicle enables high production line speeds to be attained. Of particular interest is the feasibility of using a high solids two-pack solventborne clearcoat over our basecoat, which gives outstanding appearance and further reduces solvent emission compared with conventional clearcoats.

Increased use of plastic has necessitated the development of special primers and flexible finishes, particularly clearcoats. The trend is to paint plastic parts in body colour, for which our new waterborne basecoat is well suited.

The need to transfer parts from factory to factory has brought a demand for better temporary protectives for unpainted steel. Better temporary coatings also have scope for replacing wax to protect painted cars in transit and ICI has developed new non-ionically stabilised, aqueous-based technologies for these duties with the advantage of easy removal by a weak alkaline rinse.

Refinish

The improvements in appearance in original car finishing brought about by the widespread adoption of metallics and basecoat clear systems has created the need for better appearance refinishes such as 2K systems including basecoat clears. The trend now is for higher build products to further improve appearance and reduce the number of coats required. Refinishes for plastic parts have also had to be developed. There is increasing concern worldwide about the toxicity dangers from using isocyanates, particularly in refinish paints and one or two companies including ICI have marketed an isocyanate-free 2K product.

Can

The technology for producing cans is always on the move. Perhaps the most significant change has been the adoption of waterborne lacquers, particularly for the internals of beer and beverage (mainly aluminium) cans in the USA where Glidden is dominant as a supplier. The adoption of welded cans has required the development of new side-seam lacquers including powder coatings. The move to low tin steels calls for extra protection from coatings. Most significant of all is the recent move to plastic for rigid containers, e.g. for paint, and the prospect of adopting plastic cans for parts of the beer and beverage sector. Here the coatings' needs have yet to be developed.

Coil

Aqueous industrial paints as a whole have not developed as rapidly as had been expected, mainly because of cost and application problems. The Can and to some extent the Coil market have led the way. Glidden has been in the forefront of the developments. My own company has recently introduced a new waterborne coil primer for Galvalume in Australia, with better application properties and lower cost than solventborne systems. The product is based on a new technology developed by Dulux Australia which we call Complox because it is a composite polymer latex system.

We are developing other industrial applications for the technology. The development of cold forming primers and more corrosion-resistant, flexible solventborne systems should be noted thus enabling coil to be used more widely in industrial applications. There is a need for a good high build replacement for plastisol coatings to improve exterior durability.

General Industrial

Electrocoat technology has continued to make inroads into the industrial market because of the high efficiency of the paint application process and the good protection it affords. For example, triborne paints have been replaced in the UK by high throw electrocoats for painting radiators. High build one-coat systems are being used for heavy duty applications such as scaffolding poles and, of course, cathodic electrocoat is now generally used for automotive parts, including wheels. Lower temperature curing versions of electrocoat are being sought and some companies are developing room temperature curing systems. A wider range of colours have also been developed for one-coat finishes. Quite a number of companies are active in this field including PPG, Glidden, Sherwin Williams and Valspar in the United States, and ICI, IP, BASF and Hoechst in Europe. Developments in pretreatment for metal substrates have kept pace, particularly for use under cathodic electrocoat, and over new combinations of steel with galvanised metal. Low temperature processes have also been developed.

Powder coatings have begun to show substantial growth again after a somewhat static period. Coaters are taking the opportunity of switching to powder when they install new application plant, particularly for stoved industrial finishes. Powder production is being concentrated by paint producers into economically sized plants and more producers are contemplating in-house resin production to further improve the economics. Thinner films are now possible but reduction of the stoving temperatures is a difficult, though desirable, target. Some of the new substrates such as ceramics lend themselves to powder coatings.

Plastics are being widely adopted as a substrate for industrial products either as part of, or the whole of, the fabricated article. Computer housings are an interesting example where suitably textured coatings have been adopted to disguise the move from metal housings.

Plastic has brought a greater driving force towards low temperature curing processes such as electron beam, e.g. for magnetic tape, or UV for printing. Another driving force to such processes is lower energy usage and convenience such as for Woodfinishing. In addition, the Vapocure process is now attracting quite a lot of attention for energy saving.

Again, temporary coatings have lots of potential industrial applications, both for painted and unpainted substrates.

An interesting substrate oriented development in the waterborne area is the use of ICI Haloflex PVdC technology for wet blasted steel.

Pigments and Additives

With the suspect toxicity and undesirable colour of so

many of the established anti-corrosive pigments (chromates, red lead), the search for effective near-white alternatives has a new lease of life. Quite a number of candidates have emerged from suppliers like Bayer and more recently from the BP labs. The latter work on an ion-exchange basis which it is claimed lock corrosive ions into the film before they can reach the substrate and release anti-corrosive products—but only as they are required. You may also have seen activity in new phosphates from Japan and nearer home, e.g. aluminium triphosphate.

On the novel effects front, the long-established pearlescent pigments have been prominent. Unlike their earlier counterparts, the new grades offered by Merk and Merl claim to have much improved durability and we know that grades from Merl are finding limited use to provide enhanced metallic-like effects in a few US auto-colours.

There is still no white pigment better than Titanium Dioxide but it is interesting to see a least one major supplier knocking at the door with what seems to be a viable alternative to the well-entrenched automotive/premium grade; a position previously held solely by DuPont's Tioxide R960.

A number of technologies are continuing to be developed to reduce TiO₂ pigmentation costs, e.g. by incorporating air in the polymeric particle such as Rohm & Haas or Spindrift technology ex ICI-Dulux Australia⁶.

As always there has been a plethora of new additives for paint from resin and other companies. Here I believe the Rohm & Haas technology for thickening decorative latex paints is well worth a mention.

Electronics

A number of specialist applications for coatings have emerged in the electronics field. The move to plastic housings for computers in some cases require EM shield coatings. The building of electronic circuitry itself is an ever increasing opportunity for coatings such as photoresists. The increasing demand for taped video reproduction and the move to electronic colour production is calling on chemistry from film formation through to enhanced dispersion, e.g. of ferrites. Ceramic films are also being developed in competition with organic polymers in the electronics field. The related field of fibre optics is also moving apace with the need for a protective coating on the outside of the fibre where DeSoto is a leader.

Adhesives

The emerging use of plastic and composites as structural materials is bringing with it the need for new adhesives to stick parts together. Closer to the public's interest, the unfortunate trend to glue-sniffing has brought the need for good waterborne adhesives to replace the traditional solventborne systems. One-pack systems are being developed with the performance of two-pack. Having made these points, I feel I am not sufficiently knowledgeable about this important market to do it justice.

Inks

Again, this is a very specialised market which in some ways has not achieved its full potential, dare I say it, through lack of technical input. The picture has been changing with the

developments in plastic packaging ranging from films to bottles and cans. Waterborne paint is increasingly being sold in plastic containers. There has been a need to tailor inks to suit these applications with UV curing as an important development area, also waterborne systems are emerging for use on a variety of substrates including paper as well as plastic. Screen printing of electronic circuits and components has developed as an important specialised section of the market.

Again, these are no more than passing comments which those of you who are much more deeply involved in the market would wish to expand and perhaps contradict.

Problems

I hesitated at talking about problems as I feel that to list a great string of difficulties would set the wrong tone for this meeting. However the word appears in the title of my talk so I feel I must highlight some areas where clearly the changes I have outlined do pose problems for the industry as well as opportunities. One challenging technical problem is the use of mixtures of metal and plastic components in fabricating motor vehicles and other articles. In the initial applications, the plastic parts were mainly painted off line and were not a body match, but there is a clear move towards the requirement for the plastic to be a good match to body colour, and in line painting must eventually become the norm. This requires the development of paints which are suitable for both plastic and steel in their mechanical properties and which have a sufficiently low curing temperature not to damage the plastic.

In-mould primers and other specialised primers are being developed to produce a smooth plastic surface for painting with good adhesion.

The increasing legislation on control of toxic materials is having an increasing impact on the paint industry in narrowing down the existing raw materials available to it and requiring expensive toxicity notification and clearance of new materials, thus raising the costs of research.

Furthermore, the introduction of new substrates and new paint technologies, whilst retaining most of the existing materials, is stretching the technical and production functions in the industry. For this reason, and the need to spread overheads generally, there is a continued trend for companies to expand by acquisition. Recent noteworthy examples of this are the purchase of Mobil by Valspar in the USA, the acquisitions by PPG in Europe and the further expansion in Europe by my own company through the acquisition of Holden and Valentine France. These moves in acquiring companies which are well recognised paint producers in their own right, mean a considerable effort must get into developing a suitable style of management which, on the one hand, ensures national strengths are maintained and, on the other, that full advantage is taken of the benefits of belonging to a large group.

Expenditure on research in general is on the increase again, particularly in the USA and Japan. As far as my own company is concerned, we have been stepping up the expenditure on coatings research whilst at the same time much more closely managing the research done throughout the ICI World Group of paint companies. With the internationalisation of a number of our main industrial customers, we have seen the need to ensure that at least

half of our research targets are international in nature whilst the other half are aimed at local markets, at least in the first instance. Here again, there is a need for a suitable organisation to manage our research portfolio.

I do this on a day to day basis and by holding an annual international research conference which reports to an international steering committee on which I also sit. This latter committee is responsible for setting the overall strategy of the ICI World Paint Group. A number of other business and functional international committees also report to it. These arrangements ensure that the management of such a diverse group as ICI, which could be a problem, is developed as a strength.

Concluding Remarks

In the time available, I have only been able to skim the surface as the detailed effect of changes in substrates, and increases in the standards of protection required, is very large indeed.

On reflection, I have cheated somewhat in using the theme of my talk namely new substrates and new materials as the focal point for change. Whilst these are clearly important, other factors are also dominant, particularly the drive for economic survival in the industry and its customers, and the impact of environmental legislation on both customers and the coatings producers.

Undoubtedly change is afoot in the paint industry, not only in the technology but also in the structure of the industry, as companies continue to form themselves into larger groups by acquisitions or other forms of alliance.

As always, the industry will survive by rising to the challenges with which it is presented from whatever source, including the impact of new substrates and new materials.

The words of Sir Walter Scott⁷ rallying volunteers in defence of Edinburgh give me an appropriate ending for my talk in relation to the challenge faced by the coatings industry:

*"To horse! To horse! The sabres gleam;
High sounds our bugle call;
Combined by honour's sacred tie;
Our word is Laws and Liberty!
March forward, one and all!"*

[Received 15 January 1985]

References

1. Valentine, L.M., *JOCCA*, 1981, 64, 338.
2. Lessem, R., "Management Development: Advances in Practice & Theory," edited by C. Cox & J. Beck, John Wiley & Sons, 1984; 223.
3. Materials Research Advisory Committee, National Science Foundation. "Trends & Opportunities in Materials Research", 1984.
4. BP 2,077, 746A.
5. European Patent 13,478B.
6. Chalmers, J. R. and Woodbridge, R. J., *Air and Polymer Extended Decorative Paints*. PRA 5th International Conference, London 1983.
7. Sir Walter Scott, *War Song of the Royal Edinburgh Light Dragoons*.

