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JOCCA

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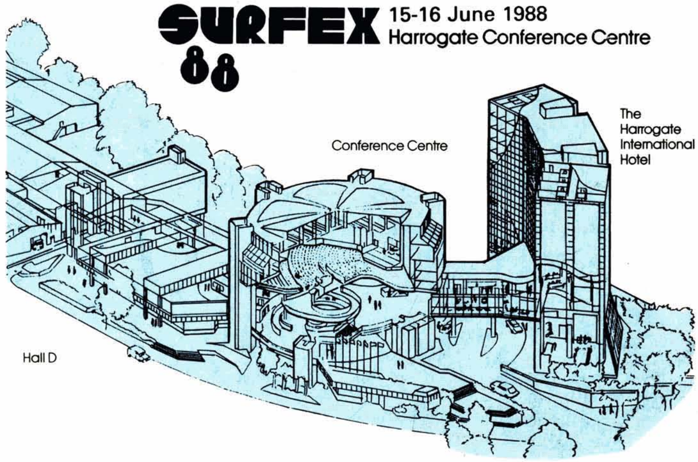
Harrogate Conference Centre



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UPDATE

Journal of Oil and Colour Chemists' Association,
Priory House, 967 Harrow Road, Wembley, Middlesex HA0 2SF, England.

JOURNAL of the OIL AND COLOUR CHEMISTS' ASSOCIATION

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Contents **Vol. 71 No. 3** **March 1988**

OIL AND COLOUR CHEMIST'S ASSOCIATION

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

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Macpherson PLC acquires Valspar from Beckers

Macpherson PLC has become the third largest paint manufacturer in the United Kingdom following the acquisition of Valspar. The well known Valspar brand has been purchased from Wilhelm Becker Ltd, a wholly owned subsidiary of the Swedish based Becker Group.

Macpherson is one of the leading manufacturers of Trade Decorative products and has a strong presence in the retail market. The Valspar acquisition will considerably strengthen Macpherson's standing in both sectors as well as gaining valuable product approvals. The acquisition will place Macpherson in third place in the United Kingdom paint manufacturing industry, behind ICI and Williams Holdings.

Production of Valspar paint at the Becker plant at Speke, Liverpool, will be transferred to Macpherson Paints Ltd at Bury, Lancashire, over the next three months.

In a separate agreement Becker's Scottish based paint company, Alexander Fergusson & Co Ltd, has also been acquired and its Glasgow production unit will continue to operate under Macpherson management. Becker's existing Industrial Coatings and Soab resins companies also based at Liverpool are not part of the acquisition.

Macpherson, which employs more than 1,500 people at its factories in Bury, the West Midlands, London, Stockport, Treforest and Haverhill, was bought in 1984 by the rapidly expanding Finnish paint group, Tikkurila Oy.

In the paint industry, Macpherson is the world leader in multi-colour paints to the trade through Fortaflek and Portatone products. In the retail sector Macpherson's brand names include Signpost Paints and Cover Plus. Macpherson is also a major supplier of industrial coatings, factory applied wood finishes, polymers and resins.

Alpine acquired by Hosokawa

Hosokawa Micron International, through its European subsidiary HMI-Unternehmens-Holding GmbH, has acquired the well known Alpine Group (Headquarters and manufacturing facilities in Augsburg, Germany, and subsidiaries in England, France, USA and Italy). Alpine is a world leader in powder technology and has been at the forefront of this field for over 90 years. Mr Masuo Hosokawa, Chairman and President of Hosokawa Micron Corp Osaka, stated, "Alpine and its world-wide sales organisation will be maintained as a separate unit with its complete range of equipment and processes. The UK will continue to be served by Alpine Process Technology Ltd at Runcorn where full sales, service, test, project engineering and manufacturing facilities are located.

BP Chemicals reorganisation

BP Advanced Composites and BP Detergents have become part of BP Chemicals International, bringing the total turnover of the business stream to £2.5 billion.

The total chemicals business is being reorganised into a number of Bulk, Speciality and Functional Divisions, each with a Chief Executive. The following will report to Ray Knowland, Chief Executive Officer of BP Chemicals International, unless otherwise indicated:

Bulk products	
Mr John Turnbull	Petrochemicals & Polymers Division
Mr Jean Lamort	Polymers Division (reporting to Mr Turnbull)
Mr Doug Campbell	Sohio Division
Mr John Hooper	Acetyls & Solvents Division
Specialities	
Dr Frank Newman	Specialities Division
Mr Iain Steeel	with effect from 1 March 1988
Mr Mark Bean	Advanced Materials Division
Mr Denis Dunstone	Detergents Division
Functional	
Dr Wilfried Petzny	Development Division
Mr Clive Thompson	Corporate Resource Division

In addition, Mr Jean Lamort remains Chief Executive of BP Chimie, while Mr Rolf Saumann remains responsible for BP Chemicals International operations in Germany. Mr Doug Campbell continues as President, BP Chemicals America. All those named are members of the BP Chemicals International Executive Committee.

Specialities division

BP Chemicals International Specialities Division has been reorganised under its Chief Executive, Dr Frank Newman, who is to retire on 31 March 1988. He will be succeeded by Mr Iain Steel, currently Chief Executive Officer of BP Ventures. In order to provide a stronger base for growth and expansion, Carshalton Division, Hythe Chemicals Ltd, Verdugt BV, Honeywill & Stein and the Performance Chemicals Business have been brought together as the Fine Chemicals Business under Mr John Svalander.

The European-based New Speciality Business in chemicals and polymers have been placed under a single management. Mr Ian Henderson is the Manager, Phenolics and New Speciality Businesses, which includes the nitrile rubbers operations at Barry, South Wales. The Polybutenes (PIB) Business remains in the Division under its manager, Mr Michel Fuccy.

Harrisons & Crosfield to acquire Lankro Chemicals

Harrisons & Crosfield PLC (H&C) have agreed terms with the shareholders of Lankro Ltd (Lankro) for the purchase of the share capital of Lankro. Lankro's only material asset is a 75% shareholding in Lankro Chemicals Ltd (Lankro Chemicals) of Eccles, Manchester. Employee shareholders throughout the Lankro group of companies hold the balance of 25% of the shares in Lankro Chemicals and H&C have undertaken, as soon as reasonably practicable, to make an offer for the remaining 25% of the shares in Lankro Chemicals for a consideration of £7.65 million. The total group profit before taxation for the year to 30 November 1987 is expected to be not less than £3.9 million on a turnover of approximately £70 million. Lankro Chemicals is involved principally in speciality chemicals in polymer additives, radiation curing chemicals, surfactants and polyurethanes. H&C's chemical manufacturing activities principally consist of chrome and zinc chemicals, iron oxides, aluminium chloride, polymer additives and surfactants.

Binks and Sames join forces

Binks Manufacturing Company Inc, Chicago, USA, has acquired all the interests of French electrostatic painting and powder application specialist, Sames SA, based in Grenoble, France. Binks-Bullows Ltd has had close trading links with Sames for many years and distributes Sames electrostatic and powder application products in the UK, Sweden and Australia.

International Paint acquires Extensor AB

International Paint plc, the coatings business of Courtaulds plc, has purchased Extensor AB, a prominent Yacht Paint company based in Sweden. This latest acquisition will further strengthen the Group's position as the leading supplier of Yacht Paint worldwide. Extensor has a significant antifouling paint business with a major share in Scandinavia and Northern Europe and a growing presence in North America.

Extensor's most significant Yacht Paint product is VC17M Antifouling, which is available in an environmentally friendly "tin free" version. It has proved to perform well in a variety of climatic conditions. VC17M Antifouling benefits from patented technology, involving the use of Teflon,* to produce an extremely smooth and unique finish for the bottom of boats which allows for increased boat speed. * A Du Pont trademark.

Steetley Berk Ltd expansion of mineral activities

Steetly Berk Ltd, a subsidiary of the building and construction materials group, Steetly plc, has completed Phase II of its minerals complex at Flexborough, S. Humberside. This second phase, to be opened in March 1988, will provide facilities to import and store bulk minerals for further processing and packaging on site. Initially the facility will handle high quality dolomite, imported from Franzefoss Bruk in Norway, with other minerals being handled in future. In response to increasing demand for high-quality close specification minerals for use in household and domestic products, this development includes the installation of new process plant. This will enable Steetley Berk to launch a new range of high brightness dolomite fillers to satisfy the demands of the market for surface coatings, adhesives, mastics and domestic products.

BASF and Tanabe (Jpn) establish OEM automotive paints company

BASF Lacke + Farben AG, Muenster (Federal Republic of Germany) and Tanabe Chemical Industries Co Ltd, Osaka (Japan), have established a joint company for the sale of OEM automotive paints. The agreement was signed in Osaka by Shimata Tanabe, President of Tanabe Chemical Industries, and Dr Juergen F Kammer, member of the Board of BASF Lacke + Farben AG. BASF Lacke + Farben AG has an important position in the field of OEM automotive paints in Europe, North and South America. With BASF Tanabe Ltd, BASF Lacke + Farben AG will be directly represented in the Japanese market as a supplier to the automotive industry.

raw materials

ICI's emulsification system

The current trend towards more ecologically acceptable products has created a demand for special emulsifiers which can be used to convert conventional paint resins into water-based emulsions for use in the production of water-borne coatings. *'Atlas' G-4809* emulsifier has been tailor-made by *ICI Speciality Chemicals* specifically for this purpose.

Ultimately, the aims of the paint formulation chemists are to bring the levels of substances such as solvents and amines as low as possible, to match the properties of the paint to those of conventional solvent-based paints and to ensure that such water-dispersible systems are simple to use. The aim of converting paints into water-based emulsions is to reduce the level of substances such solvents and amines to a minimum, while matching the film properties and ease-of-use of conventional solvent paints.

'Atlas' G-4809 emulsifer functions by bringing the hydrophilic/lipophilic balance (HLB) of the paint resin into the range between five and seven. This is the lowest level at which water dispersibility can be obtained. Paint resins normally have an HLB of around one – putting them into the category of water-in-oil emulsions.

Reader Enquiry Service No. 30

New Servo flow and levelling agent and coalescing agent

Servo-Delden B.V. of the Netherlands (represented in the UK by Hüls) has introduced a new flow and levelling agent, *Ser-Ad 100 Flow.* It is designed for powder and liquid industrial coatings. Ser-Ad 100 Flow is supplied in an easy workable liquid form. It is silicone free and does not impair initial or coating adhesion. Use of Ser-Ad 100 Flow results in a coating surface that's virtually free of craters, pinholes, fisheyes and other imperfections. Servo has also introduced *Ser-Add 511 Coalescent and Ser-Ad 516 Coalescent.* Both products are low-odour coalescing agents used in various dispersion paints to reduce the minimum film formation temperature and to improve the mechanical properties including scrub resistance of the paint film. Ser-Ad 511 Coalescent shows the best cost/performance ratio in traditional dispersion paints. Ser-Ad 516 Coalescent is a most aggressive coalescing agent, very effective in hard polymeric dispersions.

Reader Enquiry Service No. 31

Croda launches new pigment dispersant

Croda Resins Ltd, the resins specialist, has perfected a unique polymeric pigment dispersant – *Incrosperse* – which can be used as a single concentrate in paints and printing inks. In addition to being a universal dispersant, Incrosperse is claimed to impart other advantageous properties to surface coatings, ie improved flow, 20% greater tinting strength in organic pigment dispersions and considerable savings in raw material costs.

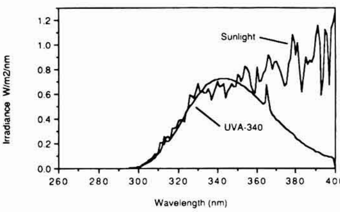
Reader Enquiry Service No. 32

equipment

New UV sunlight simulation lamp for Q-U-V

The Q-Panel Company has available the new *UVA-340 lamp,* stated to be the best simulation of sunlight available for use in the Q-U-V Weathering Tester. Short wavelength UV is widely recognized as the cause of most sunlight damage to durable, exterior grade polymers. The UVA gives an excellent simulation of this region, from 365 nm down to the solar cut-off 295 nm. Furthermore, the UVA-340 produces no UV wavelengths below the solar cut-off. In many cases the UVA-340 provides better correlation with outdoor exposure than the shorter wavelength UVB lamps most commonly used with the Q-U-V. And it usually gives faster test results than the slightly longer wavelength UVA-351 lamps. The UVA-340 complies fully with ASTM G-53, and the thousands of Q-U-V's now in service can use the UVA-340 without modification.

Reader Enquiry Service No. 33



UVA-340 lamp irradiance.

Unique new viscometers

A completely new and claimed to be unique range of viscometers are available from *Chemlab Scientific Products.* They all employ the novel principle of being able to stir the sample whilst measuring the viscosity and speed of rotation. Several models are available starting with the Visco-Mix which can be attached to most existing laboratory overhead stirrers. This means that the viscosity of the sample can be determined in customers' existing reaction vessels whilst following a chemical reaction. The Rheosyst 1000 has its own powerful integral motor and the control unit displays both the speed and torque. The top of the range Rheosyst 5000 using a patented torque system has five torque ranges from 0-1 Ncm to 0-150 Ncm and one can easily switch from one range to another without changing drive unit, rotors or cups and without interference to the sample under test.

Reader Enquiry Service No. 34

Processing capacity doubled

Particulate engineering specialist *British Rema* has doubled the capacity of its milling and classification plant at its works near Sheffield. The company has installed a second Aerosplit classifier and fitted a larger filter system to both classification units, and the performance of the plant's high speed impact grinders has also been uprated. In addition, fluid energy jet milling capacity has been increased following the installation of a supplementary compressor. These and other British Rema machines in the plant are available on a contract basis to grind and classify almost any material.

Reader Enquiry Service No. 35

Unmistakably better!

Clearly better paint adhesion through adhesion resins from Hüls.

Our adhesion resins **LTH, LTW, BL 1210, and BL 305** are the result of targeted research and development work. They are special-purpose supplementary resins which even in small amounts improve the adhesion and intercoat bond of paints and lacquers. This applies to all metallic and mineral substrates, but also to plastics. Many years of manufacturing experience ensure constant quality and reliable application.
The different property profiles and forms of supply of the individual adhesion resins offer many adaptation and optimisation possibilities.
We have got the adhesion resin that you are looking for. For any further information, please contact: Hüls AG, Referat 1122, D-4370 Marl.

In U.K. please contact:
Hüls (U.K.) Ltd.,
Central Court, 1b Knoll Rise,
Orpington, Kent BR6 OJA

4/7418/1 E

hüls

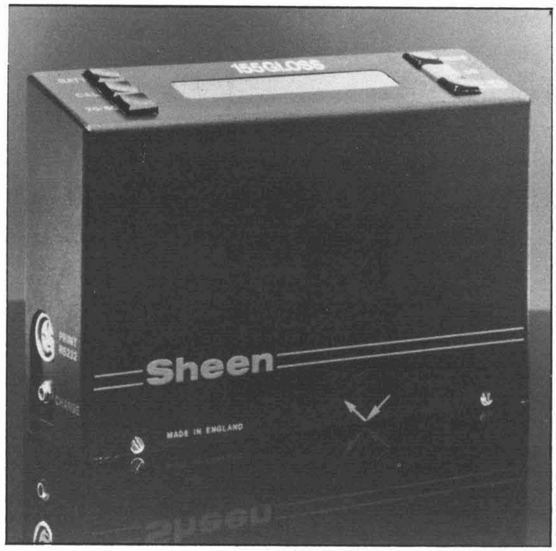
New Primarc UV cure test unit

A new benchtop ultra violet dryer, the *Minicure*, suitable for laboratory, test and quality control work, has been introduced by *Primarc Ltd.* This is designed for use with ink, paint and surface coating samples or any other application involving the use of UV-curable inks and varnishes. The dryer is very flexible in operation, able to simulate production conditions to a high degree of accuracy. The conveyor speed can be varied, and the unit may be fitted with a tachometer. There are sizes from 150 mm to 380 mm wide and the unit can be supplied with one or two air cooled medium pressure mercury arc lamps in ratings of 80, 100 or 120 watts/cm.

Reader Enquiry Service No. 36

Primarc's Mini-cure UV curing system.

Sheen's new portable glossmeter



Sheen's 155 glossmeter

By the use of the latest developments in optical and electronics engineering, Sheen Instruments is now offering the new 155 miniaturised portable statistical glossmeter. The 155 is suitable for accurate measurement of the standard of finish of plastic coatings, ceramics and many other materials as well as paints, protective coatings and inks. The new specular glossmeter incorporates optics for 20° and 60° angles of incidence, meeting the requirements of BS 3900, ISO 2813 and other international standards.

Calibration is fully automatic and is completed in 2 seconds, with both 20° and 60° sections being calibrated simultaneously. A reference tile is supplied as standard. The RS 232 printer output is provided via a 3-pin DIN socket. The levels are ±5 volts. The 155 glossmeter can be connected directly to the printer, or computer for long term storage of information. The standard display language is English, but French, German, Spanish or Japanese can be specified. Other display language can be supplied on request.

Reader Enquiry Service No. 39

Eye and face wash

Safety shower manufacturers *Maestro Safety Equipment* has introduced an eye and face wash specifically designed for use in laboratories. The Maestro *L906 hand-held eye and face wash* is mounted on a wall and has a 12 foot hose which is permanently heat set so that it returns to its recoiled position after use. The spray of water fans softly outwards to give maximum coverage to the eyes and face, or other parts of the body.

Reader Enquiry Service No. 37

Maestro eye and face wash.

