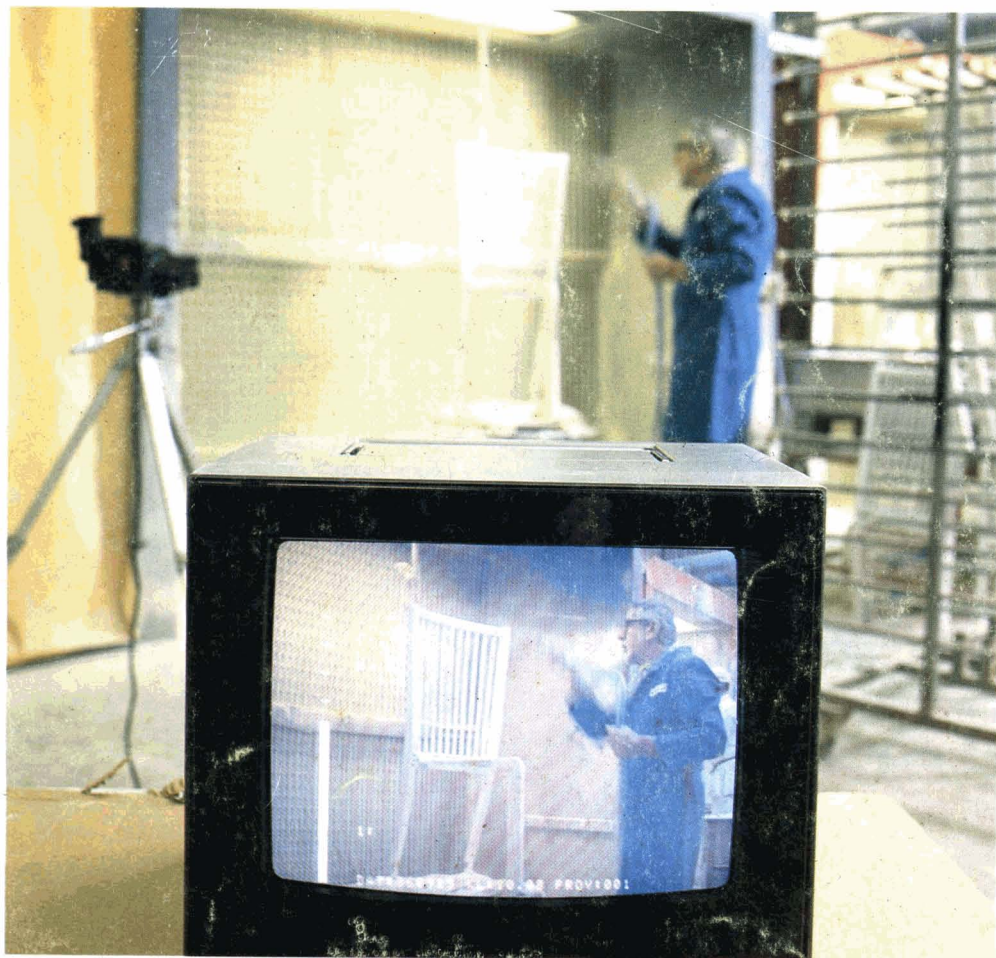




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JOURNAL OF THE OIL AND COLOUR CHEMISTS' ASSOCIATION

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Cover: PIMEX measurement of solvent concentration when spray painting (photo by courtesy of IBC AB)

Forthcoming Features: July - Printing Inks, August - Additives, September - Coatings for Plastics/R&P Preview. Contributions are welcomed at least five weeks prior to publication date.

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

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ICI Paints forms World Packaging Group

ICI Paints has formed a World Packaging Group, bringing together eleven major can coatings companies to provide benefits of greater technical and commercial synergy.

Already the leader in the £800 million global can coatings markets, with an overall share of around 28 per cent, ICI intends to consolidate and build upon its position by substantial investment in developing new technology in partnership with can makers and coaters and by broadening the geographical base of its business, particularly in the rapidly growing markets of the Asia Pacific region.

"Bringing our companies together as a cohesive world group will enable us to operate more efficiently as well as more effectively for our customers," said Quintin Knight, ICI Paints Director. "It will lead to improved cross flow of technology. It will enable our research and development to be better co-ordinated between our companies and more sharply focused on the market requirements. Furthermore, it will give us an unrivalled network of technical and commercial centres to provide on site service to can makers and coaters anywhere in the world."