Recent advances in vinylidene chloride copolymers for surface coatings

B. Ellgood

Scott Bader Company Limited, Wollaston, Wellingborough, Northampton NN9 7RL, England

Summary

There has been a recent revival in interest in vinylidene chloride (VdC) copolymers as binders in surface coatings systems. This paper updates some thirty years of development work on vinylidene chloride copolymer emulsions and will explore some of the useful properties conferred by VdC. These include water vapour permeability controllable down to very low levels, fire retardancy and high resistance to hydrolysis. The anomalous T_g -composition relationship in VdC/acrylate copolymers—are discussed in relation to its effect on formulation of surface coatings. Potential difficulties with the use of high VdC content copolymers, such as colour development on degradation will also be discussed. Finally surface coating formulation variables when using VdC copolymers will be considered.

Introduction

Vinylidene chloride copolymers have been commercially available since 1939. The author's company has been engaged in a development programme on vinylidene chloride copolymer emulsions since 1957. Yet, until recently, these polymers remained relatively little known, and are sometimes considered to pose problems.

This paper will examine the perceived problems with the manufacture and use of vinylidene chloride copolymers, will show the extent to which they have now been overcome and will indicate ways in which some of the properties of vinylidene chloride copolymers are beneficial in the formulation of surface coatings.

Two problems will be examined; those of colour development in vinylidene chloride copolymers and the toxicology of the monomer. Benefits examined will include the barrier properties of vinylidene chloride copolymers, the high levels of gloss they can confer to surface coatings, their 'anomalous' glass transition temperature behaviour, the flame retardance that vinylidene chloride copolymers can provide to coatings systems and their high level of hydrolysis resistance.

Problems

Discolouration

It has been shown¹ that polyvinyl chloride begins to discolour after the evolution of only 0.01 per cent hydrogen chloride from the polymer. Hydrogen chloride is also evolved from high vinylidene chloride content copolymers when they degrade, and this is one reason why manufacturing plant for high vinylidene chloride content copolymers needs to be glass-lined or the appropriate grade of stainless steel.

Colour development in vinylidene chloride copolymers is believed to be caused by this dehydrochlorination, giving rise to conjugated unsaturation.

It is suggested² that five or more conjugated units are

necessary for discolouration and that the reaction tends to zip along the chain of vinylidene chloride units once it has been initiated, as the chlorine attached to a double bond tends to activate the next vinylidene chloride unit. Clearly this zipping will not continue through the comonomer groups. Thus to obtain a polymer with perfect colour stability, there should be no repeat sequences of more than four vinylidene chloride units.

If the reactivity ratios of vinylidene chloride and the comonomer r_1 and r_2 are known, the sequence length distribution can be calculated. Ideally in a batch polymerization, r_1 and r_2 should be equal to one to get the most even copolymer and hence the smallest chance of long repeating units of vinylidene chloride.

In work reported³ in 1965, it was argued that r_1 and r_2 were both less than one for vinylidene chloride and common acrylate ester comonomers in emulsion polymerisation. For example, for vinylidene chloride/ethyl acrylate 2, $r_1 = 0.5$ and $r_2 = 0.8$ approximately. Figure 1 shows a plot of the instantaneous average sequence length for the vinylidene chloride/ethyl acrylate copolymer and it can be seen that at about 50 per cent

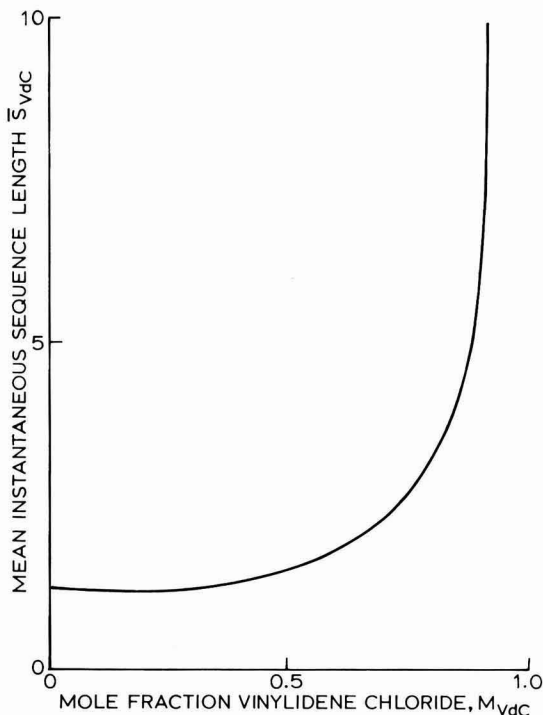


Figure 1. Average instantaneous sequence length vinylidene chloride $r_1 = 0.5$ /ethyl acrylate $r_2 = 0.8$

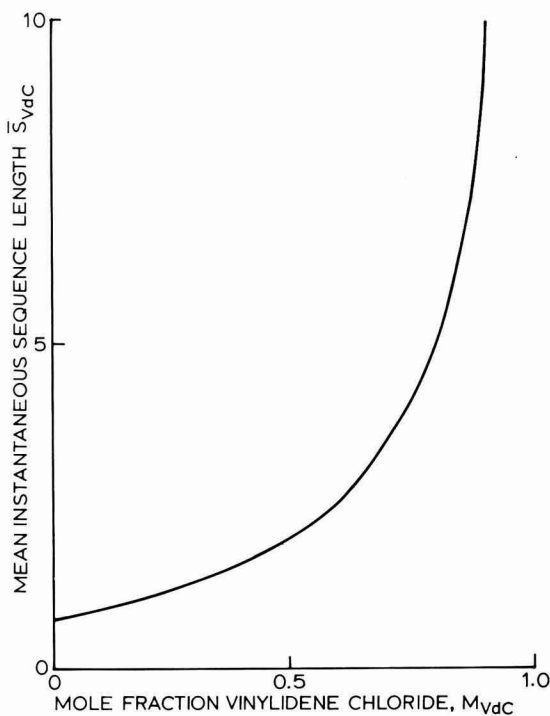


Figure 2. Average instantaneous sequence length vinylidene chloride $r_1 = 1$ /ethyl acrylate $r_2 = 1$

vinylidene chloride content only 1 per cent of the monomer is found in sequences of five or more repeat units. More recent work⁴, however, where improved methods for calculating reactivity ratios have become available, tends to indicate that $r_1 = 1$, $r_2 = 1$. Figure 2 shows the effect on instantaneous sequence length for this case.

It is thus possible to design vinylidene chloride copolymers where the possibility of long sequences of vinylidene chloride units is minimised, and with this approach discoloration in the polymer is markedly reduced, while still maintaining many of the beneficial effects of vinylidene chloride as a comonomer. Pigmentation also can assist in reducing discoloration in paint films and this will be discussed later.

Toxicology

Following the concerns expressed recently over the toxicity of chlorinated hydrocarbons, a substantial number of studies⁵ has been made over the last fifteen years on the toxicology of vinylidene chloride monomer. All these studies indicate that vinylidene chloride does not present a significant cancer risk, but is fairly toxic to the liver and kidneys of some animals. The LD50 for rats is 1500 mg/Kg⁵, which indicates a relatively low level of acute oral toxicity.

The relative safety of vinylidene chloride is also illustrated by the lack of adverse health effects found in a health survey study⁵ on 138 employees exposed to up to 70 ppm⁶ over the period 1945-1973.

Improvements in environmental controls have ensured that polymer manufacturers plants are able to operate at

lowering threshold limit values — which in the USA, for example, are now at a recommended time weighted average of 5 ppm. Similarly, improvements in manufacturing techniques have allowed vinylidene chloride copolymer emulsion producers to reduce substantially residual monomer levels in their products.

There is, thus, very little chance of the user of a vinylidene chloride copolymer emulsion being exposed to concentrations of vinylidene chloride vapour above the TLV. Manufacturers of vinylidene chloride copolymers will generally assist their customers in monitoring environmental conditions.

Benefits

Barrier Properties

Vinylidene chloride copolymers provide the highest barriers of all common polymers to gases and to water vapour. Barrier properties are broadly proportional to vinylidene chloride content and the best barrier properties are exhibited by polymers having the practical maximum vinylidene chloride content of 90-93 per cent. While gas barrier (e.g. to nitrogen, oxygen and carbon dioxide) properties are possibly more significant in flexible packaging applications, the water barrier properties are also significant in surface coatings — for example in metal primers. A combination of barrier properties and hydrolysis resistance (qv) contributes to the excellent exterior durability of paints based on vinylidene chloride copolymer emulsions. Table 1 shows the moisture vapour transmission rate of some copolymers used for coatings⁷.

Table 1

Polymer	MVTR
Barrier type vinylidene chloride copolymers	0.6-2.2
Vinyl chloride-vinylidene chloride-acrylate copolymers	20
Alkyds and modified alkyds	100-250
Styrene-acrylic copolymers	~1000
Styrene-butadiene copolymers	1100-1900
Acrylic copolymers	1200-2500

MVTR is moisture vapour transmission rate measured at a relative humidity difference of 90 per cent and a temperature of 100°F.

Rate is expressed as g.001²/m²/day.

Comparison of the figures for high barrier vinylidene chloride copolymer coatings and acrylic copolymer coatings indicates how it is possible to formulate copolymers with an extremely wide range of permeability to water vapour.

Gloss

The high refractive index imparted by vinylidene chloride to copolymers⁸ enables the formulation of surface coatings which show higher measured gloss levels, at equivalent pigment volume concentrations, than paints formulated with other copolymers⁹.

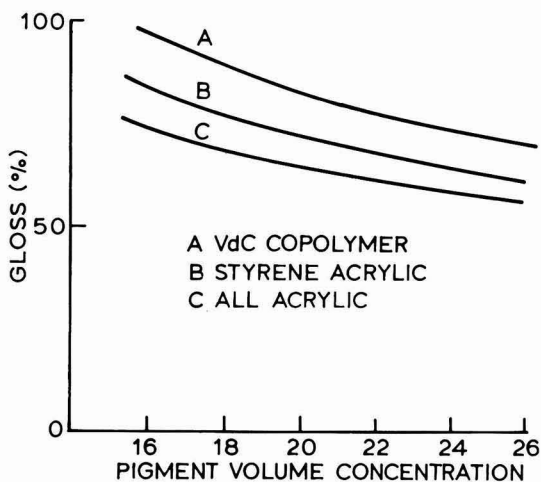


Figure 3.