Anti-crater spray gun

Coating the inside walls of hygiene related premises such as operating theatres, food manufacturing plants and establishments in the pharmaceutical industry, pose challenges to those having to specify and apply the paints or specialised coatings. Despite the technological advances of recent years in respect of coating materials and the equipment used to apply them, one challenge that still tends to persist concerns the problem of 'cratering'. That is, with the paint-spraying process, the possibility of some unatomised material leaving small 'craters' on the finished surface. To date, the irksome problem has been overcome by brushing over the craters after they spray application. This is not wholly satisfactory and defeats the object of using modern spray application equipment as superseding the old "4-inch brush" methods. The problem has concerned Liquid Plastics Ltd, a leading manufacturer of waterproof and weatherproof membranes. The company approached *Tri-Spray (UK) Ltd,* a specialist distributor of coatings application equipment, who loaned equipment for evaluation purposes. Happily, a fine solution has resulted and Liquid Plastics has discovered that, by using a *Titan gun* with an adjustable tip supplied from Tri-Spray, not only has the cratering problem been overcome but that the Titan unit can be used with standard airless spray equipment.

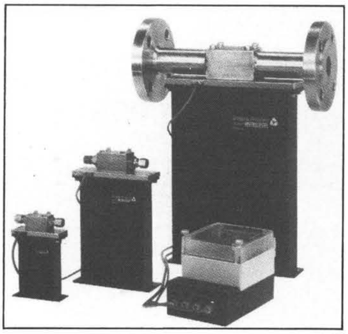
Reader Enquiry Service No. 38

New mass flowmetering system

George Meller's new Bopp & Reuther, *Rheonik mass flowmeters* are now available for direct measurement of fluids and gases including suspensions and sludges with abrasive particles, corrosive fluid, high density gases and low or high viscosity liquids.

Unlike conventional flow measurement techniques, the Rheonik flowmetering system is not adversely affected by the physical properties such as pressure, temperature, density, viscosity, etc, of the liquid or gas being measured, and can even handle shear sensitive products with ease.

Although our solutions are always innovative, they're never merely flights of fancy.



Rheonic mass flowmetering system.

The system incorporates the RHM pick-up and the RHE electronics unit. The RHM operates within the temperature −20 to +150°C, and has an accuracy of ±0.2% of measured value in the range 1:20 and ±0.5% in the 1:50 range (low pressure version). Extended temperature range models are available for operation between −200 and +300°C. The RHE electronics unit covers flow rates of up to 1,000 kg/min, and operates in a range of ambient temperatures between −20°C and +40°C.

Reader Enquiry Service No. 40

products

International Paint launch new speciality products for 1988

International Paint, backed by its parent company Courtaulds, is again strengthening its position in the speciality paints sector with the introduction of six brand new products.

Extensive research and product testing has been invested and the company's strategy of targeting specific end user needs has been carried through to produce high quality new paints, packaged in attractive and informative livery.

The new brand products are: A high-build, quick drying anti-corrosive primer/undercoat for metal, iron and steel. A quick drying one-hour undercoat. An anti-condensation paint. A universal sealer. A white satin quick-drying finish. A black satin quick-drying finish.

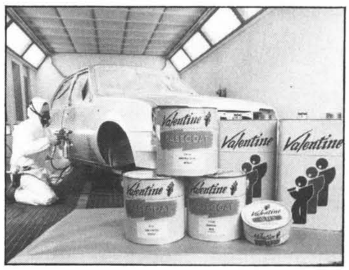
Reader Enquiry Service No. 41

International's paint range new for '88.

Valentine basecoat is launched

BASF Coatings + Inks Automotive Refinish has launched Valentine Basecoat, a new basecoat system which replaces Valentine's existing metallic systems, greatly simplifying the brand's product range. This new system substantially reduces distributor stocking levels, is easy to apply, economic to use and gives an extremely durable, high gloss finish. Basecoat is suitable for both air dry and low bake environments and is compatible with Valentine's Valroc acrylic urethane and Spragloss nitro-cellulose systems. This eliminates the need for distributors to stock separate basecoat systems for Valroc and Spragloss users. A major feature of the Basecoat system is that its 20 base colours can be mixed with either Spragloss or Valroc.

Reader Enquiry Service No. 42



Valentine basecoat.

More colours for Macpherson Paints masonry range

Macpherson Paints' new 1988 masonry range has been extended to 62 colours to make it one of the widest choices ever offered to the trade for exterior decoration. The Macpherson exterior masonry range includes Powerkote, Marbletex Fine Textured, Marbletex Smooth, Stabilising Solution and Anti-Mould solution. Mike Kinsella, Macpherson's Trade Product Manager, explains: "Choosing the right colours for exterior masonry is very important. The general environment, local preferences, existing colour schemes all play their part, but all too often the limited colour choice available from many paint companies makes the task very difficult. Our new extended range has been designed to overcome this problem. "With 62 shades, it provides the optimum colour choice. Choosing the right type of exterior coating is equally important. Ease of application and durability are vital elements and they were given special emphasis when we formulated the masonry range. So we now have both the colours and products to match."

Reader Enquiry Service No. 43

New DIY timber preservative

Granyte Surface Coatings, UK market leader in industrial wood finishes for the furniture trade, now offers a high performance timber preservative for interior and exterior DIY applications. A modern microporous decorative treatment, Granyte Woodcare has been tested and certified by TRADA (Timber Research & Development Association). The product, a decorative wood stain, is light fast, non toxic, exceptionally weather resistant and effective against a wide range of bacteria and fungi. It is offered in a choice of 12 intermixable shades, plus black, white and clear.

Reader Enquiry Service No. 44

Re-painting one of L S Lowry's favourite haunts

The Midland hotel in Manchester is one of the north's premier hotels, which has welcomed the likes of Edgar Wallace, Sarah Bernhardt, General Patton, Albert Einstein, Noel Coward, Winston Churchill and L S Lowry. Showing some signs of decay after 80 years, it was recently completely restored to its original splendour, at a cost of £15½ million. Re-christened the Holiday Inn Crowne Plaza Midland, it has taken its rightful place amongst Europe's premier hotels. The task of decorating the prestigious public rooms, including the main reception lobby, restaurants and conference suites, fell to Leeds contractor Frank Houlgate Decorators. The paint systems were supplied by Johnstone's Paints. Over 60,000 litres of paint were applied to around 30,000 m^2 of surface area.

Reader Enquiry Service No. 44

Frank Houlgate (left) and Johnstone's Paints' Technical manager, David Johnstone, in the reception of the Midland Hotel.

meetings

Interfinish 88

The 12th world congress on Surface Finishing will be held at the Palais Des Congres, Paris, France, on 4-7 October 1988. There will be a technical programme and exhibition. For further information contact: Commissariat General, 8 rue de L'Isly 75008 Paris, France.

Corrosion Engineering and Control

A short course on Corrosion Engineering will be held at the Corrosion and Protection Centre, Umist, on 11-15 April. The course will be wide ranging and include topics such as Organic Coatings, Cathodic Protection, Atmospheric Corrosion, Materials Selection and Maintenance. For further information contact: David Scantlebury, Course Organiser, Corrosion and Protection Centre, Umist, PO Box 88, Manchester M60 1QD.

1988 SSPC National Conference and Exposition

The Steel Structures Painting Council will be holding its annual National Conference and Exposition at the Baltimore Convention Centre on 13-17 November 1988. The Omni International Hotel will serve as SSPC headquarters. For further information contact R. M. Surgent, SSPC, 4400 Fifth Avenue, Pittsburgh PA15213, USA.

Surfaces, Interfaces and Adhesion

A one-day course and workshop on Surfaces, Interfaces and Adhesion will be held at Loughborough University on 29 March 1988. The fee for the course is £120.75. On 24 March 1988 a one-day seminar will be held also at Loughborough on Developments in Adhesive Bonding with speakers from Ciba Geigy and Croda Adhesives. The fee for the seminar is £103.50. For further information contact: Adhesion Consultants Ltd, 25 Barrow Road, Burton on the Wolds, Loughborough LE12 5TB.

Mixing Technology Seminar

The Department of Trade and Industry's Warren Spring Laboratory (WSL) is holding a one-day seminar on 28 April 1988 to review current industrial mixing technology. It is aimed at users and makers of industrial mixers, and researchers in mixing technology. The siminar, to be held at the Laboratory in Stevenage, will comprise lectures given by WSL and university research workers experienced in the relevant technologies. Attendance will cost £143.75. For further information contact: Ken Allsford, Warren Spring Laboratory, Gunnels Wood Road, Stevenage, Herts, SG1 2BX, England.

Period Paint

A one-day short course will be held by the Ironbridge Institute on "Period Paint: The Imitation of Natural Materials" on Wednesday, 27 April 1988. The course will look at the ways paint has been used to imitate wood, marble and other materials. The course will be held at the Weald and Downland Open Air Museum, enabling delegates to consider the project to reconstruct a historic paint shop. For further information contact: Janet Markland, The Ironbridge Institute, Ironbridge Gorge Museum, Ironbridge, Telford, Shropshire TF8 7AW.

ICHEME courses

The Institution of Chemical Engineers are running several courses of interest throughout the year: Safety Technology in System Design and Operation, Chemical Engineering for Scientists, HAZOP Studies. Their Organisation Leadership and Wider Application, Risk Identification and Control by HAZOP Study, Practical Quantitative Hazard Assesment. For further information contact: The Conference Section, ICHEME, 165-171 Railway Terrace, Rugby CV21 3HQ.

literature

UK Paints, Stains and Varnishes

Britain's paint and varnish markets continue to benefit from the surging interest in DIY, which could help boost annual sales by the end of the decade to £417M, suggests a new report from UK market information specialists, Marketpower.

Total sales of decorative paints, stains and varnishes reached the £375M mark last year, and with Marketpower's predicted 2% yearly increase, are on target to enjoy a glowing future. "An increase in the amount of leisure time available – both enforced and voluntary – coupled with a rise in home ownership levels and subsequent commensurate increase in DIY activity in general, have all helped to pave the way for a bright future," says the report, just published as part of Marketpower's well received Consumer Markets series.

Of the report's two principal sectors, the market for decorative paint last year was worth £308M, and with its expected 2½% year on year growth up to 1991, will be largely responsible for the overall market's average growth. Stains and varnishes, on the other hand, with sales last year of just £67M, will struggle to make any significant headway. Annual growth of just under 1% will push sales by the end of the five years under review up to the £70M mark.

The ICI Paints Division with its Dulux line-up continues to dominate the lucrative paints market. The company's one-third share of last year's sales reflected turnover of over £100 million. Its nearest rival is Crown Decorative Products, with a 15% stake. Well over a fifth of the paints sold last year were own label.

Within the stains and varnishes market, Cuprinol sets the pace with a 28% slice of last year's total sales. Close behind in second place is Sterling Roncraft, and the leading duo are followed by Evode.

The most significant trend in recent years has been the meteoric growth of non-drip paints which have been trying to banish the liquid equivalents into the decorating wilderness for some years, concludes the report. With penetration of non-drips running at over 50% already though, many experts suggest they may soon be reaching saturation.

For further details or a copy of the Paints, Stains and Varnishes report, price £85, and a complete titles list contact: 84 Uxbridge Road, London W13 8RA.

Inherent Safety

Conventional ideas of safety in the process industries are challenged in this new video training package from the Institution of Chemical Engineers. Process plants have steadily grown in size, complexity and cost over recent years and greater quantities of hazardous materials are being manufactured, stored and transferred. Demands for ever-higher standards of safety have closely followed major chemical accidents such as Flixborough, Bhopal and Mexico City. To comply with these, layers of protective safety equipment are added to new plant designs to control or prevent hazardous situations.

But is this approach effective? Safety equipment is expensive to purchase, to install and especially to maintain. It is not always reliable – maintenance can be neglected and equipment can fail. Controlling hazards is not the answer. This control may break down, resulting in another Flixborough or Bhopal. "Inherent Safety" advocates that hazards should be removed, early in the design stage, eliminating the need for expensive safety systems. Developed by the process safety expert, Trevor Kletz, the video shows practical examples of how inherently safer designs have simplified plant, lowered costs and, more importantly, reduced risks. Emphasis throughout the package is placed on discussion and participation, and a wide range of supporting material is included.

The video is priced at £495 or on 7 days' hire £105. For further information contact: Bernard Hancock, Manager – Safety and Loss Prevention, The Institution of Chemical Engineers, 165-171 Railway Terrace, Rugby, Warwickshire CV21 3HQ.

Lead chromates: The state of the art in 1988

G. P. Algra, L. J. H. Erkens* and D. M. Kok

Ciba-Geigy Ten Horn BV, Industrieweg 16, 6219 NR Maastricht, The Netherlands.

1. Introduction

The discovery of the orange yellow mineral crocoite (monoclinic pure lead chromate) in 1766 by J. G. Lehmann in Siberia initiated the synthesis of yellow inorganic pigments[1]. In 1809 L. N. Vauquelin synthesized lead chromate for the first time and 13 years later commercial quantities became available. At the beginning of this century the production in Europe started.

The chemistry of the Molybdate Oranges is based on the discovery of H. Schultze[2] in 1863 that the white mineral wulfenite (tetragonal lead molybdate) when found in conjunction with crocoite, showed a bright red colour.

The production of these yellow and orange/red pigments started about one century ago. Those early products hardly bear a resemblance to the presently available lead chromate/molybdate pigments, a consequence of the ongoing efforts to improve the pigment performance.

During the first decades[3] of production the attention was focussed on the improvement of the cleanliness of masstone of the Chrome Yellows and Molybdate Oranges. In addition the stability of the crystal structure, the lightfastness and the weather resistance of the Molybdate Oranges were improved. In the last decades attention was merely paid to a further improvement of lightfastness, weather resistance, dispersibility, SO_2-resistance and heat resistance without sacrificing the cleanliness of the masstone too much. The improvements culminated in a wide variety of Chrome Yellows and Molydbate Oranges showing a much better price/performance ratio than other pigment classes.

Having achieved the improvements mentioned above, research efforts have been directed to a further increase of the colour strength and opacity. Significant improvements have been accomplished using a new technology[4].

This overview describes the chemistry of lead chromates, the relations of properties within the class of lead chromates, and the properties of lead chromates with respect to organic and other inorganic pigments.

2. Chemistry

Lead chromate pigments which carry the chromate anion as the chromophore show a variety of shades. Presently the two most important classes are the Chrome Yellows and the Molybdate Oranges. The shade of Chrome Yellows varies from very greenish yellow (primrose) to reddish yellow (see Figure 1: curves 1, 2, 3 and 4), whereas the shade of the Molybdate Oranges varies from yellowish red to blueish red (see Figure 1: curves 5 and 6).

The shade of lead chromates is determined by the three factors described in Sections 2.1, 2.2 and 2.3.

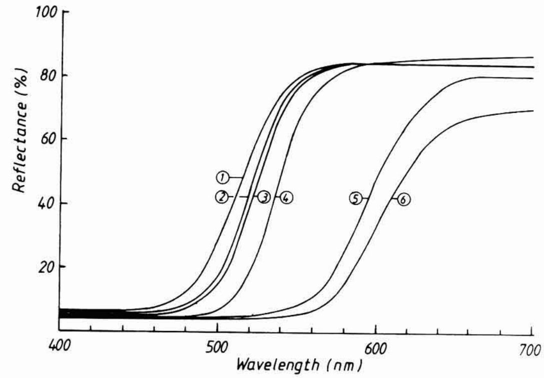


Figure 1. Reflectance curves of orthorhombic (1) and monoclinic (2, 3 and 4) lead chromates and tetragonal (5 and 6) lead molybdates.

2.1 The trimorphology of lead chromate

Lead chromate is known to have three crystal modifications[5] (see Figure 2):
a. an unstable greenish yellow orthorhombic structure.
b. a stable reddish yellow monoclinic structure.
c. an unstable orange/red tetragonal structure.

The stable reddish yellow monoclinic structure[6] is found in nature as the mineral crocoite. The unstable modifications are obtained either by a decrease in temperature (orthorhombic structure) or by an increase in temperature (above 783°C; tetragonal structure) (see Table 1).

The colour difference between the crystal modifications is due to a change in the Cr-O bond lengths causing a change in the charge-transfer spectrum of the chromate anion.

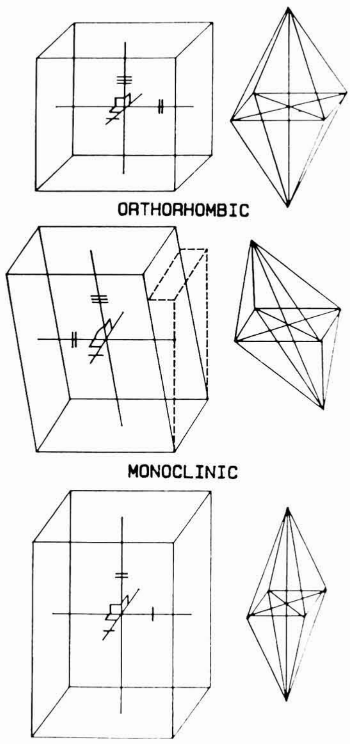


Figure 2. Schematic representation of orthorhombic, monoclinic and tetragonal crystal structures.

2.2 Mixed crystals with lead chromate

An examination of several lead salts indicates that at least two lead salts, lead sulphate and lead molybdate are closely related to lead chromate, because of the very similar geometry of the anions, in which the main differences are found in the M-O bond lengths (M=Cr, S or Mo).

* To whom correspondence should be addressed.

Table 1.