ICI leads the can coatings market in Europe through Holden Surface Coatings and Edward Marsden—a specialist metal decorating ink supplier—in the UK; ICI Lacke Farben (formerly Wiederhold) in Germany; Holden Europe, based in France; Attivilac in Italy and ICI Paints Espagna. In North America ICI's Glidden is overall market leader and pre-eminent in the supply of waterborne interior coatings for beer and beverage cans. In Asia Pacific ICI already has a strong position in can coatings with manufacturing companies in Australia, Taiwan and Malaysia. The company also has interests in the packaging business in Africa and licensing activities principally in South America and Asia. Through Holden, ICI also has a fast developing business in adhesives and coatings for the flexible packaging industry.

The Group offers a complete range of interior and exterior coatings for the protection and decoration of cans. Products are supplied for all types of cans and applications whether for food, beverage, aerosol or general lines, together with coatings for caps and closures. This range includes solventborne and waterborne interior products suitable for all types of end use and application. The same is true for exterior coatings whether they be basecoats, inks or varnishes.

The ICI World Packaging Group will draw on technology from primary research and development centres located in North America, England, France and Germany. The research and development scientists will operate in tandem with technical and commercial teams who will provide the on-site support services for customers.

Rhône-Poulenc agreement with Baxenden

Rhône-Poulenc Chemicals Ltd announces the appointment of Baxenden as their sole UK distributors for Tolonates, a range of aliphatic poly-isocyanates for non-yellowing polyurethane systems. Tolonates are poly-isocyanates used as hardeners in two-pack polyurethane paints.

Croda bituminous expansion

Croda Hydrocarbons will invest £1m to improve and expand plant and facilities for the production of speciality emulsions, solutions and blends, based on its existing and well established bituminous range, or using customers own raw materials. Products tailor made for use in roads, constructions and surface coatings are already available in trial batches and the plant will be fully operational in early 1990. Pack sizes up to 200 litres and additional toll services are a feature of the investment.

BYK-Chemie acquisition

BYK-Chemie via its subsidiary BYK-Labotron, has acquired Gardner Laboratory, a division of Pacific Scientific of California. Gardner Laboratory in Silver Spring, Maryland, is a leading company in the field of opto-electronic and mechanical measuring instruments for paint, coatings and other applications. In 1988 Gardner Laboratory reached a turnover of about 10 M US-\$ with 80 employees. The new company name will be BYK-Gardner Inc.

The integration of the Gardner program of color measuring instruments represents a significant enlargement of the product scope especially in color measuring and a significant strengthening of the market position in the USA. BYK-Labotron specializes in the development, manufacturing and sales of paint measuring instruments with concentration in gloss measurement and heat technology.

In the future, opto-electronic and mechanical instruments for the

paint and plastic industries as well as for other markets will be developed, manufactured at both locations and sold worldwide.

BASF environmental protection investment

An ecological laboratory, is to be built by BASF just a few hundred metres west of the effluent treatment plant at Ludwigshafen for a cost of around DM 60 million. Building should commence this summer and finish early 1991 when 100 people will be employed.

The laboratory will be used mainly for biological-ecological experiments and environmental analysis of individual substances, products and wastes. BASF has been undertaking research and development in this field since the beginning of the sixties at various locations in the plant. The new laboratory will allow the concentration of this work in one area and should therefore optimise co-operation between individual working groups.

Hosokawa Micron

The worldwide Hosokawa Group of companies has announced plans to consolidate its UK Powder Processing and Air Pollution Control operations on its existing purpose-built manufacturing site, in Runcorn, Cheshire. Member companies Alpine Process Technology Limited and Hosokawa MikroPul Limited will jointly trade under the name Hosokawa Micron UK.

TNO forms new merged institute

The Dutch TNO Paint Research Institute, the TNO Plastics and Rubber Research Institute and the TNO Packaging Research Institute, have merged to form the TNO Centre for Polymeric Materials (CPM-TNO). The fields of activity of the new Centre do not change and the new organization will broaden research in the various disciplines.

FRS launch fire consultancy

The Fire Research Station of Borehamwood, Herts, has launched a Fire Technology Consultancy. A part of the consultancy will include the world's largest fire research laboratory at Cardington. For a detailed prospectus call 01-207 6768.