Figure 3 shows a comparison between a vinylidene chloride copolymer and typical styrene-acrylic and all-acrylic copolymers. This important property assisted the formulation of commercial water-based gloss and semi-gloss paints at the beginning of the seventies; vinylidene chloride copolymers remain excellent binders for gloss and semi-gloss systems but work still needs to be done on thickeners and flow-aids for these systems.

Glass Transition and Minimum Film Formation Temperatures

The use of vinylidene chloride copolymer emulsions as surface coatings makes a knowledge of such fundamental properties as glass transition temperature and minimum film formation temperature and the relationship between the two of vital importance. The manner in which the nature of the surfactant in the emulsion and the composition or polarity of the copolymer modifies such relationships is also of importance to emulsion formulators. Deformation of the polymer is necessary for the process of drying and coalescence to take place. Since deformation occurs, the minimum film formation temperature ought to be at or close to, the glass transition temperature. For surface processes, however, which involve surfactant, water, and the polymer/water interface, the polarity of the polymer and the nature of the surfactant would be expected to affect the temperature at which film formation occurs. And this may be considerably different from the glass transition temperature. Vinylidene chloride/methyl acrylate and vinylidene chloride/ethyl acrylate copolymers have been studied^{3,8} for this effect. Two series of copolymers of varying composition were prepared for each system. The two series differed only in the nature of the surfactant used. One contained a mixed anionic and non-ionic surfactant, and the other was prepared with the anionic type alone. Measurements of glass transition temperature was by refractive index.

The minimum film formation temperatures were determined by coating the emulsions onto an aluminium temperature gradient bar and determining the temperature at which a continuous strong film formed. Figures 4 and 5 show the results of the glass transition temperature,

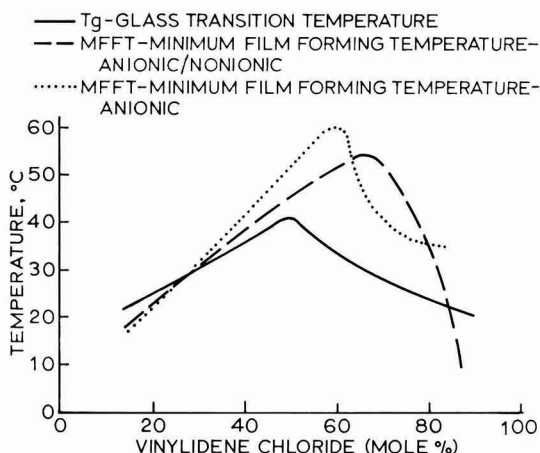


Figure 4. Vinylidene chloride/methyl acrylate

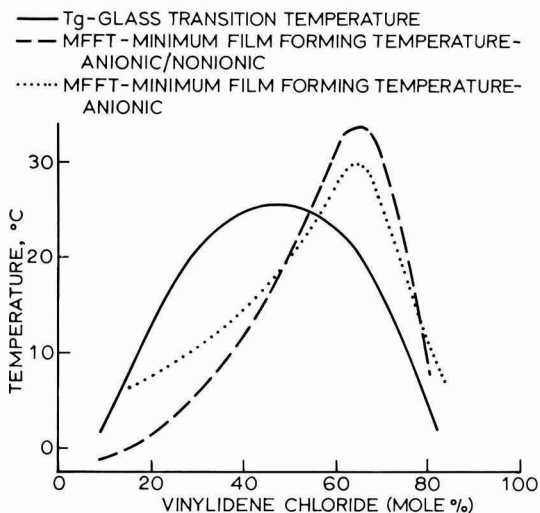


Figure 5. Vinylidene chloride/ethyl acrylate

together with the minimum film formation temperature for the systems studied. These show that the glass transition temperature of copolymers of vinylidene chloride/methyl acrylate and vinylidene chloride/ethyl acrylate do not fall on a line joining the Tgs of the two homopolymers, but rather pass through a maximum at 50 mole per cent vinylidene chloride, a result confirmed by other workers^{10,11}. This is probably due to restriction of free rotation of the ester groups by adjacent chlorine atoms in neighbouring vinylidene chloride units. This is likely to be at a maximum where there are equimolar amounts of the comonomers present provided no long sequence of either unit occurs in the copolymer. The minimum film forming temperature is found to differ quite considerably from the glass transition temperature and in fact only coincides with it at certain compositions. It may lie several degrees above or below the glass transition temperature depending on the composition of the copolymer. The minimum film forming temperature composition curve is of similar shape to the

glass transition temperature composition curves for the systems studied. The differences between the minimum film forming temperature and the glass transition temperature appear to shift from negative to positive as the hydrophilic nature of the copolymer decreases. Formulation with the appropriate surfactant thus, for example, permits the formulation of copolymers having minimum film formation temperatures noticeably below the T_g and which could be expected to be resistant to 'blocking' or 'checking'.

The copolymerisation of essentially hydrophilic groups, such as unsaturated acids or cross-linking agents, also has a noticeable effect on the T_g /minimum film forming temperature relationship.

Fire Retardance

Vinylidene chloride monomer has 73.16 per cent chlorine content. This very high chlorine content contributes greatly to reduced flammability of copolymers of vinylidene chloride. Over the past few years the flammability and smoke generation of vinylidene chloride copolymers has been extensively studied^{12,13}.

When vinylidene chloride copolymers are burnt they give off hydrogen chloride and other gases, smoke and leave a residue of char. The amount of these varies with the vinylidene chloride content of the copolymer and the amount of char, for example, appears to be proportional to the vinylidene chloride content of the polymer — a feature that proves helpful in the formulation of intumescent coatings.

However valuable resistance to flammability may be, it is well known that in many fires it is smoke, rather than flame, that kills. Much work has accordingly been done on smoke suppressants for vinylidene chloride copolymers. It has been found¹² that metal oxides such as zinc and iron oxides, and metallo organic compounds such as vanadyl acetoacetate had profound effects on smoke generation — as measured by light transmission — even at concentrations as low as 1 per cent on polymer weight. Interestingly, well known "fire retardant" additives such as alumina trihydrate and antimony oxide show little effect.

Examining copolymers of vinylidene chloride and ethyl acrylate in terms of the Limiting Oxygen Index, it can be seen from Figure 6 that the copolymers themselves will only start to reduce the flammability of systems at vinylidene chloride contents greater than 60 per cent. Here, however, antimony oxide does show a synergistic effect, enabling the readily available 40-60 per cent vinylidene chloride content copolymers to be formulated into very effective fire-retardant paints.

In conjunction with the correct formulating ingredients, therefore, vinylidene chloride copolymers form the basis not only of fire retardant surface coatings but of fire retardant textile compounds, foam coatings, adhesives and sealants.

Hydrolysis Resistance

Intermediate vinylidene chloride copolymers show high levels of hydrolysis resistance at least comparable with the best conventional paint emulsions. Figure 7 shows the

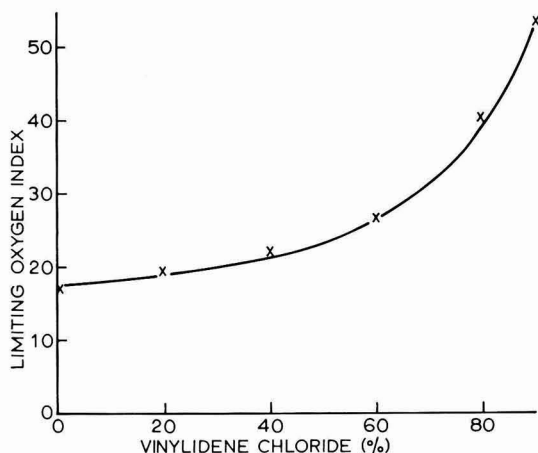


Figure 6. Copolymer composition and limiting oxygen index in vinylidene chloride/ethyl acrylate copolymers

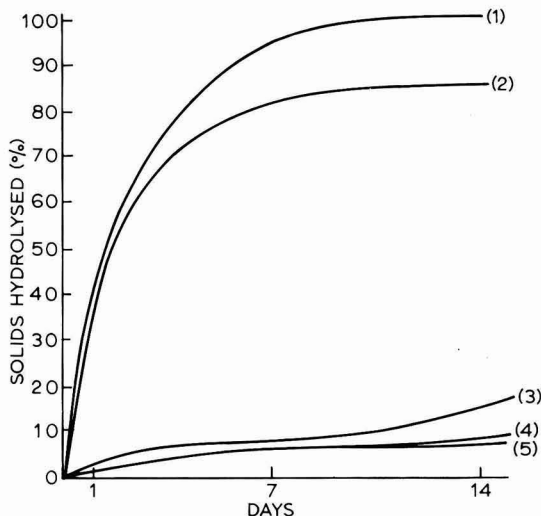


Figure 7. Hydrolysis resistance of polymers

results of hydrolysis resistance of various copolymers. Two high quality paint emulsions were compared with a vinylidene chloride/ethyl acrylate copolymer and two vinyl acetate copolymers were also included for comparative purposes.

The copolymers used were: 1) vinyl acetate/2-ethyl hexyl acrylate 85:15 2) vinyl acetate/tetradecene 90:10 3) all acrylic copolymer 4) vinylidene chloride/ethyl acrylate 50:50 5) styrene-acrylic copolymer. The hydrolysis resistance was determined by mixing the latex with an excess of sodium hydroxide at 20°C and back-titrating with hydrochloric acid.

The good hydrolysis resistance is again attributed to the steric effect where the ethyl acrylate group is protected and

hydrolysis is inhibited, thus enabling the vinylidene chloride copolymer to exhibit hydrolysis resistance at least comparable to the best comparable conventional paint emulsion — the styrene-acrylic.

This property, taken with the low but easily varied moisture vapour permeability mentioned earlier, enables the formulation of exterior paints with very good weathering resistance.

Formulating with vinylidene chloride copolymers

In this final section the way in which some of the beneficial properties of vinylidene chloride copolymers can be incorporated into paint systems will be examined. Commercially available surface coatings grades, such as the Polidene® range of vinylidene chloride/acrylate copolymers from Scott Bader or the Haloflex® range of vinylidene chloride/vinyl chloride/acrylate copolymers from ICI do not require special formulating techniques. A limited range of thickeners works well in these systems but alkali soluble acrylics, inverse-emulsion acrylics and urethane thickeners are all effective.

General formulations for gloss and semi-gloss, and chemical resistant formulations have been described previously¹⁴. By now 20-year exposure results are available on some of these systems and these tend to confirm the excellent weathering properties of vinylidene chloride copolymer based paints. They also confirm the 'bleaching' effect on vinylidene chloride copolymers given by titanium dioxide pigments in the presence of sunlight.

Three starting point formulations will be described which employ some of the properties described earlier.