Stabilities of crystal structures of several lead salts

Lead Salt	Orthorhombic	Crystal Structure Monoclinic	Tetragonal
$PbSO_4$	Stable (anglesite)	Unstable (Stable >800°C)	—
$PbCrO_4$	Stable at very low temperatures	Stable (crocoite)	Stable above 783°C
$PbMoO_4$	—	—	Stable (wulfenite)

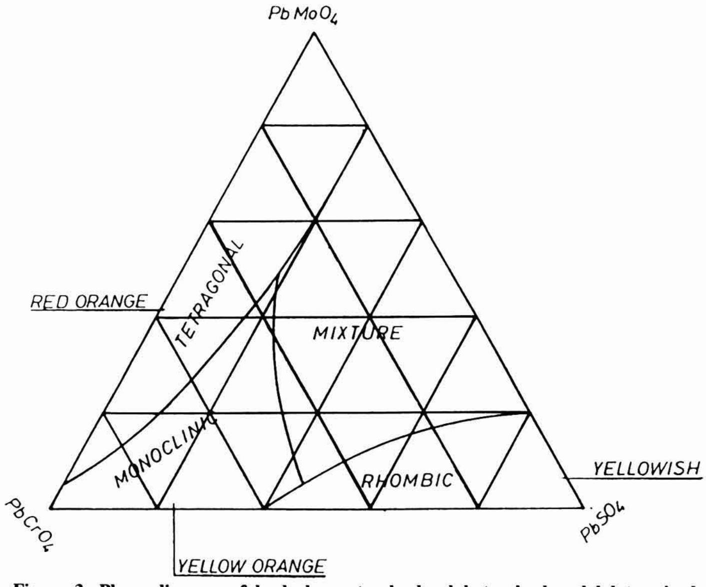


Figure 3. Phase diagram of lead chromate—lead sulphate—lead molybdate mixed crystals.

Although the geometry of the anions is very similar, the crystal structures differ distinctly from each other. Lead sulphate is found in nature in a stable orthorhombic crystal structure (mineral anglesite) and lead molybdate in a stable tetragonal structure (mineral wulfenite) (see Table 1).

Because of the close relationship between these lead salts it is possible to build mixed crystals of lead chromate with either lead sulphate or lead molybdate[5]. The evidence for the formation of mixed crystals instead of coprecipitates is found in the colour difference between the end product and the parent compounds. This is most clearly shown by the formation of a mixed crystal of lead chromate and lead molybdate. The first compound shows a reddish yellow colour and the latter compound is white, whereas the mixed crystal is brilliant orange/red.

The observation that at ambient temperature and pressure lead chromate exists in a monoclinic crystal structure would restrict the colour range of lead chromate pigments considerably. Fortunately the existence of mixed crystals yields additional stable structures at normal working conditions. When lead sulphate is incorporated in sufficient quantities in a mixed crystal with lead chromate a phase transition from a monoclinic into an orthorhombic structure is observed. When lead molybdate is incorporated in sufficient quantities then a phase transition from a monoclinic into a tetragonal structure is observed.

The foregoing is illustrated in the phase diagram given in Figure 3. Although the diagram displays only a qualitative picture (the absolute minimum concentrations are constantly changing due to still ongoing research efforts) the principle idea of the diagram is nevertheless still valid.

The differences in shade between the orthorhombic, monoclinic and tetragonal modifications have now been established and are illustrated by the reflection curves 1, 4 and 5 in Figure 1 respectively. However the colour range of lead chromates is not restricted to three distinct shades. As shown in Figure 1 the masstone of the monoclinic crystal modification may vary from reddish yellow (curve 4) to lemon yellow (curve 2). These variations in shade are accomplished by the formation of monoclinic mixed crystals of lead chromate and lead sulphate: a higher amount of lead sulphase corresponds to a more greenish shade. The shift in shade is due to the change in Cr-O bond lengths caused by the incorporation of the sulphate ions. A similar process is responsible for the variations in shade of orthorhombic Chrome Yellows.

The variations in shade for Molybdate Oranges are achieved by a totally different process. In general Molybdate Oranges have the same chemical composition apart from encapsulation chemicals.

The differences in shade are due to differences in particle size. A smaller particle size corresponds to a more yellowish red and a larger particle size to a more blueish red shade. The crystal growth is controlled via the process conditions (see Section 2.3).

2.3 Process conditions

Apart from the crystal structures or chemical compositions the properties of lead chromate pigments with regard to particle size and particle size distribution are mainly determined by process parameters like pH, temperature, concentrations, ion activities and time. The majority of these parameters is directly or indirectly related to the solubility of lead chromate, because the solubility is a most valuable tool to control the particle size of lead chromate. Therefore the process conditions are chosen either to achieve a minimum solubility of lead chromate (and thus a small particle size) or to allow a controlled degree of crystal growth. In this context the relationship between the solubility of several lead salts and pH and concentration of common ions is given in Figure 4[7].

From the well known relationship between particle size and colour strength or opacity displayed in Figure 5, it is noted that in general a smaller particle size corresponds to a higher colour strength in the end application. The opacity curve shows a maximum at an average particle size of 1/2λ, the absorption wavelength.

Because the average particle size of a lead chromate pigment still is relatively large in comparison with e.g. organic pigments, a decrease in the average particle size of lead chromates corresponds to an increase in colour strength and opacity (the average particle size being larger than 1/2λ, the absorption wavelength).

Based on the solubility – particle size relationship mentioned above and the high reaction rates (instantaneous precipitation) a new technology has recently been developed[9-11]. It comprises the intimate mixing of the reaction components under high turbulency and yields a considerably smaller particle size and a narrower particle size distribution (see Table 2).

In this way the colour strength and opacity of Chrome Yellow pigments are significantly increased. The decrease in particle size and particle size distribution is clearly demonstrated by Figures 6 and 7, particle size measurements and electron microscope photographs respectively, of the old and new products.

2.4 Encapsulation

The lead chromate pigments described so far show very bad characteristics with regard to lightfastness, weather resistance, acid/alkali resistance and SO_2 resistance. Therefore the pigment particles are encapsulated with thin layers of metal oxides like silica, titanium dioxide, antimony oxide[12], tin oxide etc.[13-15]. The final properties of lead chromate pigments are very dependent on the choice of the coating materials and the order in which the metal oxides are applied onto the pigment particles.

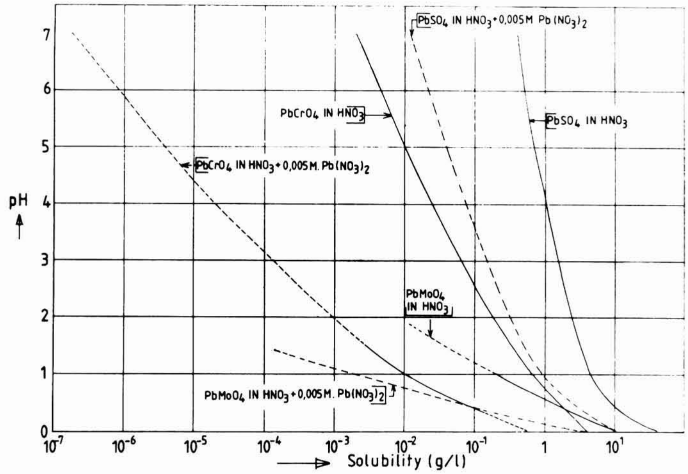


Figure 4. The solubility of several lead salts as a function of pH and the concentration of common ions.

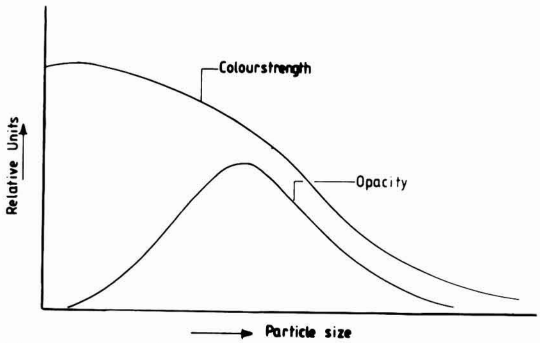


Figure 5. Qualitative relationship between pigment particle size and colour strength or opacity.

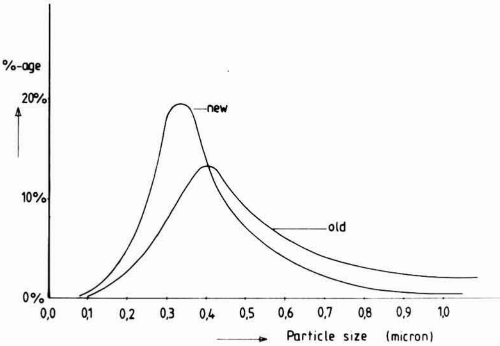


Figure 6. Particle size analysis (CAPA equipment) of the new highly stabilized Dark Chrome Yellow vs the corresponding previous product.

Table 2

Particle size analysis (CAPA equipment) of the new Chrome Yellows vs. the corresponding old Chrome Yellow products

Product description	d(average) microns
Lightfast Lemon Chrome Yellow (new)	0.30
Lightfast Lemon Chrome Yellow (old)	0.41
Lightfast Medium Chrome Yellow (new)	0.32
Lightfast Medium Chrome Yellow (old)	0.37
Lightfast Dark Chrome Yellow (new)	0.37
Lightfast Dark Chrome Yellow (old)	0.51
Highly stabilized Lemon Chrome Yellow (new)	0.44
Highly stabilized Lemon Chrome Yellow (old)	0.57
Highly stablizied Medium Chrome Yellow (new)	0.42
Highly stabilized Medium Chrome Yellow (old)	0.53
Highly stabilized Dark Chrome Yellow (new)	0.37
Highly stabilized Dark Chrome Yellow (old)	0.47

2.5 Precipitation of lead chromate pigments

The actual preparation of lead chromate pigments is based on either one of the following equations:

(1) Pure lead chromate

$Pb^{2+} + CrO_4^{2-} \longrightarrow PbCrO_4$ (1)

(2) Mixed crystal of lead chromate and lead sulphate

$Pb^{2+} + CrO_4^{2-} \longrightarrow PbCrO_4$ (1)

in combination with

$Pb^{2+} + SO_4^{2-} \longrightarrow PbSO_4$ (2)

The mixed crystal can be either of a monoclinic or an orthorhombic structure. The precipitation is accomplished via mixing of the lead solution and the combined chromate-sulphate solution.

(3) Mixed crystal of lead chromate, lead sulphate and lead molybdate

$Pb^{2+} + CrO_4^{2-} \longrightarrow PbCrO_4$ (1)

in combination with

$Pb^{2+} + SO_4^{2-} \longrightarrow PbSO_4$ (2)

and

$Pb^{2+} + MoO_4^{2-} \longrightarrow PbMoO_4$ (3)

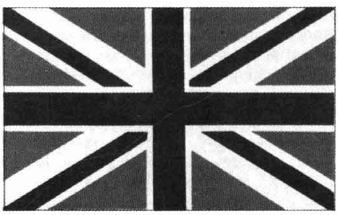
The end product has a tetragonal structure. In this case the precipitation is accomplished via mixing of the lead solution and the combined chromate-sulphate-molybdate solution.

Whether the lead solution is added to

SURFEX 88 UPDATE

Harrogate International Exhibition Centre

SURFEX 88 is the leading UK theatre style exhibition of raw materials, machinery, test equipment and other services to the Surface Coatings Industries including paint, printing ink, coatings, adhesives and sealants. The exhibition will be held at the Harrogate International Exhibition Centre on Wednesday, Thursday 15-16 June 1988. To allow you time to plan your itinerary well in advance this update is concerned with Accommodation, Travel Arrangements and Local Sightseeing. A summary of the products, machinery and equipment which will be on display by each exhibitor is also given. The Official Guide will be published in May JOCCA together with a pull-out Route Planner.

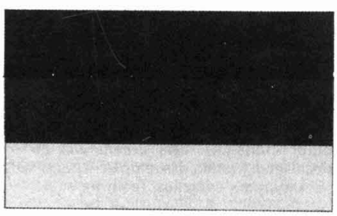


Centrally situated, at the heart of Great Britain, Harrogate is a town created specifically for the requirements of visitors. Since the first natural spring was discovered in 1571, Harrogate has evolved through a rich 'spa' heritage to become a successful business meeting centre and floral resort of world wide renown.

The Harrogate International Centre represents the culmination of decades of development to provide the finest facilities for conferences, entertainments and exhibitions.

First class hotels, homely guesthouses, award winning restaurants, superb shops, internationally acclaimed parks and gardens: surrounded by picturesque countryside coupled with the magic ingredient of 'Yorkshire Hospitality', combine to produce a perfect setting.

We look forward to the pleasure of your company.

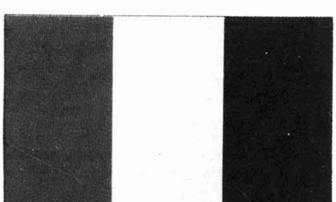


Harrogate, zentral im Herzen von Großbritannien gelegen, ist eine Stadt, die für die Ansprüche von Besuchern wie geschaffen ist. Seit im Jahre 1571 die ersten Quellen entdeckt wurden, hat sich Harrogate zum reichen Heilbad und dann zum erfolgreichen Treffpunkt der Wirtschaftswelt und weltberühmten, blühenden Erholungsort entwickelt.

Das Harrogate International Centre bildet den Höhepunkt jahrzehntelanger Bauarbeiten für die Errichtung der besten Einrichtungen für Konferenzen, Veranstaltungen und Ausstellungen.

Erstklassige Hotels, anheimelnde Pensionen, preisgekrönte Gaststätten, ausgezeichnete Geschäfte, international gepriesene Park -und Gartenanlagen, umgeben von einer malerischen Landschaft, verbinden sich mit der sprichwörtlichen Gastfreundschaft der Menschen in Yorkshire zu einem idealen Austragungsort.

Wir freuen uns auf Ihren Besuch.



Située de façon centrale au coeur de la Grande-Bretagne, Harrogate est une ville créée tout spécialement pour répondre aux besoins du visiteur. Depuis la découverte de lapremière source naturelle en 1571, Harrogate s'est transformée en un centre d'affaires efficace et une ville aux décorations florales réputées dans le monde entier. Son riche passé de ville d'eau est indéniable.

Le Centre International d'Harrogate représente le point culminant de décennies de changements destinés à offrir les meilleures installations de conférence, distractions et expositions.

Des hôtels de première classe, des pensions de famille accueillantes, des restaurants classés, des boutiques magnifiques, des parcs et jardins réputés dans le monde entier: tout ceci se marie, pour offrir un cadre parfait, aux paysages pittoresques des environs et à l'ingrédient magique qu'est 'l'Hospitalité du Yorkshire'.

C'est avec plaisir que nous vous accueillerons.

WHAT'S ON SHOW

Bayer UK Pigments will feature pigments specially developed for formulators and manufacturers in the Paint Industry with a series of technical and performance displays. These will include Bayertitan white titanium oxides, Bayer light yellow inorganic mixed phased pigments, Lightfast Green, Blue and Black inorganic spinel pigments, Bayferrox iron oxides and Baylith, a molecular sieve zeolite drier.

BDH Ltd will be exhibiting Iriodin® Pearl Lustre Pigments, Darocur® Photoinitiators, and Thermochromic Liquid Crystals. The E Merck range of Iriodin® pigments are based on mica coated with metal oxides. The Darocur® range of Liquid Photoinitiators have been developed by E Merck for use in UV-photoreactive systems.

BIP Chemicals will be showing its 'Beetle' butylated amino resins, 'Beetle' methylated resins and developments in mixed ether resins. Developments in saturated and rapid alkyds supplementing the existing range of plasticising alkyds will also be shown.

Blythe Colours – Pigments Division will be exhibiting their range of mixed metal oxides and spinel pigments for colour applications. Pigments for camouflage (infra-red specification), cadmium pigments, and new at SURFEX will be a range of transparent iron oxides for wood finishes and automotive paints.

The Bromhead & Denison stand will feature K-White Aluminium Tripolyphosphate) a non-toxic pigment with anticorrosion properties, manufactured by Teikoku Kako. On display will be photographs showing K-White applications, outside exposure panels and also panels based on ICI Haloflex systems.

Buckman Laboratories will be exhibiting their range of speciality products for the surface coatings industry including a new low toxicity high performance corrosion inhibitor replacement for zinc chromate and zinc phosphate. HSE registered wood and antifouling marine paints preservatives will be featured together with in can and paint film preservatives.

Byk-Chemie will highlight a range of new paint additives such as Byk-034 and Byk-066 defoamers, Byk-302, Byk-307 and Byk-335 silicone anti-slip/levelling additives, Disperbyk-160 range of dispersing additives. Byk-Labotron Messtechnik AG will show its range of testing equipments for the coatings industry.

Capricorn Chemicals will be exhibiting the product range of G M Langer & Co of W Germany. The Lanco Wax range of micronised waxes used in coatings to promote slip, mar/rub resistance will be featured Lanco Beit deep black flushed concentrates used for high gloss automotive application shall be shown. Also featured will be Flare daylight fluorescent colour from Sterling Industrial.

Chemapol (UK) Ltd will be presenting a wide range of products from Czechoslovakia including Titanium Dioxide and anticorrosive pigments for the Paint Industry, in addition a wide range of acrylate dispersions suitable for the paint and allied industries will be shown. Also on the stand will be Chekemcolour Ltd, our dyestuffs distributor.

Chemsafe development will be highlighting its custom blending, mixing, formulating, pre-weighing, packing and dispersing.

Ciba-Geigy Plastics will be featuring their Araldite expoxy resins which form the basis of many high-duty coating systems. The Araldite range will include solvent-containing, solvent-free and powder coating formulations.