Products

New Mearl lustre pigment

A new Pearlescent Lustre Pigment called Mearlin[®] Satin White has been introduced by The Mearl Corporation, New York, NY.

A Titanium Dioxide-Coated Mica Pigment, Mearlin Satin White is characterized by its very fine particle size. This fine composition provides excellent coverage combined with high reflectivity. The resulting effect is an extremely whiter, brighter and cleaner pearlescent luster. Mearlin Satin

Successful Paintmakers COSHH seminars

Over 300 representatives from member companies attended a series of half day Paintmakers' Association seminars on the Control of Substances Hazardous to Health Regulations (COSHH).

The seminars held in Birmingham, Haydock Park, Selby, Newcastle, and London during April resulted in a significant number of the members attending. The purpose of the seminars was to explain the impact of COSHH on the paint industry and to identify the specific actions needed to meet the requirements of the Regulations.

Practical help in areas including assessment, selection, use and maintenance of control measures, monitoring, health surveillance and training was provided to those personnel directly responsible for implementing COSHH.

"COSHH is one of the most important issues now affecting us in the Paint Industry" said Tony Newbould, "and these seminars have given members a first class opportunity of obtaining access to the combined efforts of the PA specialist working group and the Health and Safety Executive in the advice and guidance presented."



PA COSHH seminars (left to right): Steve Parker, Occupational Hygienist, Health and Safety Executive; Dr Derek Browne, Occupational Medicine and Toxicology Consultant; Bill Moffat, Deputy Director; Denis Reynolds, Safety Consultant; Tony Newbould, PA Technical Manager; P Perkis, Factory Inspector, Health and Safety Executive.

White is available as a non-reactive powder for plastics and surface coating applications. Because of its fine particle size Mearlin Satin White is also recommended for offset inks and produces equally beautiful effects in screen printing, rotogravure and flexographic ink systems.

For further information Enter F199

New Foscolor water-soluble dispersions

With increasing pressure for environmentally-friendly products, Foscolor have made a timely development introducing a new stock range of alkali soluble chips which enable the formulation of the

highest quality water-based inks and coatings.

Based on a carefully selected, high performance acrylic resin, the dispersions can be converted by simple high-speed stirring and have been specially designed to give superior gloss, good flow and excellent strength development.

Now, on completion of a successful launch, Foscolor is making the range generally available and, to meet the demand for fast turn-round, the dispersions can be despatched from stock in any quantity from 1 kg upwards.

There are thirteen colours in the stock range but Foscolor's specialist service is also available to produce dispersions of customer's own or

preferred pigment subject to a minimum quantity of 50 kgs.

For further information Enter F200

Two new Akzo thickeners

Akzo Chemicals has introduced two new associative thickeners, Dapral T 210 and Dapral T 212. These low molecular weight polymers have a dumb-bell-like structure. Since they are 100% active liquid products, they are easier to handle and incorporate than conventional high molecular weight powder thickeners. Their significant different thickening characteristics allow users to achieve tailor-made performance by blending.

For further information Enter F201

Microfine agency agreement with Kemira

Microfine minerals has been appointed UK agent for the Kemira range of Phlogopite micas. These are golden brown in colour and available in five size grades (from 1mm max to 60 microns max). Ground by a wet process, the flakes are flat with good lustre and a soft texture.

For further information Enter F202

Equipment

Electrolux specify Minolta

The Minolta Chroma-meter has been specified by Electrolux at their components factory in Newton Aycliffe and recommended to all companies in the group — including Flymo, Zanussi, Parkinson-Cowan, Peerless, Tricity and Husqvarna.

Chroma-meters will be used in the Quality Assurance Laboratory and in the Injection Moulding Shop using $L^*a^*b^*$ measurements, colour standards can be maintained within acceptable limits in co-operation with material suppliers.

According to the company, the further advantage of the Minolta Chroma-meter was its capability of SPC. This will be used to monitor



Minolta CR-200 on the Flymo production line

production lines and produce tolerance based or performance based control charts.

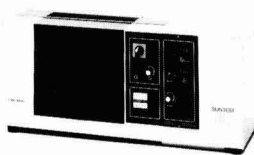
For further information Enter F203

New Heraeus light and weather fastness tester

Heraeus Equipment Ltd has introduced a new light and weather fastness tester, the Suntest CPS (Controlled Power System).