High build coating

This starting point formulation employs Polidene® 33-080, an intermediate vinylidene chloride content copolymer, but formulated to have a low Tg and minimum film formation temperature. The useful properties of fire retardance, high moisture vapour barrier and good resistance to hydrolysis, enable the formulation of coatings for flat roofing which resist 'puddling' and are fire retardant on many substrates. These tough, durable coatings achieve a Class 1 surface spread of flame rating on many substrates when tested to B.S.476 : Part 7 : 1971.

	Parts by weight
Polidene® 33-080	53.00
Water	9.80
Propylene Glycol	2.16
Acrylic Thickener (35% solids)	3.03
Antifoam	0.23
Acrylic Dispersant (40% solids)	0.23
Carbonated Talc	26.36
Antimony Oxide	4.15
Triethanolamine	1.04
PVC 27%, Solids content 60.5%	

Very high build coating

Coatings for the fire protection of structural steelwork can

be formulated using expanded fillers such as Perlite and an intermediate vinylidene chloride content copolymer having a rather higher Tg and minimum film forming temperature, such as Polidene® 33-075. The resulting composition dries slowly to give a tough, water and fire resistant coating.

	Parts by weight
Polidene® 33-075	22.50
Water	11.00
Antifoam	0.50
Coarse Perlite	4.00
Fine Perlite	3.00
Ground Limestone	53.50
Antimony oxide	2.00
Hydrated lime	2.00
Propylene glycol	1.00
Low viscosity hydroxyethyl cellulose	0.50
Solids content 78%	

Fire Retardant Paint

The fire retardance and high intrinsic gloss given by vinylidene chloride copolymers enable the formulation of fire retardant paints, at gloss levels up to about 50 per cent, which will pass Class 1 in B.S.476 : Part 7 : 1971.

A starting point formulation would be:

	Parts by weight
Polidene® 33-075	56.00
Acrylic Dispersant (40% solids)	0.35
Titanium dioxide	8.00
Antimony oxide	12.00
Talc	18.00
Urethane thickener	1.00
Water	4.65
Solids content 69.25%	

Conclusions

This paper has reviewed and updated a body of work on vinylidene chloride copolymer emulsions. It has examined how the properties of low water permeability, hydrolysis resistance, anomalous Tg behaviour, high gloss and fire retardance possessed by vinylidene chloride copolymers can bring benefits to the surface coatings formulator, and has discussed the extent to which the perceived 'problems' with vinylidene chloride copolymers have been overcome.

Acknowledgements

Many colleagues, past and present, at Scott Bader Company Limited have contributed to the development programme on vinylidene chloride copolymer emulsions. They include John Bax, Peter Berrill, Graham Brown, Deborah Crampton, Jack Knightley, Eric Powell, Barry Sauntson and David Woodford. Violete Stevens of the Dow Chemical Company has been helpful in advising on practice in the USA.

Metals and metal ions in pigmentary systems

W. E. Smith

Department of Pure and Applied Chemistry, University of Strathclyde, Cathedral Street, Glasgow G1 1XL

Abstract

Metal ions are involved in pigments as an inherent part of the chromophore in inorganic systems and in organic systems. They can be used to confer stability and insolubility, to modify the chromophore and to increase light fastness. Modern methods make it possible to give a more precise account of these chromophores. Selenium doped cadmium sulphide, a nickel azomethazine complex, and copper phthalocyanine are used as examples.

For a compound to be of use as a source of colour in a pigment, it requires: to have a reasonable colour strength in an acceptable shade; to have suitable properties such as light fastness, insolubility and chemical stability and to be suitable for particle size reduction and treatment to improve properties such as flow and dispersion. Compounds containing metal ions were among the earliest pigments since they occur naturally with an approximation to the required blend of physical and chemical properties. Considerable work has gone into improving these materials and to developing new compounds in which the metal ion is an essential part of the chromophore. However, an interest in recent years which has led to new systems has been the incorporation of metal ions into organic systems to improve light fastness and increase insolubility. In these materials, the metal ion can affect structure, sometimes acting as a template to increase structural rigidity, can affect light fastness by quenching excited states and can affect colour both by acting as a Lewis acid and altering electron density distribution in the organic chromophore and also by adding new components to the bands responsible for the colour. Modern methods make it possible to give a more precise account of the effect of the metal ion in specific systems and the use of some of these techniques are discussed with reference to particular systems.

One technique which is proving to be of value in studies of the electronic structure of pigments is resonance Raman spectroscopy. Raman spectroscopy provides vibrational information, particularly concerning symmetric modes. However, in resonance the incident radiation is chosen to have the same frequency as an absorption band in the molecule being studied and this can enhance Raman scattering on selected bands providing information on electronic structure as well as geometry. The method has the additional advantage that it is a selective technique where information on one coloured molecule can be obtained in the presence of others. One problem is that dyes and pigments often fluoresce and we have developed a simple technique in which samples are presented either incorporated into a metal disc or on a metal surface¹. As a result, self-absorption of the scattered radiation is reduced, fluorescence quenched and there is in addition an electronic interaction between the particle and the surface which has electrochemical implications.

In inorganic systems such as cadmium sulphide, lead chromes and iron oxides, the metal ion is an inherent part

of the chromophore. The origin of the colour can be due to either delocalized bands of electrons which span the whole crystal, or to electrons located on a particular molecule or ion. For example, cadmium sulphide is yellow because of a transition between bands in the crystal which are separated by an energy equivalent to blue light². The band gap is smaller in the red cadmium selenide and even smaller in black cadmium telluride (Figure 1). The colour of cadmium sulphide can be modified by the incorporation of selenium into the cadmium sulphide structure. The selenium modifies the lattice, creating at low concentrations isolated selenium impurity sites which disrupt the periodicity of the lattice and can be studied in a manner analogous to that of a molecule. These impurity sites can give rise to isolated peaks in the electronic spectrum but at higher concentrations they coalesce to form part of the band edge. Since the colour in this system is really given by the band edge rather than a discrete peak as in most organic systems, the shade obtained is very sensitive to the selenium impurity and to the treatment of the sample.

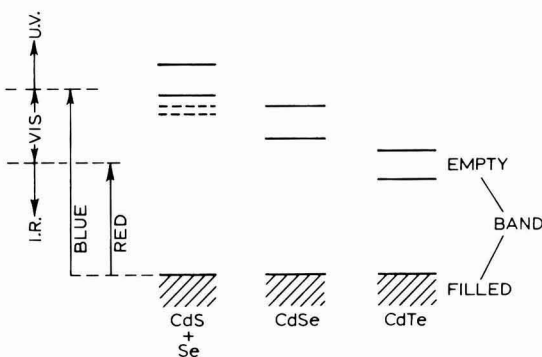
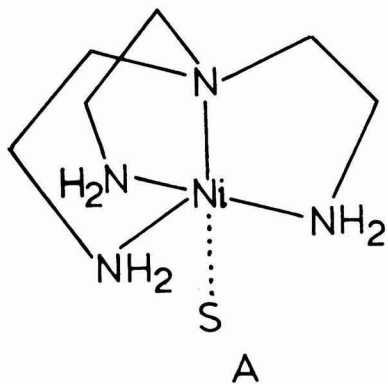


Figure 1. Energy separations in cadmium sulphide, selenide and telluride. Lines added beneath the excited state for cadmium sulphide indicate transitions to isolated impurities created by adding small amounts of selenium

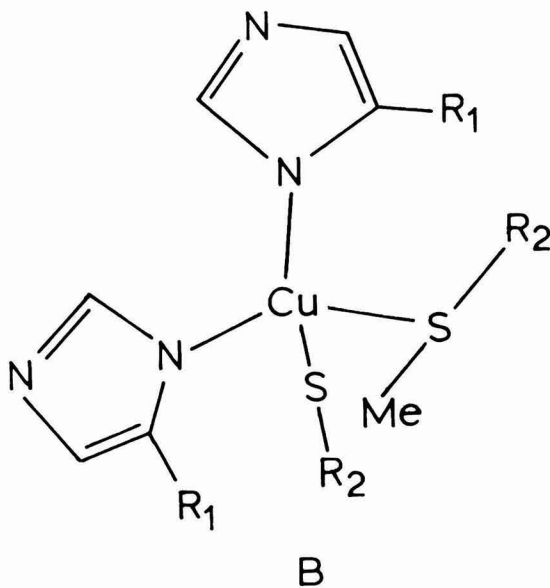
Metal ions themselves seldom give rise to strong enough colours to be considered pigmentary without some form of co-operative interaction with ligands or other metals. For example, chromates give the intense yellow colour as a result of the absorption of light caused by the excitation of an electron between two molecular orbitals on the chromium to oxygen bond. In the ground state, the molecular orbital is principally on the oxygen atom and in the excited state it is principally on the metal, so that the colour is due to "charge transfer". Such charge transfer transitions can occur between two metal ions separated by a ligand as in Prussian blue. They have been identified in many more systems³, most of which are of little interest as pigments for reasons of chemical stability, although some, such as the Ti^{3+}/Ti^{4+} system, are used.

Transition metal ions give a wide range of easily modified

and controlled colours through transitions involving transfer of electrons in the partially filled set of d orbitals. Cr^{3+} in ruby (Al_2O_3) and emerald ($\text{Be}_3\text{Al}_2\text{Si}_6\text{O}_{18}$) are examples of this, but the colours are usually too weak for use as pigments and rely for their effect on the transparency of the host material. Transitions of this type can be made more intense by incorporating the metal ion in a low symmetry environment using special ligands as shown for the nickel complex, A.



However, the absorption from these compounds lacks the strength and purity of organic chromophores and the stability of inorganic ones. From the point of view of colour strength, the chromophore in copper blue proteins, B, is suitable, but this area has not been developed to provide suitable metal complex analogues with a reasonable blend of pigmentary properties.



The role of metal ions in complexes in which the colour originates in an organic chromophore on the ligand has proved a much more fruitful field for development. The

metal ion can provide insolubility, influence the organic chromophore, act as a template to change structure and contribute to the chromophoric system in its own right. Perhaps the simplest use of metal ions is as part of counter ions for the precipitation of soluble dyes such as rhodamine. However, even in this case, the counter ion has an effect both as a filter for light and in preventing the fading of the Rhodamine through the formation of an N-oxide.

There are, however, many examples of materials in which the metal ion is bound to the chromophore and affects both the geometry of the ligand and its electronic properties. Some examples of nickel complexes of this type are shown (Figure 2).