Colourgen manufacturers of colour management, measurement and match production systems and software of their own design will have on display single constant and two constant theory software suitable for the match prediction of a very wide range of opaque and translucent materials (inks, paints, etc).

The Cornelius Group will be featuring products from their well-known range of raw materials offered on behalf of various Principals including new products and applications as follows: Methylon and Varcum range of resins (BTL), Epoxy curing agents, reactive diluents (Cardolite), Dispersions (Daniel), Titanium Dioxide (Finntitan), Paint Testing Panels (Leneta), Mirconised Silica (Min-U-Sil), Tall Oil Resin based Binders (Oulures), Phlogopite Mica (Kemira), Plexigum acrylic resins and [Meth]acrylate monomers (Roehm).

Croda Colours will show their range of organic pigments and speciality dyestuffs for the surface coating and printing ink industries. The Forthbrite range of PTMA/PMA and CF lakes used in packaging inks will be featured. A new range of Forthfast and Forthsperse organic pigments and aqueous dispersions and a selection of dyes for wood stains based on our extensive Naphthazine acid dye range will also be shown.

Crosfield Chemicals will feature HP64 and HP39, which have recently been added to its range of HP products. HP64 is a high performance matting agent while HP39 is designed for gloss control. Applications of the HP200 silicas will also be featured. The Alusil ET synthetic functional extender used in emulsion paints will also be featured.

Croxton + Gary will be featuring OMYA Calcite and Britomya chalk whitings, Diamflia (white barytes) and Vertal (floated talcs), new ranges of extenders, Hakuenka range of calcium carbonate, Miox (MOO), Micronox and Superfine (Red Iron Oxides). A range of additives will also be shown.

C & W Specialist Equipment will have on display: The new Composite Corrosion Test Cabinet; the ASTM B117-Hot Salt Spray Cabinet (450L, 1000L); Humidity Cabinets (200L, 450L, 1000L); Mebon Prohesion Cabinets (450L, 1000L).

Durham Chemicals Ltd will be showing a range of products for the paint and related industries. Products will include: Biocides – film preservatives, can preservatives, wall-washing compounds, wood preservatives; paint driers, loss of dry additives, anti-skinning agents, wetting/dispersing agent, zinc oxide, zinc dust.

Efka Chemicals BV represented in the UK by ***Stort Chemicals*** will be featuring their new products Efka Polymer 400 and Efka Polymer 10 (Resin free/minimal universal pigment concentrates), a large range of additives including the latest silicone free levelling aid Efka 772. Also featured will be Efka Uvalink ADP, a cross-linking UV absorber.

Eiger Engineering Ltd will be featuring its range of Eiger Mini and Laboratory horizontal bead mills, ie Motor Mills. Information on Eiger mixers/dispensers, change pan high speed dispensers and high speed torque mixers will also be available. Other Eiger companies projects will be displayed, ie Eiger Process Systems and Eiger Power Electronics.

Ellis & Everard is one of the UK's leading independent chemicals distributors, serving the paint, printing ink and surface coating industries from 17 local branches in England, Scotland and Wales. The Ellis & Everard product range includes binders, solvents, pigments and additives.

HARROGATE CENTRE

Ellis Jones, an established manufacturer of organic pigments, will be displaying products for the printing ink, paint and artist colour industries. The accent will be on specialised grades, developed in line with the customers' technical requirements.

Floridienne UK Ltd will show a range of organic and inorganic pigments and pigment dispersions. Pfizer high quality synthetic iron oxide red, yellow and black pigments. Micro powders micronised wax range, Repolem emulsion polymers, Florplast plasticisers for NC/UV lacquers. Also a range of additives.

Foscolour Ltd produce high quality pigment dispersions for use in paints, printing inks, adhesives and allied. Foscolour is also a well established manufacturer of

WHAT'S ON SHOW

custom made dispersions produced under strictest confidentiality. On show will be a new set of transparent iron oxide dispersions especially designed for spirit-based wood stains. Also on show for the first time is a range of Nitrocellulose concentrates for liquid inks.

Fullbrook Systems will display Viscometers from Brookfield Engineering Labs. Representing the Process range of instruments will be the Viscosel, a pneumatic, inherently safe unit. Models form the VMA Getzmann Dispermat range of high speed dissolvers for laboratory use will also be displayed.

Grace UK will present a wide range of speciality chemicals. Featured will be Syloid matting agents, Shieldex anti-corrosion pigments, Sylodex Bentonites montmorillonite day, Sylosiv moisture scavengers.

The Haeffner Group of Companies will feature Bayferrox iron oxides, Fiesta fluorescent pigments, Metana aluminium pastes, Tioxide titanium dioxide pigments, Printex colour blacks, organic pigments, mica powders and flakes, Statox carbon blacks, anticorrosive pigments, additives, fillers, extenders and a full range of laboratory, mixing and dispersing equipment.

Harlow Chemical Co, the manufacturers of polymer emulsions, will be exhibiting new generation of vinyl acetate/VeoVa 10 copolymers, which have been specifically designed to show significant improvement in pigment binding properties whilst retaining all the other qualities of our established products.

Henkel and Nopco, two forces brought together, will in combination be featuring a new product range of speciality additives for the surface coating industries.

Hoechst UK Ltd – Chemicals will be showing their complete range of products for the surface coating industry including oxygenated and chlorinated solvents, plasticisers and products for manufacture of resins, vinyl derivative resins, waxes, specialities, fire retardants and biocides.

Hoechst UK Ltd – Pigments will be featuring their range of organic pigments and will be concerned with eaily dispersible pigments and preparations.

ICI Colours & Fine Chemicals will be featuring its Solsperse hyperdispersants for inks and solvent based paints. Also featured will be two new speciality dispersing resins which can be used as multi-media tinters.

The newly established ***ICI Resins business group*** will feature the Haloflex range of water based copolymer latices, the NeoCryl range of acrylic emulsions, NeoRez water-based polyurethane dispersions, NeoCryl solid thermoplastic acrylic resins, Alloprene Chlorinated rubber and the Lumiflon range of fluorocarbon resins. ICI resins stand will be shared with Chance and Hunt.

Industrial Dispersions Ltd is a company specialising in Powder Liquid Technology and will be exphasizing its custom manufacturing facilities, master batches, single colour and colour matched concentrates of finished products, and laboratory facilities.

John Godrich will be showing the Liebisch STR-400 Salt Spray Cabinet. Also on show will be the new Credit Coater for the coating of hiding power charts. Credit Hegman gauges, cross hatch cutters, coating thickness meters, ferrous/non ferrous substrates, Zehntner range of gloss meters will be demonstrated. A variety of mixers and agitators will also be featured.

Kenroy Dispersions Ltd, manufacturers of a wide range of organic and inorganic pigment dispersions, will be exhibiting examples of products containing one or more of their K-D-Sperse pastes.

Kirklees Chemicals will be showing their range of emulsion polymers for the Decorative paint industry including the Vinyl Acetate based high binding copolymers and and Styrene Acrylic emulsions, Viking emulsions, Viking 1611, 1644 and 1605, the CTA Bonding Agent and Wood Glue bases – Viking 1655 packaging adhesive.

The Lawrence Industries Performance Minerals Group for the Coatings Industry will launch several new products including Cellulose Fibres, Anti Corrosive Pigments, Micas and Silance Treated Calcined Clays. In addition information on Attagel Mineral Thickeners, Satintone Calcined Clays and ASP 170 Speciality Extender Pigment will be available.

3M UK PLC will be exhibiting their range of fluorochemicals developed for the surface coatings and general chemistry industry. The range includes Fluorad surfactants and also on show will be the 3M additives range of Glass Bubbles.

The Marlow Chemical Co Ltd will be featuring its full range of chemical auxiliaries for the surface coating and allied industries. The following companies and their products will be highlighted: Borg-Warner Chemicals, Cires Sarl, Dow Chemical Co Ltd, Dura Commodities, Dyno Nitrogen AB, Eka Nobel AB, Hebron SA, Geo A Hormel, J M Huber Corp, Solem Industries Inc, TDF Tiofine. In addition Marlow's full range of Antimony Tioxide products, Zinc Oxide and speciality chemicals.

The Mearl Corporation, New York, represented exclusively in the UK by Cornelius, will be exhibiting a broad range of Mearlin Pearlescent Lustre Pigments and Iridescent Colours for surface coatings and plastics.

The Mearlin range on display will include white pearls of varying intensity, non-metallic, metallic-like pigments and iridescent colours, both in regular and exterior grades.

Meta Scientific Ltd will be featuring Colour and Gloss Measurement instruments from Dr Bruno Lange GmbH. The New Microcolour for colour difference will be shown and a range of portable gloss meters including the RB3 Model.

Microfine will feature the latest developments in their Ultracarb product range. Microfine are also agents for Tolsa SA from Spain and Soceite Des Ets Georges Alquier from France. Through these and its own product range on show will be thixotropes and viscosity control aids.

Minolta will be showing their full range of surface Colorimeters. There are presently four models in the range that can be used for surface coatings of all kinds. On show, for the first time in the UK, will be the new, second generation CR-221 which has a three millimetre measureing aperture for very small sections or components; printed matter and packaging.

MPLC Laboratories Ltd, who specialise in innovative research and development, will feature an important advance in pigment technology - Synthetic Micaceous Iron Oxide. Grades of lamellar oxide suitable for primers (Laminox F) and weathering coats (Laminox S) are to be manufactured, opening up opportunities to produce anti-corrosion coatings with better performance capabilities.

NL Chemicals (UK) Ltd will be featuring their Kronos titanium dioxide pigments including Kronos CL310 and Kronos 2160. In addition to the Thixatrol and MPA rheological additives new development products will be on display. Information will be available on Wolfamid non-reactive and Wolfkur reactive polyamide resins. Kelsol water dispersible alkyds and Spensol L water dispersible urethane polymers.

Norwegian Talc (UK) Ltd will be promoting their range of fillers for paint, plastic, sealant and adhesive applications. The Microdol H Grades will be featured. Details on Micro Tack, Micro Mica range and Sil-Cell® lightweight mineral additives will also be given.

The Paintmakers' Association of GB Ltd will have on display details of the Association's packages of training modules in Surface Coating Technology offered by the open tech distance learning format.

Details of services provided by the Paintmakers' Association together with application forms will also be displayed as will be copies of recent reports produced by the Association and details of new legislation.

The Paint Research Association will be presenting its Expert System (computerised knowledge database) project awarded under its first ever EEC contract in conjunction with CORI, IIRS which is a Coatings Selector and will be of interest to specifiers, engineers and small finishers.

Pearson Panke Equipment will be exhibiting a representative selection of their extensive range of surface coatings testing equipment: the latest Erichsen Glossmeters, the Erichsen Cupping Tester, the Flocculation Monitor, the Pearson Panke Universal Automatic Applicator and thickness gauges.

Perchem will be featuring its Easigel thixotrope and its Econogel dispersing organoclay. Information on Perchem's hydrogenated castor oils, AMU types, Mastergel range applications will also be available.

Q-Panel Co will have on display the QUV Accelerated Weathering Tester and a new light source, the UV-A340. Also on show will be the QCT, a tester for performing continuous and cyclic condensation. A range of Q-Panels will also be shown.

Reed Plastic Containers will display two types of plastics containers. Alongside its 'S-Range' containers, Reed will exhibit its 'Paintainer' all plastics lever-lid can with capacities of 1, 2.5, 3 and 5 litres.

Resinous Chemicals Ltd, the Tyneside resin manufacturer, will be exhibiting their range of surface coatings products and their acrylic-based hot melt and solvent-based pressure sensitive adhesives.

In particular will be featured alkyd resin Alftalat VAS 9160, 9168 and 9204; and modified alkyd resins.

Rohm and haas (UK) Ltd will be exhibiting their complete range of performance acrylic resins and additives for decorative, industrial and protective coatings. An on-stand computer will demonstrate formulation and costing for Ropaque OP-62 Opaque Polymer.

Samuel Banner & Co Ltd will be exhibiting a selection of products with special emphasis on the trend towards cleaner, safer solvents. For a number of years now Samuel Banner have been able to custom blend products to meet individual requirements and this has been extended to offer products matching specific solvency and flammability criteria with improved toxicology. In addition will be Downstream Olea chemical products.

Sandoz Chemicals will be exhibiting pigments, dispersions, solvent soluble dyestuffs and an update on the UV stabiliser range. On show will be the new opaque Graphtol Fast Red 2GLD, the Sandosperse multi-purpose industrial preparations, the Graphtol SP alkyd dispersions.

For printing inks Graphtol Rubine GDO, BDO-3 and Sandosperse W range; two new Savinyls will be introduced.

Schering Industrial Chemicals will feature their range of synthetic resins and organometallic products. In particular, new and improved products will be highlighted for the printing ink, hot melt adhesive and building protection sectors.

SCM Chemicals, the world's second largest manufacturer of Chloride process Titanium Dioxide, will be featuring the performance and quality of the renamed Tiona RCL range of pigments. The display will highlight the performance of Tiona RCL 535 and the importance of quality control.

Scott Bader Co Ltd will be featuring the following products: TexicrylHyperbinder (High performance emulsion), Texicote Powder Resins (polyester), Wood Stains (range of resins) and Flexible Membranes.

The Shear Group manufacture high quality dispersions and additives for the Paint, Printing Ink and Plastics Industries. ***Shear Colour*** will be showing its latest range of high quality, high performance pigment dispersions for OEM and refinish automotive paints. Also shown will be Transparent Iron Oxide concentrates. ***Shear Chemicals*** will be showing specialist additives for the Printing Ink industry.

Sheen Instruments will be showing a range of completely new instruments for the measurement of gloss, colour, opacity, thickness and viscosity.

Shell Chemicals (UK) Ltd will be featuring their Epikote range of resins, Cariflex range of thermoplastic rubbers, Veova 9 and 10 used in emulsions, Cadura E10 glycidil ester reactive diluent. The Shell range of chemical and hydrocarbon solvents will also be highlighted.

Silberline will be exhibiting specially developed aluminium pigments for medium solid paint systems. These include new generation high sparkle round-flake pigments. Also on display will be the Silvet range of solvent free granular products for the printing ink and plastic industries.

Steetley Berk Ltd will exhibit from NL Chemicals the full range of easy-dispersible Bentone Rheological additives, Bentone SD-1, SD-2 and SD-3 together with Benathix 141 for polyester systems. A new range of high-brightness white fillers will be introduced. Other products will include Hi-Sil silica pigments and Dicaperl fillers.

Sud-Chemie AG, Munich, together with their UK partner Production Chemicals Ltd, will feature an extensive range of gelling agents. Tixagel (Organophilic bentonite), Optigel (hydrophilic bentonite), Rheotix and Rheocin (organicgellants).

The Colours Group of Sun Chemical will be exhibiting Pigments and Preparations demonstrating the multi end-use capability of the company. Particularly featured will be Flexiverse – a preparation for water based inks and speciality coatings. Sunsperse 6000 – a newly introduced product range comprising organic pigments in a non-resinous, non-glycol containing aqueous system.

Charles Tennant & Co are featuring on behalf of their three major Principals: Elvacite Methacrylate resins and non-aqueous AB dispersants (Du Pont); Cymel and Dynomin Amino Resins – conventional butylates, high solids butylated and methylated (Dyno Cyanamid AS & Co); Alkyds, Polyesters and Alkyd Emulsion systems (Dyno Industrier AS).

Tennant KVK will be exhibiting pigment and pigment dispersions on behalf of their three Principals: New products for offset and liquid printing inks (Kemisk Vaerk Koege A/S), paste and liquid dispersions (Runnymede Dispersions Ltd), new high colour beaded Black and Black Pearls 1400 (Cabot Carbon Ltd).

Tego Chemie Service GmbH will be featuring a wide range of additives and silicone based binders to the paint and printing ink industries. On show will be Tego® Airex range of de-aerators together with a newly developed series of dispersants for inorganic pigments, Tego® Dispers. The binder Silikophen® P 40/W will also be on show.

Thor Chemicals (UK) Ltd manufacturer of speciality products will be featuring from the Biocides Division a range of bactericides, fungicides and algicides (Acticide range) and also a range of paint driers and polyurethane catalysts (Thorcat range).

Tioxide Group PLC, the international producer of titanium dioxide pigment, will be making an official launch of a significant new grade – Tioxide TR92. This has been designed to give superb dispersion, high stability and excellent optical properties and durability in a very wide range of media used in decorative and industrial paints.

UCE Developments Ltd will be featuring a range of mixers and vessels for the paint and allied industries Standard blending/tinting mixing outfits, resin plant installations, reactors, blenders and condensers will be illustrated.

Vinamul Ltd will exhibit its full range of pressure polymers for the Paint Industry including new developments. In addition to the established Vinamul 3459, a new 55% solids terpolymer will be shown.

Wengain Ltd will highlight pigments and resins imported from Norway, Italy and the USA as well as items manufactured in the UK. Featured will be non-toxic anti-corrosive pigments, high performance lead chromes and chlorinated rubbers and paraffins. Flushed and dry organic pigments, acrylic chips for very high quality aqueous systems for printing inks will also be shown.

Yorkshire Computer Services the UK and Eire distributors for Datacolor AG of Switzerland will be exhibiting the Datacolor Industrial Colour Matching and Control System ("Pigmenta"). Also on show will be the Datacolor metallics system used by the automotive industry.

surfex 88 update

Also exhibiting at SURFEX '88 will be the following companies:

● Arco Chemical Europe Inc. ● Allied Colloids Ltd. ● BASA ● Boud Marketing Ltd. ● Ciba Geigy Pigments ● Cray Valley Products ● Croda Resins ● ECC International ● Electro-Physik ● Erichsen GmbH ● Hays Chemicals Ltd ● Heraeus Equipment Ltd ● Industrial Trade Journals ● ISC Alloys Ltd ● K & K-Greeff Distribution ● K & K-Greeff Ltd ● Netzsch Mastermix Ltd ● OCCA ● Production Chemicals ● Stratford Colour Co Ltd ● Torrance Process Plant

Note To Exhibitors
The SURFEX PREVIEW (OFFICIAL GUIDE) will be published with the May issue of JOCCA and will all companies exhibiting please return their Official Guide Entry Forms to Peter Fyne at Priory House by Tuesday, 15th March.

Please send me details of SURFEX '88 and other OCCA services as detailed below:

- ☐ **Free SURFEX pre-registration tickets (state number) ....**
- ☐ **Advertising details for the JOCCA-SURFEX PREVIEW (May, 1988)**
- ☐ **PRA Harrogate, Symposium (13 - 14 June)**
- ☐ **Subscription details for JOCCA**
- ☐ **Membership information for OCCA**

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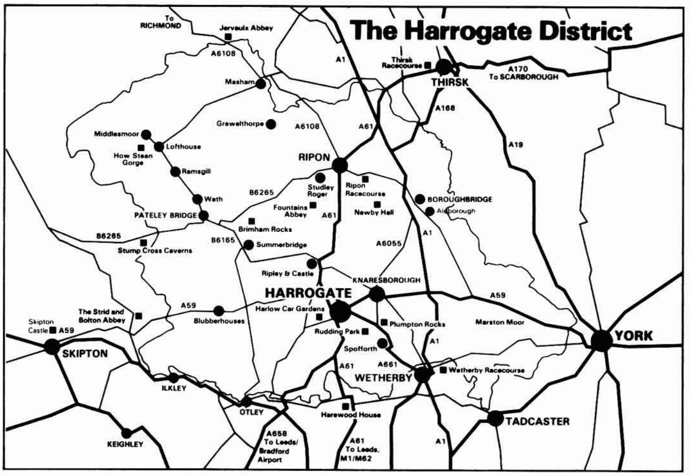
Please return to: **OCCA, Priory House, 967 Harrow Road, Wembley, Middlesex HA0 2SF. Telephone 01-908 1086, Telex 922670 (OCCA G), Fax 01-908 1219**

JOCSUR

What to see and do in and around Harrogate

Welcome to the Harrogate District. Over 500 square miles of beautiful countryside interspersed with bustling towns and quaint villages. Set in the heart of Great Britain in North Yorkshire, England's largest county, the district has excellent road, rail and air links and is centrally located between London and Edinburgh and the East and West Coasts.

Royal Baths Assembly Rooms



Harrogate was founded following the discovery of the first spring in 1571 and laterly flourished as a Victorian Spa resort. The Royal Baths Assembly Rooms dating from 1897 contain the traditional Turkish Baths. The Royal Pump Room Museum is a "Celebration of the Spa" including an opportunity to sample the famous sulphur water. The atmosphere of yesteryear's elegance and style in the buildings, tree lined streets, exclusive shops and restaurants combine perfectly with the futuristic International Conference and Exhibition Centre, lively wine bars and nightclubs. Harrogate is England's Floral Town, with several internationally renowned gardens. In the town centre there are tea rooms, antique shops, art galleries, theatres, a cinema, swimming pools and sports centre.

Aldborough and Boroughbridge is to the North East of Harrogate. Aldborough is a traditional village with its Roman past preserved in the Museum. Boroughbridge is dominated by coach houses and regency, Georgian and Victorian buildings.

Knaresborough enjoys a spectacular setting astride the gorge of the river Nidd. This market town is only four miles from Harrogate. Central to the town is the medieval square where a busy market is held each Wednesday. Flanked by Tudor and Georgian buildings the square boasts "Ye Oldest Chymist Shoppe in England" dating from 1720 where the famous lavender water is made from a secret 18th century formula.

Pately Bridge is a dale town with a fascinating Museum, the old St Mary's Church and nearby Stump Cross Caverns.

The city of **Ripon,** eleven miles to the north of Harrogate is one of the oldest in England and a treasure trove of history and heritage. Central to the City's activities is the market place where the busy Thursday market is opened by the bellman at 11 am. The magnificent Cathedral incorporates several types of architecture contributed by successive generations including Saxon, Decorated and Perpendicular architectural styles.

A comprehensive colour guide (45p plus p&p) of the Harrogate District is available from the Harrogate Tourist Centre on 0423 525666.

SURFEX Dinner

Majestic Hotel

The highly succesful SURFEX dinner is being repeated with this year's exhibition. The dinner will be held at the Majestic Hotel on Wednesday 15 June. Mr B. Dineen, Business Editor of the Yorkshire Evening Post is the Guest Speaker. For ticket enquiries contact G. Anderson on 0532 584646 to be placed on the Waiting List.

AGM

Harrogate Centre Auditorium

The association's AGM will be held at 5.45 pm on Wednesday 15 June in the Harrogate Centre Autitorium. The space age interior can seat over 2,000 people. The Agenda for the AGM will be circulated to overseas members. UK members attending the AGM will be handed the Agenda on entering the Auditorium.

Accommodation

To assist in arranging accommodation in Harrogate, contact **The Tourist Information Office on (0423) 525666.**

Symposium

As an associated event the Paint Research Association will be holding a symposium on "Towards better Industrial Finishing" on 13-14 June, 1988, Cairn Hotel, Harrogate. For further information contact **Dip Dasgupta at PRA on 01-977 4427, Telex 928720.**

Registration/Preview

If you are resident outside the UK you will find enclosed your Registration Card for SURFEX 88. UK readers will receive their registration card with the April issue. If you have not already booked Advertising Space in the Special Surfex Preview Edition (Official Guide) of May JOCCA or require additional registration tickets, please contact The Surfex Organisers at Priory House on 01-908 1086.

Routes to Harrogate:

By Air

The Leeds/ Bradford Airport is situated just 12 miles south of Harrogate with taxi and bus links from the airport to Harrogate. There are daily services from Amsterdam, Birmingham, Gatwick, Heathrow and Paris to Leeds Airport. For flight information call Leeds Airport on (0532) 509696.

The following Air Carriers operate domestic and international scheduled services:

Aer Lingus operate flights from Dublin. Enquiries (0532) 508194, Reservations (0532) 434466.

Air UK operate flights from Amsterdam, Belfast, Edinburgh, Stansted and Paris (CDG) to Leeds Airport. Enquiries (0532) 503251, Reservations (0532) 457468.

The following telephone numbers can be used when making reservations for Air UK from within Europe: France – Air France Paris (1) 45356161, Netherlands – KLM Amsterdam (020) 747747, Norway – SAS Bergen (05) 310950, SAS Stavanger (04) 521566, Belgium – KLM Brussels (02) 720.71.50, KLM Antwerp (03) 232.78.60, West Germany – KLM Frankfurt (069) 290-401, Denmark – Cimber Air Sondeborg (04) 422277.

British Midland Airways operate flights from Heathrow. Enquiries (0532) 508194, Reservations (0532) 451991.

Capital operate flights from Cardiff and Glasgow. Enquiries (0532) 505650, Reservations (0532) 504992.

By Road

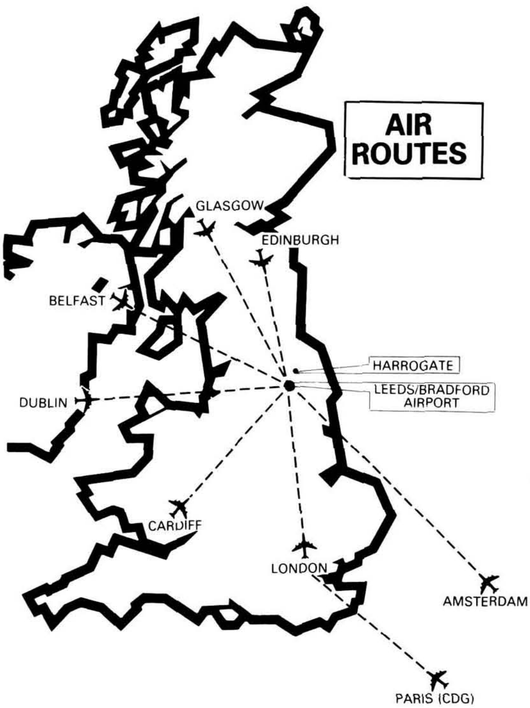
Harrogate is centrally situated in UK. London is 200 miles to the South and Edinburgh is 200 miles to the North. The schematic map adjacent shows the major road routes to Harrogate. The West Yorkshire Road Car Company (part of the National Bus Company) provides bus and coach services to and from the Harrogate area. For coach information call (0423) 66061.

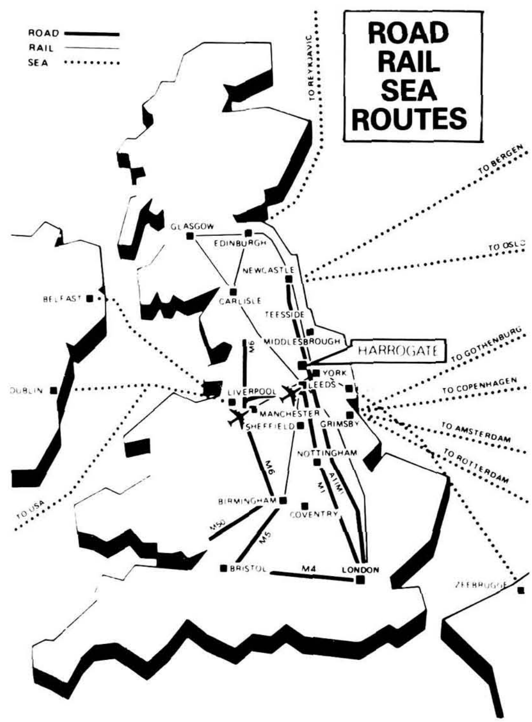
By Rail

Harrogate is served by British Rail (Eastern Region) and trains include high speed services from Kings Cross, London. The journey takes approx. 3 hrs. 19 mins. There is a service from Leeds every hour to Harrogate and this is connected to most major cities within the UK.

By Sea

Hull is the nearest seaport to Harrogate. North Sea Ferries operate from Rotterdam (Europort) or Zeebrugge to Hull. Hull has excellent travel links to Harrogate. For further information call 0482 795141.





SURFEX 88

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SURFEX 88

List of Exhibitors

Arco Chemical Europe Inc.
Allied Colloids Ltd
BASA
Bayer (UK) Ltd
BDH Ltd
BIP Chemicals Ltd
Blythe Colours Ltd
Boud Marketing Ltd
Bromhead & Denison Ltd
Buckman Laboratories
BYK Chemie
C & W Specialist Equipment
Capricorn Chemicals
Chemapol (UK) Ltd
Chemsafe Developments
Ciba Geigy Pigments
Ciba Geigy Resins
Colourgen Ltd
Cornelius Chemicals Ltd
Cray Valley Products
Croda Colours
Croda Resins
Crosfield Chemicals
Croxton + Garry Ltd
Durham Chemicals Ltd
ECC International
Eiger Engineering Co Ltd
Electro-Physik
Ellis & Everard Chemicals
Ellis Jones Ltd
Erichsen GmbH
Floridienne (UK) Ltd
Foscolor Ltd
Fulbrook Systems
H. Haeffner & Co Ltd
Harlow Chemical Co
Hays Chemicals Ltd
Henkel-Nopco Ltd
Heraeus Equipment Ltd
Hoechst UK Chemicals
Hoechst UK Pigments
ICI Chemicals & Polymers
ICI Organics Division
Industrial Dispersions
Industrial Trade Journals
ISC Alloys Ltd
John Godrich Engineers
K & K-Greeff Distribution
K & K-Greeff Ltd
Kenroy Dispersions Ltd
Kirklees Chemicals
Lawrence Industries Ltd
Marlow Chemical Co Ltd
Mearl Corporation
Meta Scientific
Microfine Minerals
Minolta (UK) Ltd
MPLC Laboratories
3M UK Ltd
Netzsch Mastermix Ltd
NL Chemicals (UK) Ltd
Norwegian Talc (UK) Ltd
OBS Machines Ltd
OCCA
Paint Research Association
Paintmakers Association
Pearson Panke Ltd
Perchem Ltd
PPCJ
Production Chemicals
Q-Panel Co Ltd
Reed Plastic Packaging
Resinous Chemicals Ltd
Rohm & Haas Ltd
Samuel Banner Ltd
Sandoz
Schering Chemicals
SCM Chemicals Ltd
Scott Bader Co Ltd
Shear Chemicals
Shear Colour
Sheen Instruments Ltd
Shell Chemicals (UK) Ltd
Silberline Ltd
Steetley Minerals Ltd
Stratford Colour Co Ltd
Sud Chemie
Sun Chemicals
Tego Chemie Service
Charles Tennant
Thor Chemicals
Tioxide UK Ltd
Torrance Process Plant
UCE Developments Ltd
Vinamul Ltd
Wengain Ltd
W. R. Grace Ltd
Yorkshire Computer Services

SURFEXp2

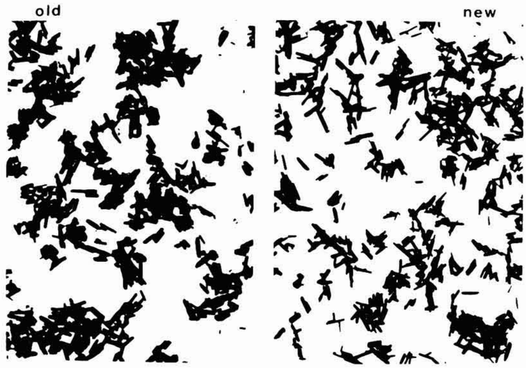

Figure 7. Electron microscope photos of the new highly stabilized Dark Chrome Yellow (right) vs the corresponding previous product (left).

the chromate or combined chromate solution or vice versa is dependent on the desired colour of the end product.

3. Properties

In the previous Section the principles of the lead chromate pigment chemistry have been reviewed. A few pigment properties were briefly discussed, therefore this section deals with properties like brilliance, colour strength, opacity, lightfastness, weather resistance, SO_2 resistance, solvent, acid and alkali resistance, dispersibility and heat resistance in depth.

3.1 Brilliance

In Section 2 the factors determining the shade of lead chromate pigments, i.e. greenish yellow to reddish yellow and yellowish red to blueish red respectively, were discussed. In addition, Chrome Yellows and Molybdate Oranges show a very bright vivid shade. A determining factor for the brightness of these pigments is the kind of encapsulation which has been applied.

Several coating materials will accomplish a chemical reaction between the compounds at the pigment surface (mostly chromate) and the metal oxide, thereby modifying the pigment surface. Consequently the reflection curves will be changed, resulting in a change of shade and brilliance. This is exemplified in Figure 8 in which curve 1 represents a product in which no chemical reaction between chromate and the metal oxide(s) takes place. Curve 2 represents a product in which such a reaction does take place.

In comparison with other inorganic pigments, for example yellow iron oxide and nickel titanate, Chrome Yellows show a (much) cleaner shade, while with respect to bismuth vanadate or cadmium sulfide a comparable cleanliness[16,17] is observed (see Figure 9).

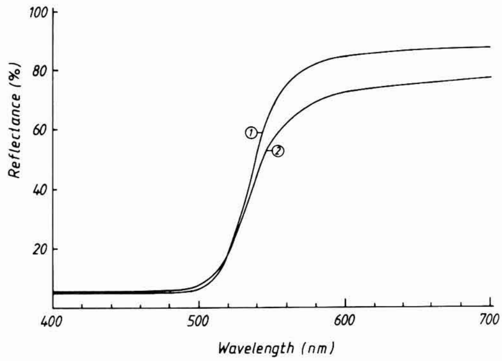

Figure 8. Reflectance curves of a lightfast (1) and a highly stabilized (2) monoclinic Dark Chrome Yellow.

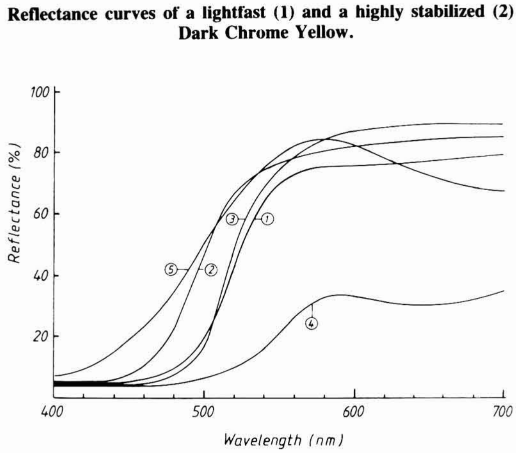

Figure 9. Reflectance curves of chrome yellow (1), bismuth vanadate (2), cadmium sulphide (3), yellow iron oxide (4) and a nickel titanate (5).

3.2 Colour strength and Opacity

Colour strength and opacity are very important economical aspects of a pigment. Depending on the application, for example industrial coatings, coil coating and plastic applications, one or both of these properties determine the pigment concentration in the formulation.