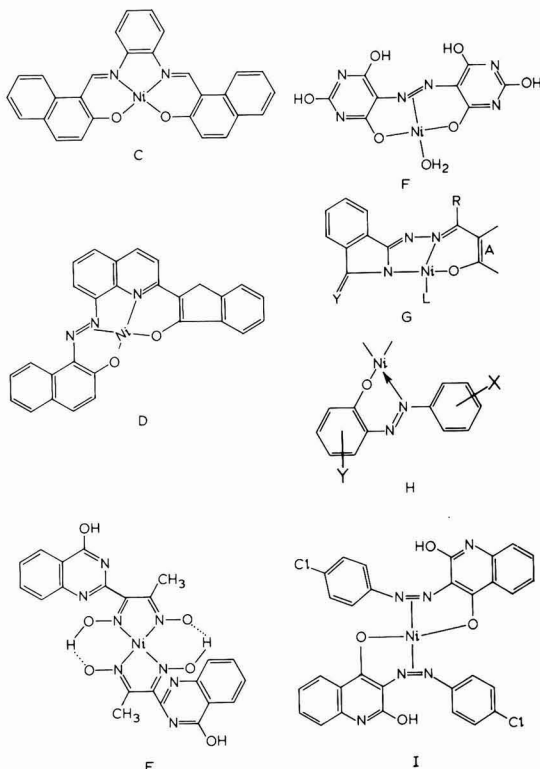
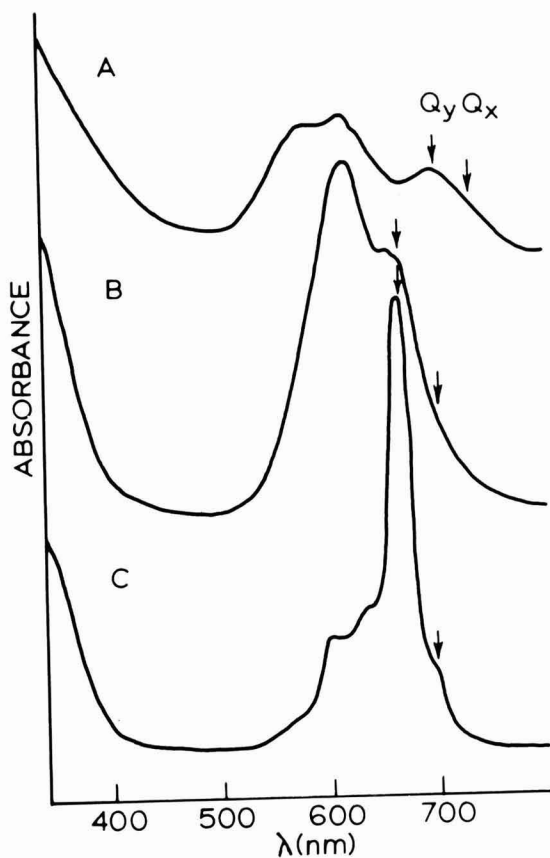


Figure 2. Some nickel complexes of interest as dyes or pigments

Phthalocyanines provide a good illustration of the effect of geometry. The ring is relatively flexible, hinged about the nitrogen atoms in the macro cycle and the effect of solvent and of complexing is therefore quite large (Figure 3). The Q bands are illustrated in the visible region and confer the colour on phthalocyanines. The excited state is degenerate in high symmetry and split in these materials by a combination of geometric distortion and electronic structure giving Qx and Qy as separate components. Resonance Raman spectra are required to confirm the positions of Qx and Qy in the insoluble pigment copper phthalocyanine. In contrast to the dyes, the pigment molecule is essentially planar but the structure of the phthalocyanine peak is due to an electronically driven



Figures 3. Electronic spectra of phthalocyanines. A - α -copper phthalocyanine in the solid state B - sulphonated copper phthalocyanine in aqueous solution and C - sulphonated copper phthalocyanine in solution in ethanol with added tetraethylammonium bromide

distortion (Jahn Teller effect) which creates the characteristic shape of the pigment spectrum.

Finally, the structure of a parent molecule for a series of nickel complexes of interest as pigments is given in C (Figure 2). In this case, the absorption gives colour in a manner analogous to that of the cadmium sulphide/selenide system in that it is the structure of the band edge which lies in the region where the dye is most sensitive to blue light. Initially it was believed that the chromophore was due to azomethazine groups, but this is only in part correct. Mixed in with the azomethazine bands whose positions are altered by the Lewis acid properties of the metal is a band due to charge transfer between the metal and the oxygen groups on the ligand (Figure 4)⁴. In addition, the band edge is affected by the stereochemical requirements of the molecule and it can be sharpened by substitution of say, naphthaldehyde for benzaldehyde in the structure.

Our method of approach has been to use a combination of preparative methods and modern techniques of analysis to probe the electronic structure of these insoluble materials. It provides the opportunity for further studies, particularly in the field of metal complexes where surmises

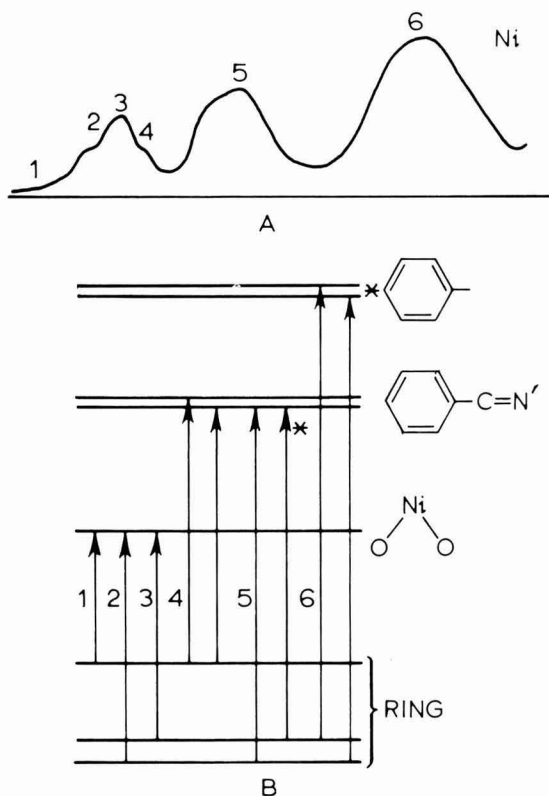


Figure 4. Electronic spectrum (A) and assignments (B) of the peaks for a bis azomethazine nickel (II) complex. The transitions are from filled orbitals on the ligand but the major contribution to intensity concerns different parts of the complex as shown

as to the effect of changing substituents can be checked by subsequent analysis of the products and it has become possible only with developments, such as the simple metal disc technique, which overcome the difficulties of working with materials, which to be effective as pigments are usually intractable to conventional methods of analysis.

[Received 24 April 1985]

References

1. Bovill, A. J., Nimmo, J. A., McConnell, A. A., and Smith, W. E., *J. Raman Spec.*, accepted for publication.
2. Orna, M. V., *J. Chem.*, 1978, **55**, 478.
3. Robin, M. B. and Day, P., *Adv. Inorg. Chem. Radiochem.* 1967, **10**, 247.
4. Brown, D. H., Morris, J. H., Oates, G. and Smith, W. E., *Spectrochim Acta*, 1982, **38A**, 333.



January 1st is the date when the 1984 Labelling of Hazardous Substances comes into full effect. If YOU have not complied with these regulations YOU will be the one carrying the can.

However, we can help you with the new **MICRORISK** computer package. This package, designed and used by someone who well knows your problems, is now available off the shelf.

Already tried and proven by AULT & WIBORG GROUP PLC, it will shrink the hours of tedious assessment down to twenty seconds per product. It will also provide you with Hazard Data Sheets to send to your customers. By designing the package to run on IBM microcomputer equipment, we can keep the price low and provide you with the advantage of having the market leader's hardware at your disposal for other uses.

Best of all though – because it comes from Ault & Wiborg, major manufacturers of paint and printing inks, most of the industries raw materials are already included which will save you even more time.



For details please write to:
G.T. Eady, Ault & Wiborg Paints Ltd.,
 28 Wadsworth Road, Perivale, Middlesex, UB6 7JT.
 Tel: 01-997 6633 Telex: 935363

So, to ensure that the only can you carry is correctly labelled –
make MICRORISK your New Year resolution.

Reader Enquiry Service No. 381

AT YOUR SERVICE to develop finer, more durable products

The fast, economical weather tests of
SUB-TROPICAL TESTING SERVICE, INC

established 1929

Sub-Tropical Testing Service is known and utilised world-wide

Our 55th Year



Send for free
 Sub-Tropical colour
 brochure

**Sub-Tropical Testing gives fastest Natural Weather tests available for ★ paints ★
 chemical coatings ★ plastics ★ textiles ★ fabrics ★ related products ★**

Wir waren die ersten, welche einen Prüfdienst dieser Art für Lacke, Kunststoffe, chemische Beschichtungen, Stoffe und Gewebe aller Art, Farbstoffe und verwandte Erzeugnisse in den U.S. möglich machten.

Mr C. Hubbard Davis, Founder, Sub-Tropical Testing Service, Inc. (1904-1977)
 PO Box 560876, 8290 S.W. 120th Street, Miami, Florida, U.S.A. 33156

Phones: (305) 233-5341
 Cable: SUBTROP, Miami

Reader Enquiry Service No. 309

Natal Section

Anti-corrosive measures in the motor vehicle industry

The first lecture in 1985 of the Natal Section was held at the Westville Hotel on 6 February, 1985.

The lecture entitled "Anti-corrosive measures in the motor vehicle industry" was given by Mr Derek Nourse of Toyota SA Manufacturing.

The speaker highlighted four main aspects of anti-corrosive measures which were used in the manufacture of motor vehicles, namely: design, phosphating, electro-painting and sealing.

1. Modern designs emphasise easy access to box sections to permit paint penetration and eliminate areas of dirt and water entrapment. There is also extensive use of pre-coated steels such as AGSS with a new low reactive type about to be introduced.

2. The initial phosphating pre-treatment used to provide a key to the electropaint had been zinc phosphate of the hopeite crystal type structure.

However, a new full dip system has recently been commissioned based on the phosphophyllite crystal, being more suitable for cathodic electrocoat and will prevent the occurrence of scab corrosion.

3. Electropainting systems were initially based on anodic products which had limited performance. Cathodic systems were introduced to RSA in 1981. With their enhanced throwing power, which is a function of the high polymerisation of the resin, corrosion performance is at least five times better than anodic systems with a paint thickness of up to 20 microns being achieved in box sections.

4. Finally, the speaker mentioned the use of seam and underbody sealers which were at present based on plasticised PVC resins reinforced with fillers and adhesion promoters. However, new moisture-cured polyurethane types which have greater flexibility will soon be available in SA.

Tests have also been carried out on heat cured epoxy adhesives which could replace spot welding on door and roof panels.