The colour strength and opacity of lead chromates are mainly determined by two factors, i.e.

a. The chemical composition of the pigment. In Table 3 the differences in colour strength and opacity between an orthorhombic lead chromate (very greenish shade) and two monoclinic lead chromates (lemon yellow and reddish yellow shade respectively) are given. First of all there is a difference in crystal structure, causing a difference in opacity. Secondly the chromate-sulphate ratio of the (mixed) crystals differ considerably. Because the chromate ion is the chromophore, a pure lead chromate will show more colour strength than a mixed crystal of lead chromate and lead sulphate. Consequently the reddish yellow product (pure lead chromate) is stronger than the other two products which are both lead chromate-lead sulphate mixed crystals.

b. The average particle size. Figure 5 illustrates the relationships of the average particle size vs. colour strength and opacity respectively[8]. As described previously Chrome Yellows and Molybdate Oranges have an average particle size larger than half of the absorption wavelength, which about characteristizes the optimum in the opacity curve. Therefore a reduction of the average particle size will result in both an increase in colour strength and opacity.

As shown in Section 3.1.a the colour strength and opacity of Chrome Yellows are also a function of the chemical composition of the (mixed) crystal, contradictory to the Molybdate Oranges which generally all have the same chemical composition. For Molybdate Oranges properties like shade, colour strength and opacity are predominantly determined by the average particle size. This is exemplified by the two Molybdate Oranges in Table 3, where the yellowish red product, having a much smaller average particle size, shows much more colour strength and opacity, while the blueish red product is relatively weak and transparent because of its larger particle size.

Table 4 illustrates the effects of a reduction of particle size on colour strength and opacity for Chrome Yellows. As mentioned previously a new precipitation technique, comprising the intimate mixing of reaction components, has been developed[9-11]. This technique allows the manufacturing of products with a significantly smaller particle size. The table contains colour strength and opacity data for the conventional and the novel products. The new products are significantly stronger and more opaque.

With respect to organic pigments Chrome Yellows and Molybdate Oranges are relatively weak but very opaque. These differences in performance are due to the difference in average particle size. The organic pigments generally have a much smaller particle size.

On the basis of Figure 5 this corresponds with more colour strength but less opacity (average particle size much smaller than half of the absorption wavelength: the left hand part of Figure 5). With respect to other inorganic pigments Chrome Yellows and Molybdate Oranges perform very well. From Table 5 it is seen that cadmium sulfide is equally strong but nickel titanate, bismuth vanadate and iron oxide are relatively weak with respect to the Chrome Yellows. With regard to the opacity only iron oxide can be more opaque.

Table 3.

Colour strengths and opacities of an orthorhombic and a lemon and dark monoclinic Chrome Yellow, a yellowish and blueish Molybdate Orange

	Colour strength*	Opacity** Yb/Yw
Orthorhombic Chrome Yellow	8.5	0.79
Monoclinic (lemon) Chrome Yellow	12.8	0.81
Monoclinic (dark) Chrome Yellow	17.2	0.90
Yellowish Molybdate Orange	12.4	0.95
Blueish Molybdate Orange	3.1	0.88

* The figures correspond to the amount of titanium dioxide necessary for 1g of pigment to achieve standard depth 1/25 according to DIN53235

** Dertermined on a dry paint film of 35 micron; PVC=6.6%

Table 4

Comparison of the new Chrome Yellows and the corresponding old Chrome Yellows in an air drying soya alkyd system with regard to colour strength and opacity.

Product description	Colour strength	Opacity* Yblack/Ywhite
Lightfast Lemon Chrome Yellow (new)	130%	0.84
Lightfast Lemon Chrome Yellow (old)	100%	0.81
Lightfast Medium Chrome Yellow (new)	130%	0.86
Lightfast Medium Chrome Yellow (old)	100%	0.84
Lightfast Dark Chrome Yellow (new)	135%	0.92
Lightfast Dark Chrome Yellow (old)	100%	0.90
Highly stabilized Lemon Chrome Yellow (new)	130%	0.82
Highly stabilized Lemon Chrome Yellow (old)	100%	0.80
Highly stabilized Medium Chrome Yellow (new)	125%	0.87
Highly stabilized Medium Chrome Yellow (old)	100%	0.83
Highly stabilized Dark Chrome Yellow (new)	125%	0.94
Highly stabilized Dark Chrome Yellow (old)	100%	0.93

* determined on a dry paint film of 35 microns; PVC=6.6%

Table 5.

Comparison of the colour strengths, opacities and SO_2-resistances of various inorganic yellow pigments

	Standard depth (1/25)*	Opacity Yb/Yw**	SO_2-resistance
Dark Chrome Yellow	21	0.94	standard
Medium Chrome Yellow	18	0.86	equal
Nickel Titanate	1	0.83	equal
Cadmium Sulphide	22	0.91	slightly less
Bismuth Vanadate	5	0.84	less
Iron oxide	8	1.00	slightly less

* The figures correspond to the amount of titanium dioxide necessary for 1g of pigment to achieve standard depth 1/25 according to DIN 53235.

** Determined on a dry paint film of 35 microns; PVC=6.6%

3.3 Lightfastness, weather resistance and SO_2 resistance

Over the past two decades there has been an increased demand for high performance pigments with regard to lightfastness and weather resistance. During the past decade the aggressive atmospheric conditions in highly industrialized areas induced a shift towards SO_2-resistant lead chromate pigments. Presently all major lead chromate manufacturers fulfil these demands to varying degrees.

The exposure to light of lead chromate

pigments without additional encapsulation of metal oxides causes a rapid darkening of the products. The mechanism of this photochemical reaction still is subject to discussion. The darkening would be due to the formation of a chromium(III) compound, probably either lead metachromite[18], $Pb(CrO_2)_2$, or chromium trioxide[19], Cr_2O_3.

The exposure of lead chromate pigments to SO_2 causes a discolouration respectively greyness and a loss of gloss. The discolouration/greyness is due to the formation of lead sulphate and a chromium (III) compound. So far the situation has been described for untreated lead chromate pigments. The performance of commercially available pigments however depends on three important factors:

a. The stabilization of the pigment. As described in Section 2.4 lead chromates are encapsulated with thin layers of metal oxides. The choice of the correct materials and the proper order of application enables the manufacture of excellently lightfast, weather- and SO_2-resistant products.

b. The dispersion of the pigment. Because of the applied encapsulation these pigments require a proper dispersion. Too long a dispersion time or too aggressive the dispersion equipment, will cause a deterioration of the encapsulation. Consequently parts of the pigment surface become exposed and the pigment will be readily affected by light, weather or SO_2.

c. The system in which the pigment is applied. Generally different paint systems absorb different parts of the (near) UV light. Consequently the pigments will be affected in different ways. This is illustrated in Table 6 in which the colour difference between the artificially exposed and unexposed area is given for an airdrying soya alkyd system and polyurethane system.

In addition the hardness of the coating plays an important role. The harder the coating the smaller the permeability (for example to SO_2) will be. Consequently the pigment will be little affected by atmospheric conditions.

A comparison of lead chromate and organic pigments with regard to lightfastness and weather resistance reveals a marked difference in performance. On reduction with other pigments, for example titanium dioxide, the organic pigments are less lightfast and weather resistant than in their pure applications, in contrast to lead chromate pigments which perform equally well both in masstone and reduction. With respect to other inorganic pigments like nickel titanate, bismuth vanadate and cadmium sulfide, highly stabilized lead chromate pigments perform equally well.

3.4 Solvent/Acid/Alkali resistance

Due to the ionic character of lead chromate pigments their solvent resistance is excellent. This is a major advantage with respect to most organic pigments, which generally show some solubility in organic solvents.

The acid/alkali resistance of lead chromate pigments without encapsulation is moderate. In this case the ionic character of the pigments is a disadvantage. However the resistances are significantly improved by the encapsulation process.

3.5 Heat resistance

The heat resistance of pigments is determined either by the intrinsic heat stability of the pigment or by the interactions of the pigment with the, mostly organic, matrix of the application system. Organic pigments are mostly limited in their intrinsic heat stability due to intramolecular rearrangements or intermolecular reactions, whereas the heat resistance of lead chromates is restricted by the chemical reactivity of the chromate anion towards the organic matrix of the application system. A few other inorganic pigments e.g. yellow iron oxide show an insufficient intrinsic heat stability.

On the basis of the foregoing the suitability of the pigments for plastic applications can be very restricted. The heat resistance of highly stabilized lead chromates is up to about 260°C. In addition special lead chromates[20-22] have been developed for plastic and coil coat applications with a heat resistance up to about 300°C. These pigments are heavily encapsulated with amorphous silica to enlarge the barrier between the pigment and the organic matrix of the plastics. However the heavy encapsulation is accompanied by a significant decrease in colour strength and opacity.

Although the development of these heat resistant products is a considerable improvement, the heat resistance of lead chromates is by far inferior with respect to other inorganic pigments like cadmium sulphides, nickel titanate or red iron oxide. However the heat resistance of lead chromates is comparable or better than that of most classical organic pigments.

3.6 Dispersibility

The dispersibility of lead chromates is very good[23]. Lead chromate manufacturers have succeeded in preparing easy dispersible products. The dispersibility is comparable to, but mostly somewhat better than other inorganic pigments such as cadmium sulphides and iron oxides. With respect to organic pigments the dispersibility of the lead chromates is generally much better.

4. Applications

About 65% of the lead chromates are used in paints and varnishes, 20% in plastics and 15% in printing inks and other applications. They are used in decorative, protective and functional systems as automotive finishes, marine paints, industrial coatings, traffic paints, maintenance paints, emulsion paints and printing inks. In addition they can be used for mass colouration of fibers, plastics, paper, elastomers and rubber. Heat resistant products allow application in a wider range of plastic materials. Lead chromates are considered to be the most versatile of the inorganic pigments and therefore cover a broad spectrum of end-uses.

5. Environmental aspects

The environmental aspects of the use of lead chromates have been the subject of numerous publications[24,25,26,27,28]. Therefore a summary of recent literature will now be given.

About one decade ago lead chromates became suspected of a possible carcinogenic character, causing a shift to lead free formulations. However over the past five years several scientific studies appeared[29-32] dealing with the carcinogenic character of chromate compounds. Both animal and mortality studies showed that the carcinogenic character of chromate compounds is directly related to the solubility of the compound.

Consequently zinc chromate and strontium chromate, which are used as primer pigments requiring at least some solubility, are considered to be carcinogenic, whereas barium chromate and lead chromate, being virtually

Table 6

Lightfastness of a highly stabilized medium Chrome Yellow and a yellowish Molybdate Orange in an airdrying soya alkyd system and a polyurethane system

	Airdrying soya alkyd system	Polyurethane system
Chrome Yellow Colour difference (CIELAB-units) exposed/unexposed area	2.0	0.6
Molybdate Orange Colour difference (CIELAB-units) exposed/unexposed area	1.5	0.4

insoluble, do not exert a carcinogenic effect.

The toxicity of lead is similarly related to the possibility of the compounds to dissolve into the body liquids[28]. Only those compounds having at least some solubility are able to exert a toxic effect. Examples of this category are lead oxide and lead carbonate, the use of which has been forbidden in most European countries. Although lead chromates are virtually insoluble all major lead chromate manufacturers have significantly contributed to a safe handling of materials by developing products with a very low acid soluble lead content[33].

In addition it is a proper place to put this information into perspective. On a worldwide basis about 60,000 chemicals are being merchanted[34]. Of approximately 1% of these products some toxicological information is known and moreover of a very limited number of products extensive information is available, lead chromates belonging to this last group.

The conclusion therefore is that lead chromates do not constitute a risk if normal precautions of industrial hygiene have been taken.

6. Economy

In Section 3 all important pigment properties of lead chromates have been reviewed in relation to other inorganic and organic pigments. It is observed that lead chromates show a very good performance. Moreover, when the price of these products is considered, it must be concluded that the price-performance ratio or lead chromates cannot be matched by other pigments.

Calculations have shown that the substitution of lead chromates by organic pigments is accompanied by an increase in pigmentation costs by a factor of 2 to 6, depending on the application system used[27].

7. Conclusions

In the previous sections the class of lead chromate pigments has been characterized in relation to other inorganic and organic pigments. Although this group of pigments is relatively old, the development of improved products is still in progress. In this respect the most recent results are the development of products with a significantly higher colour strength and opacity. With regard to the other performance properties it is concluded that lead chromates fulfil market demands to a very high degree.

With regard to the environmental aspects of lead chromates it should be realized that these pigments belong to a small group of chemical compounds of which extensive toxicological information is available, contrary to most other pigments. Moreover, recent studies have shown that lead chromates do not constitute a risk if normal industrial hygiene precautions are taken.

The economy of these pigments puts their performance in a very favourable position. No other pigments match the price-performance ratio of lead chromates.

Abstract

Lead chromates are known to be the most versatile of all coloured inorganic pigments. Therefore it is worthwhile to review the state of the art of this class of pigments. The chemistry of Chrome Yellows and Molybdate Oranges will be discussed in connection with the factors which determine shade and performance. The properties are related to the performance of other inorganic pigments as well as organic pigments. Although lead chromates have been available for about 90 years, it still is possible to achieve significant improvements. Consequently the latest developments in lead chomate pigment chemistry will be discussed.

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The effect of environmental conditions on the adhesion of paints to metals

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Summary

This paper describes the use of the blister technique to study the change in adhesion of a chlorinated rubber lacquer to mild steel after immersion in various solutions, and after exposure in a salt spray chamber. Furthermore, the recovery in adhesion strength after removal from aqueous environment has also been investigated. It has been found that loss of adhesion took place when the specimen was fully immersed and its extent depended on the time of immersion. Recovery of adhesion was rapid and the extent of recovery depended on initial immersion time. It has also been shown that the water activity of the solution is a major factor determining the adhesion. Adhesion loss was not shown after exposure to salt spray even though substantial corrosion was observed. This observation calls into some doubt current thinking concerning the relationship between wet adhesion and anti-corrosive ability.

Introduction

The relationship between the corrosion processes underneath a coating and its adhesion to the substrate is complex. It is not certain whether corrosion is consequent upon loss of adhesion or vice versa.

James [1] made specimens of cold-cured epoxide resin paints on steel and glass panels. He immersed these in distilled water and compared the loss of adhesion. He suggested that the primary failure was by blistering, with corrosion consequent upon this.

However, Gay [2] studied mild steel panels coated with various paint systems, immersed in sea water, and found that corrosion of the steel substrate accompanied blister formation, although it sometimes occurred at an appreciable distance from the blisters. If corrosion did not occur, the blisters did not develop to an appreciable size, implying the dependence of loss of adhesion upon the corrosion processes.

Garber and Zuev [3] showed a relation between corrosion and adhesion by comparing the corrosion rate of steel bonded to chlorinated neoprene or polyethylene films with different adhesives, and exposed to a 10% salt acid environment the corrosion rate was found to be inversely dependent on the strength of the adhesive.

Funke and Haagan [4] proposed that water and oxygen permeability of organic coatings and their adhesion when exposed to high humid environment or water can be considered as basic properties to estimate the corrosion protection performance, and its wet-state adhesion seems to be the most important one. They found that a paint system may exhibit good protective properties, although water permeability is not remarkably low, if its wet-state adhesion is excellent and the rate of permeation of water is much higher than that of oxygen. They suggested that the rate-determining factor for loss of adhesion is water permeability, if water interferes at the film/substrate interface, and the rate of oxygen permeation is to be considered as the rate-determining factor for the corrosion reaction beneath a paint film.

The loss of adhesion of coated mild steel substrates under immersion or high humidity conditions has been discussed by Eden [5] who pointed out that loss of adhesion may be considered as a two stage process: 1. A reversible stage involving diffusion of water molecules through the coating to the interface and subsequent competition for adhesion sites. 2. Separation of cathodic and anodic reactions with the destruction of the oxide layer at the interface as an irreversible stage.

However, a correlation between loss of adhesion and corrosion does not always seem to exist. Schwenk [6] immersed coated metal specimens in 0.5M sodium chloride solution and maintained that loss of adhesion itself had no adverse effect on the protection from corrosion, a conclusion also arrived at by Walker [7].

Waker used tensile tests to measure the adhesion of several different types of coatings to steel substrates before and during immersion in distilled water or 3.5% sodium chloride solution. He found that there was an appreciable loss of adhesion within about the first 10 hours of immersion, several of the coatings losing between 50 and 75% of their original adhesion. No correlation was found between adhesion and corrosion, coatings with the lowest adhesion sometimes showing the greatest corrosion resistance.

The blister technique is one of the methods for measuring the adhesion of organic coating on metal substrate. Its simplicity and reproducibility have been described [8, 9]. Recently a novel apparatus has been designed to measure adhesion of a polymeric coating to a solid substrate, in such a way that quantitative data are obtained. The apparatus has the same principle as the Dannenberg test [8] where a fluid is injected between the coating and substrate to form a blister. This technique has been applied to chlorinated rubber lacquer on mild steel. Variables reported included various film thickness, the pressure of compressing fluid and roughness of the substrate [10].

This paper is an extension of this work and will consider the effect of the environment on the adhesion of chlorinated rubber onto mild steel.

Experimental

The blister technique consisted of the Hydraulic Test Pump type T1200 supplied from Pressurement Limited, Figure 1. This pump has two stations, one for the specimen holder 1, and the other for the pressure transducer 4. The pressure screw 3 controls the rate of pressurising and the fluid pressure on the system. A video camera in combination with a TV screen was placed above the coated specimen to monitor the detachment of the coating along the grooves. The specimen holder (Figure 2) consisted of a coated specimen and perspex cover plate which has three grooves to control the form of a blister by defining its shape and size. This also decreases the probability of fracture of the film when the pressure is applied. The steel disc and perspex cover plate are clamped together by a specimen holder.

1. Preparation of specimens

The coating was composed of a chlorinated rubber (Alloprene R40)* dissolved in toluene in a 50:100 ratio by weight, and plasticized with a chlorinated paraffin "Cereclor" 42*, in the ratio 70:30 binder to plasticizer by weight.

Mild steel discs, 50mm diameter and 7mm thickness, were prepared by abrading with 600 grade emery paper, washed with distilled water and acetone and dried with hot air. The chlorinated rubber lacquer was applied to the cleaned panels as soon as they had dried, using a film spinner. After two layers of coating were applied, the coated specimens were placed in dust free environment for 18 days. The final film thicknesses were 150±20μm.

*Alloprene Res40 is manufactured by ICI and Cereclor 42 by Shell.

2. Environmental conditions

Table 1 shows the four environmental conditions which had been chosen for this experiment and Table 2 shown the water activities of the solutions [12]. Total immersion was carried out in the 3% sodium chloride solution and 0.2M zinc chloride solution for time periods up to 14 days. Total immersion was carried out in the calcium chloride solutions and distilled water for 8 days. Exposure in the salt spray chamber was for total test period of 720 hours. Coated specimens were supported in a plastic rack at a 15° angle from the vertical in the salt spray chamber. The spray solution was artificial sea water. The specimens in the chamber were subjected to 24 hours salt spray and 24 hours dry

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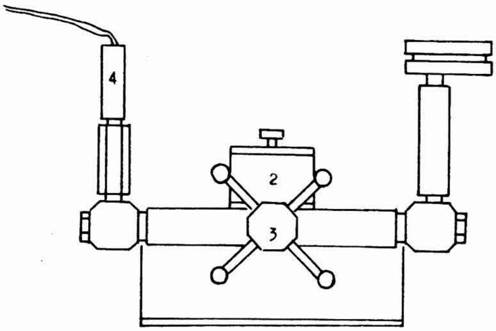

Figure 1. The scheme of blister technique
1. specimen clamp 2. liquid reservoir
3. pressure screw 4. pressure transducer

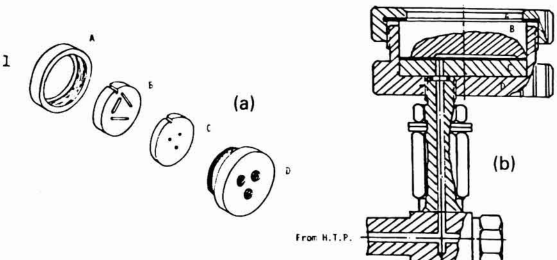

Figure 2. Specimen holder
(a) General view (b) Cross-section

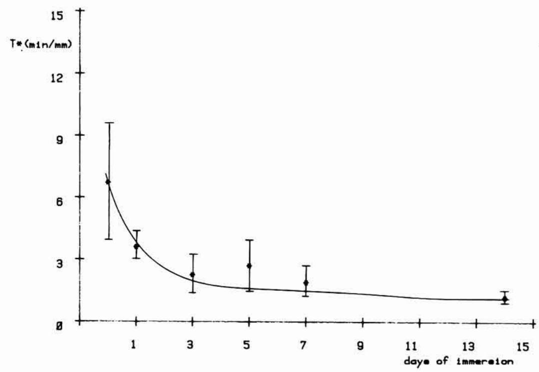

Figure 3. Adhesion versus time of immersion in 3% NaCl

period. The temperature of chamber was kept at 20°c.

3. Blister method procedure

The coated specimens were removed from the test environments after a certain period of time, rinsed with distilled water and wiped with paper tissue, then the blister test was carried out in a few minutes. The pressure was held constant at 200 p.s.i. (14 MPa) during the whole test process. The distance and time of detachment were recorded. The inverse detachment volicity T*(minutes per mm) has been demonstrated to be a useful empirical measurement of the adhesion strength and this value will be further used in this paper. Figure 8 shows a typical time-distance curve from which T* has been calculated.

In order to investigate the recovery of adhesion when the coating was dried, some specimens were left in the laboratory under normal conditions for a few hours to two days, after they were removed from the test solution.

Result and discussion

The loss of adhesion of the specimens immersed in 3% sodium chloride is shown on Table 3 and Figure 3. The film lost approximately half its value on the initial bond strength after one day immersion. After 14 days immersion, Tμ was about one fifth of average initial value. The results are in remarkable agreement with that obtained by Walker using the direct pull-off method [7, 11]. This correlation with Walker's classical work further confirms that the adhesion parameter Tμ used in this paper and the adhesion value given by Walker measured in tension are comparable.

The recovery of adhesion of the coating while drying out after immersion have been found, Figure 4 and Table 4. This process has also been mentioned by Walker [7, 11]. The results show that the recovery of adhesion after removing from solution was rapid and the extent of recovery depended on initial immersion time. The less the number of days of immersion, the more adhesion recovery. It might be thought that the adhesion loss

Table 1
Exposure conditions

Environment	Conditions
3% NaCl	static immersion
0.2M ZnCl2	static immersion
3.4M, 5M, 7.18M CaCl2	static immersion
salt spray chamber	intermittent (24 hr. spray followed by 24 hr. dry) at room temperature, artificial seawater

Table 2
Water activities of immersion solutions

Solution	Concentration	Water activity at 25°C (a_w)
distilled water		1.0
NaCl	3%	0.983
CaCl2	3.4 M	0.7
CaCl2	5.0 M	0.5
CaC12	7.18 M	0.3

Table 3
Tμ versus time of immersing in 3% sodium chloride solution

Tμ (min/mm)	days of immersion in 3% NaCl					
	initial	1	3	5	7	14
	6.71±2.8	3.60±0.6	2.26±0.9	2.70±1.3	1.90±0.7	1.20±0.3

Table 4
The recovery of adhesion of chlorinated rubber

days after immersion	hours of recovery			
3% NaCl	0	3 - 6	24	48
5	2.70±1.3	4.40	—	9.70
7	1.90±0.7	2.60	5.50	—
14	1.20±0.3	—	4.30	5.20

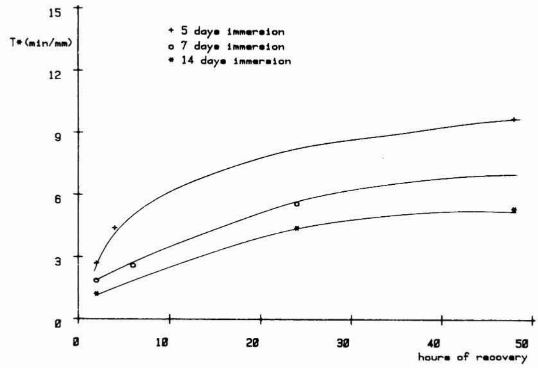

Figure 4. Recovery of adhesion of paint

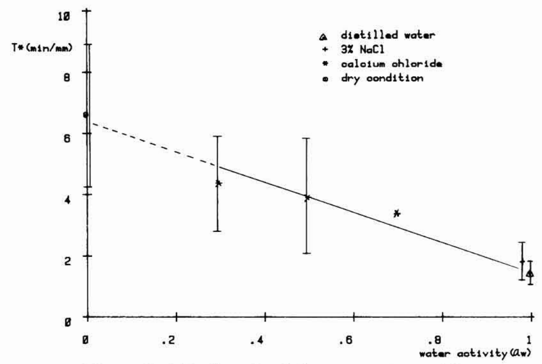

Figure 6. Adhesion of paint versus water activity.

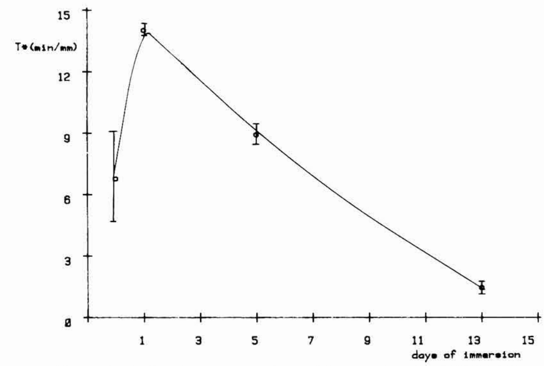

Figure 5. Adhesion versus time of immersion in 0.2M $ZnCl_2$

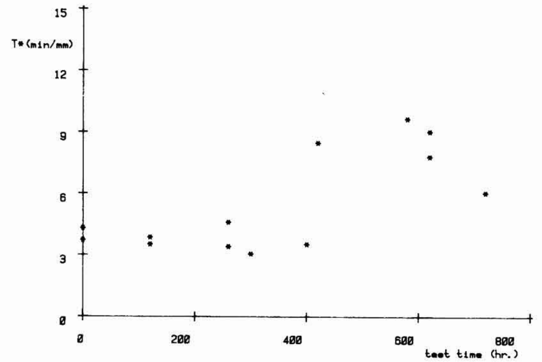

Figure 7. Adhesion versus time in the salt spray chamber.

and recovery could be explained by assuming that water ingress is the main factor of effecting the adhesion. While the coated metal was immersed in the test solution, the water molecules diffuse through the organic film to the interface and compete for adhesion sites. Thus the adhesion decreases. When the film dries again, the water molecules escape from the interface and the adhesion is recovered. There is some suggestion that for the longer immersion time, the adhesion recovery is not complete. Clearly molecular rearrangement is possible at the interface because of plasticisation by the absorbed water and rebonding on drying out may not be totally reversible.

In order to compare different cations on the adhesion of the coating 0.2M zinc chloride solution was chosen for immersion. The preparation of specimens were the same as above experiment. The result of loss of adhesion is shown on Table 5 and Figure 5.

When changing solution from 3% sodium chloride to the isotonic zinc chloride solution an interesting effect can be seen. After one day there was an apparent increase in adhesion strength based on the dry values. This is thought to be associated with the presence of zinc compounds at the interface acting as an adhesion promoter. After 14 days the adhesion falls to a similar value as observed with the 3% NaCl solution. This is probably due to a corrosion induced interfacial pH change which alters the nature of the zinc compound from an insoluble to a soluble specie.

Since it was suggested earlier that adhesion loss is somehow associated with osmotically driven water absorption, it was decided to test this hypothesis by varying the water activity of the external solution by using various calcium chloride solutions which are capable of very low a_w values. The solutions used and the corresponding a_w values are shown in Table 2. The relationship between T* and a_w after immersion for eight days is shown in Table 6 and Figure 6. It can be seen that at low a_w values there is considerable spread in the data, whereas at the three higher a_w values, the spread is substantially less. A general trend is also apparent, namely, as a_w approaches unity the adhesion values diminish. These two observations may be interpreted by suggesting that the adhesion under dry or low a_w conditions is governed by a boundary or interfacial layer with substantial variation in adhesive strength. This might be caused by, for example, the presence of areas of incomplete bonding which could act as stress raisers. If this interfacial layer were osmotically active due to the presence of hydrophilic material, acid groups, soluble salts etc, then water would be attracted from the external solution such that there was movement along the chemical potential gradient. Thus, with external solutions of

Table 5

Tμ versus time of immersion in 0.2M ZnC12 solution

Tμ (min/mm)	initial	days of immersion 1	5	13
	6.85±2.3	14.1±0.2	9.00±0.5	1.53±0.2

Table 6

Tμ versus the water activity

Tμ (min/mm)	water activity (a_w) 1.0	0.983	0.7	0.5	0.3	dry
	1.52±0.5	1.90±0.7	3.49	4.00±2.3	4.47±1.8	6.71±2.8

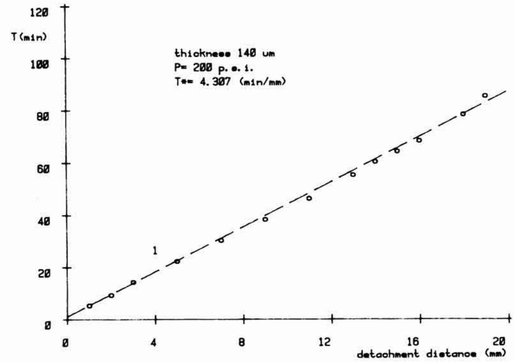

Figure 8. Time versus distance.

Table 7
Tμ versus time in salt spray cabinet

Tμ (min/mm)	hours of salt spray					
	initial	120	280	400	600	720
	4.00±0.3	3.69±0.2	4.20±1	5.90±2.8	8.80±0.8	6.03

higher water activity, water would be absorbed by the interfacial layer causing two effects. Firstly there is a more uniform interfacial region; this is shown by a decrease in the variability of adhesion measurement. Secondly, there is a gradual loosening of the interfacial boundary manifest in decrease in overall adhesive strength.

It is however difficult to see why the adhesive strength, given this model would not diminish to zero.

Lastly, adhesion values, Tμ were measured using an intermittent salt spray (24 hours spray followed by 24 hours dry) for a total of 720 hours.

The results obtained are shown on Table 7 and Figure 7. The adhesion values can be seen to be independant of exposure time. This suggests that during the dry cycle, the film dries out and the adhesion values recover in a way shown earlier. This is contrary to Walker's findings but is not unexpected since he used a continuous salt spray test.

A few of the very small black spots were found underneath the film after exposing the specimen in the salt spray chamber for 120 hours. With time, the colour of specimens became light brown. After the test, the film was peeled off from the substrate, corrosion of mild steel substrate was evident. This result, namely that the onset of corrosion under the film is not matched by a decrease in the adhesive strength agrees with the views, already stated, of Schwenk [6] and Walker [7], and is contrary to the opinions of Funke[4].

Conclusion

1. The adhesion of a chlorinated rubber lacquer on mild steel was adversely affected by immersion in 3% sodium chloride. After one day immersion, the coating lost approximately half its initial bond strength.

2. The adhesion of coating can be recovered when the paint is drying out. The extent of recovery is related to the time of immersion and the drying time.

3. The water activity of the solution plays a major role in affecting the adhesion of coatings.

4. Zinc ions appear to act as temporary adhesion promoters.

5. The adhesion was not adversely affected during intermittent salt spray teasting.

6. Wet adhesion strength of a coating is not related to its anti-corrosive ability.

Acknowledgement

X. H. Jin wishes to thank Professor G C Wood and Dr R. P. M. Procter for provision of laboratory facilities and The People's Republic of China for sponsoring his research work at the Corrosion and Protection Centre, UMIST, UK.

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occa meetings

London Section

New photoinitiator

The fourth technical meeting in the current programme of the London OCCA section, took place on Thursday 21 January 1988 at the now established venue of "The Naval Club".

The speaker for this lecture was advertised as Dr G. Li Bassi, however, due to unforeseen circumstances he was unable to present the lecture and Dr Bisel also from Fratelli Lamberti SPA delivered the lecture in his colleagues absence.

Dr Bisel outlined briefly the history in the early 1970s of the use of U/V curing in the paper and board industries, highlighting the problems encountered in the use of photoinitiators, in particular the yellowing and odour associated with these products.

In the 1980s new photoinitiators were produced but they had not completely overcome the problems. However, Fratelli Lamberti SPA at their development laboratories near Milan have now developed a new class of polymeric non-yellowing photoinitiator ESACURE KIP, which they believe has solved most of the problems associated with the earlier initiators and represents a major advance in low odour U/V cured coatings.

Dr Bisel used numerous slides to illustrate the developments and the chemistry involved. He concluded by outlining the main advantages of the new initiator, namely:

a) High reactivity
b) Low odour
c) Low volatility
d) Freedom from coloration
e) Low toxicity

and indicated that quantities would be available early this year. A guide price of £14-£15/kilo was indicated for a 75% concentrated solution.

A lively discussion session followed the lecture, indicating the interest generated by this subject.

The vote of thanks to Dr Bisel for this topical and interesting lecture and also to Croxton & Gary representing Fratelli Lamberti SPA in the UK for hosting the evening, was proposed by Mr K. O'Hara.

P. C. Neal

Newcastle Section

China Clay as an extender

The fourth meeting of the 1987/88 session was held at St Mary's College, University of Durham, on 7 January 1988, when some forty members and guests attended to hear a lecture by Mr R. McGuffog of English China Clays entitled "China Clay as a Functional Paint Extender".

Mr McGuffog began with the ISO definition of an extender as a powder, insoluble in paint media, with a refractive

index less than 1.7, the purpose of which is to supplement the prime pigment; generally inorganic, insoluble in water and cheaper than the prime pigment.
He listed some common extenders and their crystalline form; plate-like in the case of hydrous clays, talc and mica, irregular in the case of kaolin, nodular for calcined clay, calcium carbonate and barium sulphate. The platy crystals of hydrous clays reinforce paint films and reduce moisture permeability. Calcined clays, being nodular, do not affect moisture permeability and are used primarily as opacity improvers.

The crystal structure of hydrous clays are based on alternative sheets of silica and alumina. Minerals found naturally associated with clays are separated by differential aqueous suspension, which serves to classify coarse particles from finer paricles. Settling, followed by final hydrocyclone separation gives a range of particle size distributions representing different grades of the same basic clay.

He illustrated the effect of particle size on opacity, whiteness, gloss, scrub-resistance and rheology using acrylic emulsion paints at 20-80% PVC. Finer particles favoured higher opacity, whiteness and gloss although scrub-resistance and rheological structure decreased. The superior opacifying performance of finaclay versus three common carbonate extenders and barytes was shown with data for a semi-gloss emulsion paint. His explanation for this performance of fine clay versus three distribution of titania scattering centres within the fine platy particles as distinct from the interparticle crowding of titania with coarser extenders. SEM photographs demonstrated these effects, especially after oxygen plasma etching of the paint surface. The more uniform distribution of clay particles compared with the other extenders was also seen with modified Talysurf traces of surface roughness.

On the same theme, Mr McGuffog's slides illustrated advantages with clay of resistance to burnishing and increased gloss in emulsion paint at 30-32% PVC compared with various other extenders.