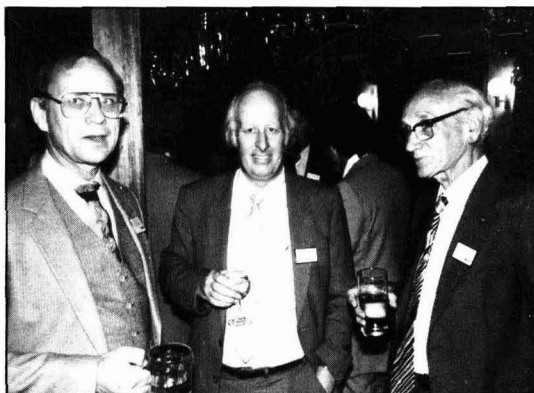
A lively question time ensued when the merits and demerits of pre-delivery corrosion protection systems were discussed at length. A vote of thanks was proposed by Len Diedericks and the audience responded with a round of applause.

The logistics of paint manufacture in Zimbabwe

At a meeting of the Natal Section a lecture entitled "The Logistics of Paint Manufacture in Zimbabwe" was given by



At the Natal OCCA meeting shown above are Mr D Nourse (left) and Mr A Pirow of Toyota SA Manufacturing.



At the same meeting, shown above are (from left to right), Mr H. Van de Merwe, Mr R. Philbrick and Mr B. Topp.

Mr E. Jeffers of Berger Paints (SA) (Pty.) Ltd. Mr Jeffers recently joined Berger having spent the last 15 years in Zimbabwe/Rhodesia operating one of the largest paint factories in Harare.

The speaker dealt with the problems experienced with obtaining raw materials during UDI and since independence. As 90% of the products used are imported there was, and still is, difficulty in obtaining foreign exchange allocations. Zimbabwe at UDI was traditionally a mining and agricultural based economy with a small manufacturing industry. As a result of sanctions industry had to become innovative with great demands made on technical expertise. A lot of manufacturing plant is antiquated and there is no foreign currency available to purchase replacements. Under UDI foreign exchange was distributed equally to industry and commerce (i.e. import agents) based on past performance and came under the control of one Ministry which did create difficulties due to

conflict of interest. Despite these difficulties both sectors survived but industrial output was limited to essential items only, e.g. industrial paint users took preference over the decorative stockist.

Industry was rated on a priority scale and the paint industry was grade category C, whereas mining was category A. It was also possible to obtain foreign exchange on an ad hoc basis if required for essential projects and there was intense pressure on sales staff to find these projects to enable manufacturers to improve their viability in the market place.

The current situation is relatively unchanged except for the advent of foreign aid. The manufacturing industry is still on allocation and foreign aid requests can take up to 18 months to be processed.

A donor country can say where the money must go and in respect of US aid the actual host supplier can approve the allocation. The paint industry in Zimbabwe has been favoured by Holland and Norway with Germany and Switzerland giving aid for equipment replacement.

New ventures in barter trade are now being explored and can be another means of obtaining essential raw materials.

Finally, Mr Jeffers closed his lecture with a plea for young technologists to consider a career in the paint industry in Zimbabwe as there is a definite need for technical expertise and the rewards are very attractive.

After a short question time a vote of thanks was given by Len Diedericks, with some amusing anecdotes of the years he spent working with the speaker in the 1970's.

R. Philbrick

Manchester Section

Epoxy resins and curing agents

On Monday, 4 March, 1985, a sponsored lecture was given by Mr John Sinclair, Anchor Chemical Group, to 130 members and guests at the Manchester Club. The lecture, entitled "Epoxy resins and curing agents", was followed by an excellent buffet provided by Anchor Chemicals.

Mr Sinclair gave a brief outline of the types, structures and functions of the various epoxy resins available. The latter part of the talk covered in detail the range of available types of curing agents for epoxy resins. Mr Sinclair explained the basic structure of the curing agents and the various modifications which could be made to alter their properties. Details were given of the suitability of the curing systems to final applications.

The talk was followed by a lively question time and a vote of thanks was put by Mr Cyril Williams.

R. G. Handley

Midlands Section

The science and technology of quinacridone pigments

A meeting of the Midland Section was held on 21 March, 1985, at the Clarendon Suite, Stirling Road, Edgbaston, Birmingham. Members and guests heard Dr E. Jaffe speak on "The Science and Technology of Quinacridone Pigments".

Dr Jaffe described the historical developments of the pigments and with the aid of slides showed some of the ways by which the pigments are chemically produced. The pigment exists in three distinct forms:

1. Alpha – which is red.
2. Beta – which is violet.
3. Gamma – which is also red.

It is these last two forms that are most used by the pigment manufacturers.

The speaker then went on to describe some of the factors that affect pigment rheology. The Quinacridone pigments produced today show much better flow than the earlier types. This has been achieved mainly by changing the particle size, shape and surface characteristics of the pigment.

In conclusion Dr Jaffe spoke of the advantages and disadvantages of the pigments. As a group they have excellent durability, chemical resistance, bleed resistance, heat stability and very low toxicity. The main disadvantage is price, because of the complex chemical nature of the pigment and its method of manufacture make it an expensive product.

After a lively question time the meeting finally closed with a vote of thanks proposed by Dr G. Lewis.

B. E. Myatt

Trent Valley Branch—Hansa Yellows and High Opacity Organic Pigments

A technical meeting of the Trent Valley Branch was held at the British Rail School of Engineering on 28 March, 1985.

The meeting was sponsored by Hoechst UK Ltd., who kindly provided a buffet before the technical meeting.

The paper was entitled Hansa Yellows and High Opacity Organic Pigments and was presented by Adrian Abel and Brian Lomax.

Brian Lomax summarised the history and development of Hansa Yellow pigments from the original Hoechst patent dated 1915 covering Pigment Yellow 1, Hansa Yellow G to the last decade during which five new ones have been formulated.

The pigment properties—tinctorial strength, hiding power, flow, rheology, light and weathering fastness—were compared by means of slides and transparent film.

Adrian Abel discussed the formulation and properties of high opacity organic pigments mainly for use as Chrome substitutes. The C.I. numbers of these involved are Pigment Yellows 151, 16, 74, 83 and 13, Pigment Oranges 62, 34, 36 and Pigment Reds 112 and 170. Two-thirds the opacity of Chromes have been achieved.

There were 19 members and visitors present and the vote of thanks was proposed by Mike Hannah.

Ontario section

Evolution of fluorescent pigments—New areas for marketing

The sixth technical meeting of the Ontario Section's 1984-85 session was held on 20 February, 1985, in the Cambridge Hotel, Toronto.

Thirty-one members and guests turned out to listen to Mr

Frank Williamson of A. R. Montith who market daylight fluorescent colours.

Mr Williamson opened his presentation with a brief history of the subject with the earliest commercial application of fluorescence being invisible shirt laundry marks. The first fluorescent pigments made in the late forties were very crude having 10-14 days lightfastness. Over the years more sophisticated products evolved up to the present time where they exhibit high performance in various applications.

The uses of fluorescent pigments in marketing consumer products were discussed in some detail, and the already wide spread applications of these materials were surprising to those present.

During his presentation, Mr Williamson showed various examples of daylight fluorescence to support his text.

After a lively question period the Vice Chairman, Mr R. Purnell proposed a vote of thanks.

P. Marr

company visits

Heraeus Equipment Ltd

Heraeus Equipment Ltd., Brentwood, is the UK subsidiary of the West German company W. C. Heraeus GmbH, well known for their "Xenotest" accelerated testing machines. These utilise xenon discharge lamps in conjunction with filters to provide high intensity illumination with various spectral distributions, e.g. intensity sunlight, sunlight through glass or sunlight with an enhanced U.V. intensity, as required for specific testing purposes. Xenon lamps permit a closer approximation to sunlight than do carbon arc lamps, and some international standards are being changed from carbon arc to xenon lamps.

At a recent seminar Heraeus introduced the Xenotest 150S, an improved version of the Xenotest 150, of which some 3000 have been supplied during the last 25 years. The 150S is of modern compact design incorporating its own water tank. A new ultrasonic humidifying system is used instead of the older water spray jets; this avoids trouble from jets becoming blocked and also means that no air compressor is required, ensuring that the new machine is much quieter in operation than the old one. There are ten specimen holders each 130 × 45mm, giving a total test area of 900cm². The humidity and temperature in the test chamber can be controlled, and various cycles of light and

humidity can be selected to comply with standard specifications or with users' own requirements. Whilst the 150S is primarily a textile testing machine it is sometimes used for plastics and printing inks.

For paint testing Heraeus normally recommend their Xenotest 1200, a larger machine with a total test specimen area of 20,000cm². This has facilities to conduct tests under a variety of conditions, e.g. (i) continuous or intermittent radiation, the filters providing differing spectral distributions as noted above, (ii) black panel temperatures up to 85°C, also alternating high/low temperatures, (iii) relative humidity up to 95 per cent, also alternating high/low humidities, (iv) five different rain cycles, or continuous rain. As with the 150S, these cycles can be set to comply with national or international standards, or with users' own requirements.

Heraeus supply standard units for non-metameric colour matching under artificial daylight, tungsten lighting and departmental store lighting, cabinets providing high intensity U.V. light for special tests, ultra-violet radiation meters, etc. They also manufacture environmental testing cabinets to meet customers' requirements, providing a wide temperature, humidity and radiation range, and of all sizes up to "drive-in".

T. A. B.

NL Industries, Inc. are to buy Spencer-Kellogg Division of Textron

NL Industries, Inc. and Textron Inc. jointly announced today that the signing of a definite agreement providing for the acquisition of the Spencer-Kellogg Division of Textron Inc. by NL Industries, Inc. for an undisclosed sum. The agreement is subject to normal government review.

Spencer-Kellogg is a leading supplier of speciality resins to the coatings, inks, electrical and adhesives industries. It is head-quartered in Buffalo, New York and operates manufacturing facilities there as well as in Baltimore, Maryland, Minneapolis, Minnesota; Newark, New Jersey; San Carlos, California and Valley Park, Missouri.

This announcement follows the recent acquisition by NL of Victor Wolf Industries Ltd, producers of polyamide resins and other speciality chemicals for the ink, plastics and coatings industries, located in Bedlington, near Newcastle-on-Tyne.

Reader Enquiry Service No. 30

Aluminium specialists join Canning

Specialist suppliers of aluminium pre-treatments, Clare Chemicals Company Ltd of Halifax, have been acquired by W. Canning Materials Ltd, the metal finishing and industrial chemicals company.

The newly-formed pre-treatments division of Canning Materials, based at the Birmingham HQ, handles the Clare range of chemicals for treating aluminium prior to anodising and painting, together with the Canning phosphating products. Clare director Mr Jim Kape is division manager and his co-director Mr David Fox joins Mr John Fowler, the Canning Materials phosphating expert, on the technical sales team as pre-treatment specialist.

Jim Kape commented, "With the extensive Canning Materials technical resources and the large force of sales representatives, we shall be able to provide Clare customers with a more professional response to processing problems, to maintain better contact and to build closer relationships. We also plan to develop more customer-oriented packaging and labelling. The Clare product range, in combining with Canning plating materials, forms a very strong single supplier source of finishing processes and will enable some plating products to be tailored to aluminium".