Next, he discussed calcined clay, produced by kiln heating hydrous clay at 1100°C. In these conditions dehydroxylation occurs, giving a less hydrophilic product consisting of sintered platelets and irregular shape, which gives more light scatter. In addition, due to re-distribution of iron impurities within the crystal, the calcined extender is whiter.

Comparison of contrast ratio, at various PVC levels between 20-60% in emulsion paint, showed calcined clay to be superior to hydrous clay above 35% and superior to a whiting at all levels. The lower CPVC of calcined clay was cited as the reason for the superiority. In the same paint formulation a marked improvement in scrub-resistance was seen when substituting calcined clay for the others. Finally, the beneficial effects of calcined clay on contrast ratio, sheen, brightness and scrub-resistance were shown compared with precipitated carbonate, talc and a standard whiting.

Questions afterwards covered organic surface treatment of clays to encourage even better clay/titania distribution, uniformity of china clay shipment properties, poorer stain-resistance of calcined clay versus hydrous clay (Gilsonite test), thixotropy, recoatability and paint application properties. Mr McGuffog explained his use of emulsion paint examples rather than solvent-thinned coatings as being due to china clay properties being exceptionally developed in latex products.

The vote of thanks was given by the Chairman, Mr S. Lynn, after which an enjoyable buffet, with appropriate liquid refreshment, was sponsored by ECC.

J. Bravey

Manchester Section

The future in colour

One hundred and twelve members and guests attended the meeting of the Manchester Section held at the St James's Club, Manchester, on 1 February 1988 and a paper entitled "The Future in Colour (The Next Decade in Colour Matching Prediction and Management)" was presented by Peter Wall (Managing Director and Jim Nobbs (Technical Director) of Colourgen Ltd.

Initially a brief outline of Colourgen the company was presented by Peter Wall, the company being unusual in that it is a subsidiary of an American company but is however quoted on the British Stock Exchange.

After this general introduction, the technical aspects of the presentation were made by Jim Nobbs. It was outlined how technology in colour matching is now following a similar line to that of pocket calculators, i.e., towards low cost, small size, easy to use, with the result that the total cost of a colour system could reach down to perhaps £1000.

There are three basic areas involved in colour matching:
(a) Colour Theory
(b) Radiation Transfer Theory
(c) Instrumentation/Computers/Software
and each of these was outlined in turn.

Quantifying colour means quantifying a natural sense, and all aspects must be taken into account in detail. Sources of illumination and their emission spectra were described, and the CIE specifications and definitions for different illuminants outlined. The calculations required in defining colour were illustrated, the theory behind them described, and from this, how the colour difference equations were derived was explained. The accuracy of the standard CIE L*a*b* compared with a single observer was outlined, and other systems described. Of the currently published scales, CMC (2,1) is the most accurate, is reaching the limits of what is considered possible with numeric systems, and may be used as the basis for a new British Standard. Further advancements in this field would be to take into account simultaneous contrast, the lecturer illustrating the effects of this with a simple demonstration.

Radiation Transfer theory, which is based on an ideal situation, was explained, and how this differs from a practical situation described. The defects in the theory can be overcome quite easily in opaque systems, as errors tend to cancel each other out. With semi-transparent inks, this is not the case and much more complex corrections are required. Bronzing and metallics cause other problems, some of the ways this may be overcome, and the areas where research is currently under way to overcome them were briefly described.

Jim Nobbs outlined the historical development of the computer from the original designed at Manchester University, through to current desk top machines to some speculation regarding future advances, current desk top computers being easily adapted for colour match prediction. There have been considerable advances in optics for Sprectrophotometers resulting in smaller, more accurate, reliable and robust instruments. These changes were illustrated, and taking into account the latest advances and possible future developments, a vision of what may be possible in the future was speculated upon.

Peter Wall briefly summed up the current position, and outlined the situation as they anticipate it to be in the future, with quality control in colour becoming possible at the factory gate.

After a lively question an answer period, a vote of thanks was proposed by Graham Fielding, and those present invited to try the instruments on display, and participate of a buffet sponsored by Colourgen.

M. G. Langdon

Midlands Section

Waxes

The first meeting this year of the Midlands Section was held on 21 January 1988 at the Clarendon Suite, Stirling Road, Edgbaston, Birmingham. Members and guests heard Mr K. Jansen of G. Langer and Son give a talk on "Waxes".

The speaker said that for centuries the word Wax had meant only Beeswax which was used for candles and waterproofing ships. Today the term is applied to both the natural and synthetic materials. Synthetic waxes are made from polymeric compounds of Polyethylene, Polypropylene, PTFE and various polyamide types. The have molecular weights between 1,500 and 4,000 and melting points over 40°C. There are four basic methods for incorporating them into a paint system:

1. Dispersion using conventional paint making processes.
2. Using micronised wax and stirring in.
3. Melting. This can only be used for some waxes and only certain solvents can be used, also this is a fire hazard.
4. Emulsification—surfactants are necessary for stability and may lower water resistance.

The final effect of the wax is dependent on its method of incorporation and can give different results even when the same wax is used.

The speaker gave examples of the uses of the various waxes such as:

1. 2-3% of PTFE Wax to overcome metal marking.
2. For anti-blocking and water repellency Polypropylene, Polyethylene and PTFE Waxes are used.
3. Scratch and slip—Polypropylene and PRFE Waxes.

The micronised polymeric waxes have little effect on gloss at normal levels of addition. Another bonus of the wax is that when used in combination with fine silicas they help prevent the silica from settling.

The particle size of the wax is very important and during the production process it is constantly checked using either a Coulter Counter or Laser beam instruments when every second bag is checked.

The waxes also find a use in powder coatings, here it is not always necessary to use the micronised grades as extruders are used in the powder manufacturing process.

Throughout his talk Mr Jansen showed numerous slides to illustrate the various wax types, their properties and uses. The meeting ended with a lively question time and a vote of thanks was proposed by Mr M. Round.

The Chairman thanked Capricorn Chemicals, the UK Agents for G. Langer and Son, for sponsoring the meal after the talk.

B. E. Myatt

Zimbabwe

Micro computers in the surface coating industries

The last technical meeting of 1987, held at the CZI boardroom in Harare, was attended by 15 members and guests.

The presenter, Mr Maz Vico, Sales Director of the Computer Processing Group (WANG) gave a talk on micro computers and their applied application in the paint, ink and textile industries.

The talk lasted over 20 minutes and dealt with such aspects as the micro computer today—where it's heading and the various interfaces available to a paint or ink manufacturer in particular.

Mr Vico concluded his presentation with a question and answer session based on his talk, which was met with a variety of interesting questions being raised and answered.

Mr Claud Calasse proposed a vote of thanks to Mr Vico and Computer Processing Group Zimbabwe for giving the talk at such short notice.

M. A. Johnson

occa news

Message from Mrs J. Newton, wife of the Late Honorary Editor D. S. Newton

Mrs Newton wishes to thank all Don's colleagues and friends in OCCA and elsewhere in the industry for their kind sentiments at the time of his death.

FROM THE GENERAL SECRETARY

Around the Council Chamber

The basement meeting rooms of London's Great Northern Hotel could have been mistaken for an extension of the Association's Headquarters on 10 February, as a succession of Committee meetings and a Council meeting took place. Two meetings of the Executive Committee and meetings of the Professional Grade and Technical Committees in addition to a full and well attended meeting of Council were all fitted into a crowded 6 hour schedule.

Members who arrived late for the pre-Council lunch thought the clock had been turned back when they saw Robert Hamblin addressing the informal gathering of members. However, the occasion was the presentation of the scroll of Honorary Membership to Robert in recognition of thirty-six years' service to the Association. In presenting the scroll President John Bourne again paid tribute to the contribution made to the development of the Association by the former Director & Secretary.

The meeting opened on a sad note as members stood in silent tribute to the memory of Don Newton, the Association's Honorary Editor who served in this capacity on two occasions from 1962-65 and again from 1980 until his death. He was also one of the original subscribers to the formation of the Association.

Council also remembered Ken Hedgecock, a member of the London Section, who died in December.

The President, in introducing a lengthy agenda, was able to report on the extensive overseas travel that he had already undertaken and had still to undertake on behalf of OCCA during his remaining period as President, part of his Presidential theme of strengthening

Mr R. H. Hamblin (left) receiving his Honorary Membership Scroll from the President.

relations with the world-wide surface coatings family. Council was relieved to know that despite all this overseas travel, the President was still able to find some time for holidays!

The meeting considered the draft Annual Report to be presented to the Harrogate Annual General Meeting and gave approval for it to be printed in a different style to previous reports and to include photographs of Honorary Officers. The meeting also considered nominations for Vice Presidents and Honorary Officers for the forthcoming Association year which would see changes in the position of Honorary Editor, Honorary Exhibition

Officer, and Honorary Research & Development Officer. The arrangements for the Council Reunion Dinner was agreed, the Dinner being combined with the SURFEX Exhibition Dinner on Wednesday 15 June at Harrogate, immediately following the AGM. As usual, invitations would be extended to Past Presidents, Past Honorary Officers and Honorary Members of the Association. It was also agreed to extend the Association's guest list to include the Presidents of sister organisations whose Dinners had been attended by the President and General Secretary.

Honorary Treasurer, Brian Gilliam, introduced proposals for membership subscriptions for 1989 and explained that possible changes to the Association's VAT position could result in VAT no longer being charged on UK subscriptions from 1989.

General Secretary Chris Pacey-Day suggested that if VAT were no longer to be applied to subscription rates a larger increase could be made in 1989, but this view was not supported by Council, who maintained that subscriptions should rise roughly in line with inflation. Council resolved that subscription rates for Ordinary and Associate Members for 1989 be £37.00, Retired Members and Registered Students (under 21) £13 and Registered Students (21-25) £18.50. It was noted that these resolutions would further be considered by Council at its next meeting and formally proposed at the AGM for confirmation. Council also considered and agreed proposals for the South African and Ontario Sections Subscriptions for 1988.

The General Secretary introduced a lively discussion on JOCCA and the proposals of the Publications Committee to re-launch the Journal in the spring. He also outlined efforts being made to attract more advertising income through the appointment of an Advertising Manager and proposals to obtain more articles for JOCCA. The meeting supported and endorsed the proposals for the Journal and noted the General Secretary's willingness to talk to Sections and Branches on the development of the Journal.

Honorary Conference Officer Tony Jolly gave a typically enthusiastic report on the 1989 Chester Conference which, although seemily a long way away, was now in the final stage of planning. Honorary Research & Development Officer John Taylor reported that whilst papers were being offered for the Conference, actual papers had not yet materialized and he urged Council members to encourage colleagues to submit papers for consideration.

Honorary Exhibition Officer Fred Morpeth was able to report that SURFEX was now a complete sell-out, although he was trying to fit in additional companies who wished to exhibit. Council were pleased to receive the report and applauded the sterling efforts made by Fred Morpeth and his committee. The associated SURFEX Dinner was already proving to be very popular and members who wished to attend were urged to make early application.

The meeting received notification of a number of vacancies on BSI and other outside committees. The President stressed the importance of OCCA being fully represented on these outside bodies so that the Association could influence technical standards and other legislative matters of vital importance to the industry. Sections agreed to make nominations at the next meeting of Council. Similarly, members were asked to consider suitable papers for overseas conferences including the American Paint Show and the South African Division's Symposium in Sun City. Details of both these events have been featured in the Journal.

The General Secretary updated Council on the modernization of the offices at Priory House and reported that the computer system was fully operational, the new telephone system was proving to be of considerable benefit to staff and callers to Priory House and that the installation of a facsimile machine, approved at the previous meeting of Council, was assisting considerably in the production of the Journal. The General Secretary also reported on plans for the improvement of the layout of Priory House with the aim of releasing the ground floor for commercial lettings.

Council considered a suggestion by the General Secretary that a more appropriate venue might be sought for Council meetings, ideally at a Council Chamber of one of many learned societies or professional bodies in the London area. This suggestion was enthusiastically endorsed by the meeting who felt that the cramped conditions of the current meeting room inhibited lively debate. It was agreed staff would find an alternative venue for future meetings. The Council also considered proposals from the Scottish Section that Council may occasionally meet outside the London area. Although members found some merit in the suggestion, it was generally felt that London was the least inconvenient venue for meetings, bearing in mind the geographical spread of the membership.

A lively and interesting meeting of Council concluded at 3.40 pm.

OCCA ties at £4.25 each are available from the Association's offices, with a single Association Insignia on either a blue or maroon background.

Natal Section

Christmas party

Last year's Christmas Cocktail Party, held at the Durban Club on Friday November 27, was supported by 45 sponsors from the raw materials and paint manufacturing industries. A good attendance of sponsors, members and guests enjoyed an informal buffet supper. Guest speaker was Mr Barry Cleveland of Marine Oil & Diamond Shamrock, who is also a member of the Natal Wildlife Society. Mr Cleveland's theme for the evening was industry's effects on ecology in Natal.

D. Philbrick

Mr and Mrs Roly Eglington at the Natal Section's Christmas Party.

Dick Philbrick (on the right), Chairman, Natal Section thanking Barry Cleveland for his interesting address.

OCCA

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Chester Conference Column

Social Programme

No doubt there are some of the JOCCA readers who will be making comments to the effect that the social aspects would seem to be more important than the technical papers. Such cynicism would be destroyed with the comment that at this point the Social programme is complete and the technical papers are being diligently collected and appraised by John Taylor. As soon as the latter are virtually settled upon they will be reported in this column.

Meanwhile it is my intention to keep everyone aware of the Conference and the social programme will undoubtedly play a part in making the event memorable in all aspects as well as contributing to persuading delegates and their wives to attend.

In future issues the following events will be described in a little more detail together with those of a golf tournament at Chester's Curzon Park on Wednesday lunchtime.

Wednesday evening (Jun 21)
The Ale Trail (a now famous series of tours around Chester's genuinely historic pubs with a very professional guide and with astounding surprises).

Thursday morning (Jun 22)
Tour of the City and its Roman Walls (an amazingly absorbing experience).

Thursday afternoon (Jun 22)
Coach Trip into the Welsh mountains with tea in Llangollen.

Lady Diana Riverboat

Thursday evening (Jun 22)
A few hours on board a riverboat through the Duke of Westminster's estate with good food and with a restrained jazz band.

Friday morning (Jun 23)
To Stapeley Water Gardens and The Palms Tropical Oasis (an experience unique to the UK—seeing is believing!).

Friday afternoon (Jun 23)
A visit to the Chester Heritage Centre (for as long as you like it the hairdressing appontment presses!).

Friday evening (Jun 23)
Reception, Dinner and Dance (hopefully with The Duke and Duchess of Westminster, definitely with the Lord Bishop of Chester and the Lord Mayor of Chester and their wives).

The Town Crier of Chester will assist one of Her Majesty's Corps of Toastmasters in the more ceremonial occasions.

More next time! *A. C. Jolly*

professional grade

At the meeting of the Professional Grade Committee held on 10 February 1988 the following admissions were made:

Admitted to Associateship

Dooley, David Brian *(London)*
Egan, Muireann *(Bristol)*
Rouillard, Marie Michel Joseph *(General Overseas – Mauritius)*

Admitted to Associateship through approved affiliated body

Rowlands, Michael Peter John *(Auckland)*

new members

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

Ordinary members

Brant, M. *(Midlands)*
Chesterman, M. P. *(West Riding)*
Dibble, J. *(Midlands-Trent Valley)*
Docherty, D., BSc *(Midlands)*
Donkin, A. J. BSc *(Manchester)*
Ferguson, A. S., BSc, Ph.D *(West Riding)*
Ginn, A. A., BSc *(General Overseas – USA)*
Gomes, O. N. S. *(Transvaal)*
Leblanc, O. *(General Overseas-Spain)*
Mohd, S., BSc, MSc *General Overseas – Pakistan)*
Pugh, P. *(Manchester)*
Sayer, P., BSc *(Scottish)*
Williams, D. P. *(Midlands-Trent Valley)*

Associate members

Agner, B. *(Transvaal)*
Anderson, M. E. *(Cape)*
Du Toit, M. *(Transvaal)*
Lane, M. *(West Riding)*
Rodd, B. *(Transvaal)*
Van Dyk, J. A. *(Cape)*
Woodman, M. B. *(Cape)*

Registered Students

Godley, C. H. *(West Riding)*
Powell, M. E. *(West Riding)*

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SURFEX 88

Exhibition of the latest developments in raw materials and equipment used in the manufacture of paints, printing inks, colour, adhesives, sealants and allied products to be held at the

HARROGATE INTERNATIONAL EXHIBITION CENTRE YORKSHIRE, ENGLAND

Wednesday, 15th June, 1988
09.00 - 17.30 hours

Thursday, 16th June, 1988
09.00 - 17.30 hours

ADMISSION FREE

The "Official Guide" will be circulated in the May 1988 issue of the Association's Journal (JOCCA) and will also be freely available at the entrance to the Exhibition. Advertising space for the Official Guide can now be booked by contacting Frank Craik on 01-908 1086.

ACCOMMODATION SERVICE

To assist in arranging accommodation in Harrogate, contact
The Tourist Information Office on (0423) 525666

AIR TRAVEL

12 miles to the south of Harrogate is the Leeds/Bradford Airport. There are daily services from Amsterdam, Birmingham, Gatwick, Heathrow and Paris to Leeds Airport. For flight information, call
Leeds Airport on (0532) 509696.

SYMPOSIUM

As an associated event the Paint Research Association will be holding a symposium on "Towards better Industrial Finishing" on 13-14 June, 1988, Cairn Hotel, Harrogate. For further information contact
Dip Dasgupta at PRA on 01-977 4427, Telex 928720

SURFEX 88

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