W. Canning Materials Ltd is a member of W. Canning plc, the chemicals, metals and electronics group.

Reader Enquiry Service No. 31

Natrosol plant to be expanded

Hercules Inc. have announced a planned 20 per cent expansion of their Natrosol hydroxyethylcellulose plant at Zwijndrecht, Holland.

The increased capacity will be on stream before mid-1986 and is needed to meet the growing demand in, and, outside Europe for this high quality polymer used in waterbased paints, emulsion polymerization, and oil field fluids. The biostable grades of Natrosol particularly have gained widespread acceptance in latex paints, and greater demands in new applications have accelerated the company's expansion programme.

In addition to its Zwijndrecht plant, Hercules produces Natrosol in Hopewell, Virginia, and in Parlin, New Jersey, USA.

Reader Enquiry Service No. 32

New factory for Baker Perkins Chemical Machinery

A £1.25m pound satellite manufacturing unit has been opened by Baker Perkins

Chemical Machinery Ltd at Stoke on Trent. The new factory is just a few miles from the company's main works at Cooper Street, Hanley.

The additional manufacturing capacity has become necessary because Baker Perkins Chemical Machinery has more than doubled its sales in the last two years and its number of employees has increased from 120 to 200.

Located on the Parkhouse Industrial Estate, the new unit has been equipped with the latest CNC (computer numerical control) machine tools to speed the production of components for the wide range of products made by Baker Perkins Chemical Machinery for the plastics, powder coating, chemical process and pharmaceutical industries. The Cooper Street factory has been redeveloped, creating more space for assembly and other machine tools. The company say that the new facilities will enable them to maintain their delivery performance during this period of increasing sales.

One hundred and seventy thousand pounds of the total investment is being spent on computer aided design and computer aided manufacture equipment. CAD installation will be linked to the powerful computer of Baker Perkins, Peterborough, by optical fibre transmission provided by British Telecom. It is the first link of its kind in Britain.

The CAD/CAM installation at



One of the new machine tools at the new Baker Perkins Chemical Machinery Factory

Peterborough is the most advanced of its kind in Europe, so the new link gives the Stoke-on-Trent company the benefits of existing expert management and immediate access to sophisticated software.

Many of the machines produced by Baker Perkins Chemical Machinery are made to extremely high tolerances—to a tenth of a thousandth of an inch or less. The use of CAD/CAM will enable the products to be made quickly to the most stringent standards.

The range of products includes continuous twin screw mixers, highspeed batch mixers, pharmaceutical granulators, universal Z-blade mixers, explosive and propellant mixers, and centrifugal liquid/liquid extractors.

Reader Enquiry Service No. 33

products

New Lankro primary emulsifiers for emulsion polymerisation

The Perlankrol F range of alkyl phenol ether sulphates is claimed to be one of Lankro's most versatile and widely used ranges of primary emulsifiers. These materials find application in the manufacture of vinyl acetate homopolymer and vinyl acetate-veova, vinyl acetate-acrylic, all acrylic and styreneacrylic co-polymer emulsions. Ranging in hydrophilicity, they are said to enable the formulator to produce emulsions with varying characteristics, but always affording excellent storage and freeze-thaw stability. These materials are frequently used with a highly ethoxylated nonionic secondary emulsifier, such as Lankro's ethylan HA, Levelan P208 or Monolan 8000E/80.

Recent developments have been focussed on the extension of this range of primary emulsifiers. First of all, Lankro has decided to broaden its range of alkyl phenol ether sulphates by extending the degree of alkoxylation.

The Perlankrol F range (Perlankrol PA Conc, FF, FD63, SN, RN75) contains products based on differing ethoxylates of alkyl phenol. Lankro can now offer development quantities of sodium salts of alkyl phenol ether sulphates based on intermediate levels of EO (ECD1501) and higher levels of EO (ECD1502), which fill gaps in the present range.

Foaming of primary emulsifiers con-

tinues to be an unwanted feature which leads to processing and application problems unless antifoaming agents are incorporated into a formulation. In an attempt to reduce the foaming potential of the primary emulsifier system, Lankro is said to have developed a small speculative range of alkyl phenol poly (alkylene glycol) ether sulphates for evaluation in this area. Initial results are said to look promising although the evaluation programme is not yet finalised.

Lankro's work in other areas of surfactant applications, where improved dispersion and emulsification properties are a pre-requisite, has led to the development of a range of nonionic and anionic dispersants and emulsifiers based of very large, sterically "bulky", hydrophobes. These include ranges of alkyl aryl phenol ether sulphates and triaryl phenol ether sulphates. The objective in evaluating these materials in emulsion polymerisation is not only to find more cost effective emulsifiers, but also to produce a final emulsion which can be more readily pigmented or "filled". The products described are said to have afforded excellent results when evaluated as dispersants for organic pigments and it is expected that their use in polymer production will enable easier formulation into paints, inks, etc.

Reader Enquiry Service No. 34

Graco UK introduce modular concept for paint circulating systems

Graco UK have announced the introduction of Powerflo, a modular paint circulating system, claimed to be designed to enable engineers to select the configuration most suited to their particular requirements.

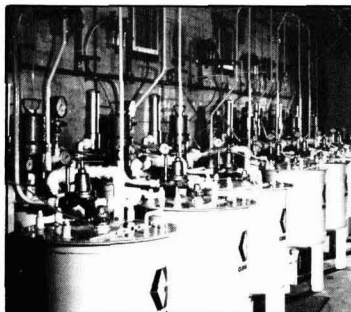
Paint circulation is being used increasingly throughout industry where mass produced products have to be finished in a variety of colours. Typical applications include domestic appliances, telephones, furniture, motor cars, agricultural equipment, office machinery, office furniture, storage equipment and a host of other items.

A typical Powerflo circulating system comprises a mix/pump room where paint is pumped from bulk containers (one pump/container module per colour), and circulated under constant pressure through the system to take-off points in a spray booth. The system is so designed to maintain a constant operating pressure regardless of the number of take-off points in use. These take-off points can be in the form of manual air spray guns; electrostatic

air spray guns; manual or electrostatic airless spray guns; air-assisted manual, automatic or electrostatic spray guns; automatic reciprocating arms or robots. In addition, the paint pump and pipework within the Powerflo system is "Sized" to ensure that paint is kept in adequate suspension, irrespective of line-length or numbers of spray booths in use.

The new Graco Powerflo system enables the user to select the pump/take-off module unit most suited to the particular requirements of his application.

Reader Enquiry Service No. 35



Mix room of Graco Powerflo 7-colour paint circulating system at Austin Rover, Cowley

Epoxy rust converting paint

Brunox, the rust converting paint with top coat power is now available with epoxy formulation.

Epoxy Brunox can be painted directly on to clean firm rust. The rust is converted into a water resistant black organic iron complex. The complex is stabilised by a special epoxy resin which protects iron and steel from environmental attack.

Epoxy Brunox can be overpainted with most top coat paints including two pot formulations and chlorinated rubber.

Stoving Brunox at temperatures up to 180°C is claimed to considerably enhance the ability of Brunox to withstand sea water and solvent attack.

Reader Enquiry Service No. 36

New screen printing medium for decals

The Ceramic Colours Division of Degussa AG, Frankfurt am Main (Federal Republic of Germany) has now added to the 80 829 screen printing medium to its range, for the

literature

Chemical hazard information online

Chemical Hazards in Industry (CHI) and Laboratory Hazards Bulletin (LHB) are now available online from Data-Star. Both bulletins are also published monthly by the Royal Society of Chemistry.

CHI provides information on chemical and biological hazards, plant safety, protective equipment, legislation, and storage, as well as health and safety measures, for workers in the chemical and allied industries.

References are drawn from over 200

primary journals and periodicals worldwide, in fields such as toxicology, epidemiology, chemical engineering, and legislation. The current data base of over 3000 entries is brought up-to-date by the addition of 200 items monthly.

LHB provides information to laboratory workers and safety officers concerning chemical hazards, work practices, safety measures and legislation. 70 new entries per month are added to the file, which currently contains over 3000 entries.

Reader Enquiry Service No. 38

production of decals for use on glass, enamel, porcelain and ceramics. The new product is said to ensure that the colour paste flows uniformly and at the same time prevents it from running during vertical drying. A particular advantage when working in premises which are not air conditioned or in tropical climates is its lack of sensitivity to high atmospheric humidity, which avoids thickening or a "cheesy" consistency in the colour paste. Since the new medium dries relatively slowly, it is recommended for hand printing and slow-running semi-automatic machines in particular. The colour prints dry after 30 to 40 minutes in the continuous drier or, depending on ventilation, after 6 to 12 hours in the tray drier. All Degussa film solutions are suitable for the cover coat.

Reader Enquiry Service No. 37

OCCA NEWS

Manchester Section

Informal Buffet Dance

On Friday, 22 March, 1985, 160 members and guests attended the Manchester Section Informal Buffet Dance at the RAFA Club, Sale.

Prior to the interval the dance floor was much under-utilised and opinion divided as to the cause. One school of thought ascribes the reason to the reluctance of the male members of the party to take their eyes off the female vocalist with the Art Leicester Band, whilst the opposing school blame the Old Tyme aspect of the repertoire.

Whatever the true reasons, after an excellent buffet, the feet of the party started tapping and dancing was soon in full swing.

The traditional coin rolling event raised £28 for the RAFA Charity.

R. G. Handley

Natal Section

AGM

On Friday, 29 March, 1985, the ninth

annual general meeting of the Natal Section was held at the Westville Hotel.

The Chairman, Mr T Say, tabled his report for the past year and advised that a total of seven meetings had been held with an average attendance of 39, with the one-day symposium in August being supported by 45 participants.

The Honorary Secretary, Mr R. Archer, outlined the latest developments with regard to education in the paint industry and advised that SAPMA were evaluating the distant learning course designed by the British Paint Makers Association. The following members were elected for the forthcoming year:

- Chairman Mr T. E. Say
- Hon. Secretary Mr R. J. Archer
- Hon. Treasurer Mr K. M. Englebert
- Hon. Publications Sec Mr R. H. Philbrick
- Committee: Mr A. Mackenzie
- Prof D. E. A. Williams-Wynn
- Ms I. Davies

At the close of the meeting, the members then joined the ladies who had been entertained in the meantime by Mrs A. Mackenzie who gave a lecture on landscape gardening.

The evening was concluded with a most enjoyable dinner.

R. Philbrick

News of Members

Mr N. L. Hester

Mr N. L. Hester ATSC, has informed the Association that the Open University has conferred the degree of Bachelor of Arts upon him and that he has been elected to the category of Licentiate of the Royal Society of Chemistry. He is employed as a Research and Development Chemist with the Sericol Group at Broadstairs.

Obituaries

Mr J. Tooke-Kirby

Mr H. C. Worsdall writes:

The death of John Tooke-Kirby on 5 March, 1985, is a loss not only to the London Section but will be felt in the Association itself.

Few of the members realised that beneath that ever cheerful exterior was a very sick man. He had suffered a multitude of illnesses for a number of years and had borne his suffering with admirable fortitude.

Most of his working life had been spent in the industry with the exception of the war years when he served in India and Burma, finishing with the rank of captain.

Most members will associate him with Hoechst with which company he worked until he retired although he continued as a consultant for some time after.

John had been an OCCA member since 1961 and had given considerable service to the London Section Committee and to Council. His early service started with his being a founder member of the Southern Branch of the London Section and later as Chairman.

On the London Section Committee his service goes back to 1970 when he represented the Southern Branch on that body. From 1973 onwards he was continuously making a major contribution to the Section Committee as a member and as Chairman from 1975-77. His service on the Committee ended only in 1981.

Not only did he serve on the London Section Committee but he also served Council in many different ways, as London representative, as an elective member from 1981-82. He also served on the President's Advisory Committee, the Exhibition Committee and was present in Toronto at the inauguration of the Ontario Section.

His loss will also be felt in the Society of Dyers & Colourists and in the Institute of Petroleum in which bodies he also made a contribution.

The sympathy of members go to his son, David, also in the industry and a London Section member.

Mr A. McKendrick

Mr B. Gardner writes:

The Scottish Section lost a valued friend, and a tireless administrator, when Alec McKendrick died in his sleep at home, on 3 April, 1985. He was 60 years of age and for the past 15 years had been the buyer for Craig & Rose Ltd., Edinburgh.

The continued strength of the Eastern Branch of the Section was due, in large measure, to the considerable effort he was prepared to invest. It was inevitable that his talents would elevate him to greater things within the Section and such was the case.

Alec McKendrick was in his first year as Scottish Section Chairman. He was a man who sought a high level of achievement in all the facets of his life and there was evidence of this in his approach both to OCCA activities, as well as his business career.

He was also a first class gardener raising a bountiful crop, year in year out, from his

greenhouse and from his garden. He was an enthusiastic caravaneer. He was an extraordinary wine maker. He was a DIY expert of more than average competence.

Everything he undertook was carried out with seeming professional expertise.

Alec McKendrick is survived by his charming wife Bette and by his two sons of a previous marriage.

He will be missed, not only by his family, but also by his large circle of friends both within, and outside, the industry.

new members

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

Ordinary members

- Black, W. H., BSc (*Transvaal*)
- Brough, P. (*Manchester*)
- Burke, R. T. A. (*Transvaal*)
- Colthorpe, J. N. M. (*Manchester*)
- Compston, R. D., BSc (*Auckland*)
- Conlon, P., BSc (*Manchester*)
- Deodhar, J. D., BSc., PhD (*Manchester*)
- Farley, K. R. (*Zimbabwe*)

- Grabandt, M. F. (*Transvaal*)
- Haxell, J. P. N., BSc., PhD (*Bristol*)
- Hirst, J. W. A. (*Auckland*)
- King, C. B. (*Midland*)
- Lopez, B. Y., BSc (*General Overseas — Iran*)
- MacCallum, G. (*Natal*)
- Mandeno, W. L. (*Wellington*)
- Metge, N., BSc., MSc (*Auckland*)
- Nicholson, R. E., BSc (*Natal*)
- Olivier, P. A. (*Transvaal*)
- Pople, S. C., BSc (*Auckland*)
- Ratcliffe, T. B. (*Manchester*)
- Renfrew, R. W., PhD., MSc (*Wellington*)
- Robinson, J. A. E., BSc (*West Riding*)
- Signal, A. G. (*Manchester*)
- Soobramoney, M., BSc (*Natal*)
- Stachowiak, S. A., BSc, PhD (*Transvaal*)
- Stanfield, R. F. (*Manchester*)
- Stembridge, C. A. (*Newcastle*)
- Stucklin, S. F. (*Zimbabwe*)
- Taine, R. G., BSc (*Auckland*)
- Thompson, M. (*Scottish*)
- Tottle, I. P., BSc (*Auckland*)

Associate members

- Barker, C. M., BA (*Wellington*)
- Coetlee, P. L. (*Transvaal*)
- Everitt, J. (*Natal*)
- Hoal, E. H. O'Neill (*Zimbabwe*)
- Holden, R. J. (*Auckland*)
- McDonald, K. S. (*Wellington*)
- Morris, G. C. (*Auckland*)
- O'Riordan, M. F. (*Irish*)
- Stayt, G. E. J., BSc (*Bristol*)

**FLAME AND DUST PROTECTED
BATTERY ELECTRIC
FORKLIFT TRUCKS**



LANSING BAGNALL FRER 8 Reach type, 4,500lb. capacity. Choice of 14ft. 6in. or 17ft. 6in., triple stage full free lifts.

CONVEYANCER Counterbalance type, 4,500lb. capacity. Choice of 9ft. or 14ft. lifts.

Complete with battery charging units.
Overhauled, repainted, serviced and guaranteed.

AT BARGAIN PRICES

Open to any inspection. Conform fully to British Safety Standards.

Details and photographs available from:
SPEED ELECTRICS
2 Thackerays Lane, Woodthorpe, Nottingham
Tel: 0602 268723



GROUP LEADER, AQUEOUS COATINGS

- ★ Pioneering the concept of common ownership, Scott Bader has developed a highly participative style of management for over 30 years. Based near Northampton the Group has an annual turnover of £50 million with worldwide interests and is a leader in creative chemistry-related technology.
- ★ Scott Bader is strengthening its commitment to the Surface Coatings Industry, both in the U.K. and overseas. With the broadest technology base of any supplier of polymers, the resources are available with which to establish the company as a leading supplier.
- ★ A new position of Group Leader, Aqueous Coatings, has been created to spearhead the technical support function. This position will appeal to a person with at least four years practical experience in a senior capacity of both decorative and industrial coatings technology. A good grounding in Polymer Chemistry will be needed, to enable close interaction with Research and Development. A minimum of degree level of education is desirable.
- ★ The position will have a firm orientation towards the market place, and will serve to provide both application development and technical service. The person appointed will be directly responsible to the Market Manager, Surface Coatings.
- ★ Applicants must be able to demonstrate drive, enthusiasm and self discipline. Limited travel within the U.K. and overseas is envisaged.
- ★ Salary is negotiable, based on experience and ability, and there is generous help with relocation expenses.
- ★ *Please write in strictest confidence, with full c.v., to Donald Cross, Management Consultant, Adviser to the Company:*

**c/o Personnel Department, Scott Bader Company Limited, Wollaston, Wellingborough,
Northamptonshire NN9 7RL.
marking the envelope GL885.**

JOCCA

READER ENQUIRY SERVICE JULY 1985

Name

Job Title

Company

Address

.....

Country

Telephone


For further information on adverts or editorials enter the Reader Enquiry Service Number/s in the boxes below:

This enquiry will be forwarded to the company/ies concerned.

JOCCA

**Priory House, 967 Harrow Road, Wembley,
Middx., HA0 2SF, England
Telephone: 01-908 1086 Telex: 922670 (OCCA G)
Photocopy or cut out form and send to above address:**

SERVICES



SHELLACS NATURAL RESINS GUMS & WAXES

A. F. SUTER & CO. LTD.

Swan Wharf 60 Dace Road
London E3 2NQ

Tel 01-986 8218 Gram Suterresin London E3
Contact B. A. Slater

INDEX TO ADVERTISERS

Further information on any of the products advertised in this Journal may be obtained by completing the Reader Enquiry Service form. The Reader Enquiry Service numbers are shown in brackets below.

A		
Ault & Wiborg Paints Ltd.....	(381)	173
N		
National Physical Laboratory.....	(382)	loose insert
S		
Sachtleben Chemie GmbH.....	(364)	ii
Sanyo-Kokusaku Pulp Co. Ltd.....	(283)	cover
Sub-Tropical Testing Service Inc.....	(309)	173

SURFACE COATINGS

VOL 2—PAINTS AND THEIR APPLICATIONS

Prepared by OCCA Australia

Surface Coatings was first published in 1974. Since then the industry has undergone dramatic and rapid changes. For the second edition the book has been split into two volumes, the first covering raw materials and their usage, the second paints and their applications. Volume 1 was published in the autumn of 1983.

Volume 2 gives a comprehensive overview of decorative and industrial paints. Cross references to appropriate chapters in *Volume 1* are provided and the index covers both volumes. Revised and rewritten by over 80 expert contributors from industry, research institutes and universities, the books represent the most up-to-date reference available on paint technology.

Volume 2 is available in December by placing orders now (prepayment only) through the Oil & Colour Chemists' Association at £32.50 (inc. p&p in the UK) plus £3.00 for orders sent overseas by surface mail.

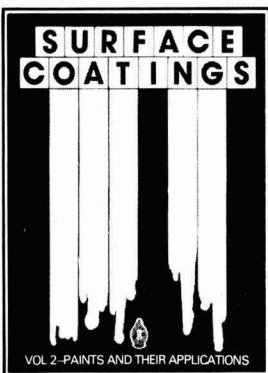
Volume 2 – Hardback – 480 pp.

Contents

Rheology
Formulating Principles
Paint Manufacture: Pigment Dispersion
Paint Manufacture: Processing Operations
Architectural Coatings
Heavy-Duty Protective Coatings
Anti-fouling Paints
Industrial Coatings
Automotive Coatings
Lacquers
Conversion Coatings
Powder Coatings

Ultraviolet-Cured Coatings
Printing Inks
Components and Technical Aspects of a Paint-Tinting System
Colour Matching (Using Computerized Techniques)
Testing and Quality Control
The Substrate and its Preparation
Metal Cleaning and Pretreatment
The Selection of Decorative Paints
Corrosion and Prevention
Industrial Coatings: Application and Curing Methods
Surface Coatings Defects

Analysis of Polymeric Materials
Technical Service in the Surface Coatings Industry
Standardisation, Inspection and Accreditation in Australia
Statutory Requirements of the Paint Industry
Appendix: Paint Calculations
Useful Data and Conversion Tables
Glossary of Terms
List of Contributors



To: Oil & Colour Chemists' Association
Priory House, 967 Harrow Road, Wembley, Middlesex HA0 2SF, UK

Please arrange for me to receivecopy/ies of "SURFACE COATINGS", Volume 2 Paints and their Applications at £32.50 each (inc. p&p in the UK) plus £3.00 for orders sent overseas, at the following address:
(BLOCK CAPITALS)

.....
.....
.....

I enclose remittance (payable to OCCA) for £