The irradiation source is variable between 400 and 750 watts per square metre which allows for adjustment of the black standard temperature between 40 and 52°C at a laboratory temperature of 25°C.

The Suntest CPS has a complementary capability in the optional flooding system, for cyclic wetting of samples to simulate weathering. Time cycles can now be electronically adjusted from 1 up to 999 minutes. Pump power has also been made variable.



Suntest CPS

For further information Enter F204

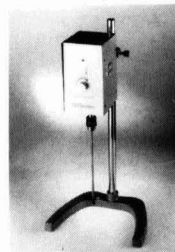
New Perkin Elmer spectrometer

The FIAS-200 is the first high performance flow injection system for atomic spectrometry. It combines the advantages of the mercury/hydride techniques with those of the flow injection technique.

For further information Enter F205

Ultra mix top drive stirrer

A new high power top drive stirrer has been introduced by Sheen Instruments. The ultra Mix 3000 provides both high speed and high power mixing and is suitable for laboratory, pilot plant and small production unit applications.



Sheen Ultra Mix 3000

The unit has continuously variable speed control, in which "state of the art" power phase angle techniques are utilised, to provide high torque at low speeds. Once the operator has set a speed for mixing, this speed will be maintained regardless of changes in sample viscosity. This is achieved by monitoring the motors by EMF and compensating for any change in load. A safety cut-out operates if the viscosity of the sample being stirred increases beyond the operating range of the drive unit. Thus both motor and speed controller are completely protected.

For further information Enter F206

New high resolution particle sizer

A completely new particle size analyser from Malvern Instruments employs a novel aerodynamic principle to separate particles in samples of dry powders or suspensions.

Designed for high resolution size analysis in the 0.5-100 micron range, the new AeroSizer uses laser technology to measure the velocity of the particles as they are accelerated in a near-sonic air stream. The smaller the particle, the higher its velocity through the measurement zone.

Using this simple principle and measuring times of flight with a



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In the 1990s, Epikote will be made from

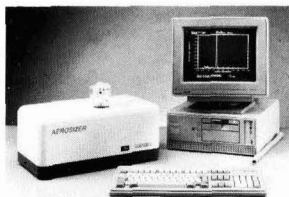
enhanced quality raw materials using all our manufacturing skills. So for resins of outstanding quality and consistency there will only be one name.

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



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precision of 0.025 microseconds, the AeroSizer can analyse up to 10,000 particles per second and resolve particles differing in size by as little as 10%.

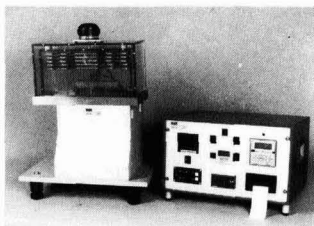


Malvern Aerosizer

For further information Enter F207

CoRI stressmeter

All organic coatings (paints, inks) applied to a substrate are practically always under stress as a result of film formation and variations in temperature and/or in relative humidity. Above a certain critical value, determined by coating and substrate properties, the stress can affect the adhesion and/or cohesion of the coating and lead to irreversible damage. The coating formulation affects the magnitude of stress and thus its durability. The CoRI Stressmeter instrument has been designed to determine the stress in different environments.



CORI Stressmeter

For further information Enter F208

Safe snakes

Rocol has introduced a range of 8 absorbent products designed to soak up all kinds of industrial spills and leaks—including chemicals—quickly, efficiently and cleanly. The range includes absorbent socks, pillows, wipes/sheets and low dust granules, together with a handy plastic drip tray holding absorbent

material.

For common spillages — water based, low hazard liquids and coolant, hydraulic oils etc — the Rocol Puddle Python is recommended — the flexible “snake” is filled with highly absorbent material and can be used to both contain and soak up messy liquids, taking up many times its own weight.



Rocol absorbant snakes

For further information Enter F209

New electrostatic spray gun

The MRV 760, the latest electrostatic hand gun range from Sames SA, part of the Binks worldwide organisation, has been developed to provide improved lightweight handling characteristics and the ability to efficiently apply the majority of the new generation of finishing materials. The MRV 760 guns will handle most industrial finishes and is especially suitable for woodworking and metalworking applications.



Binks MRV 760

For further information Enter F210

Metrohm programming titrator

V. A. Howe has introduced the Metrohm Titrator 686 which stores 40 user-designed programs and performs all routine end-point titrations.

For further information Enter F211

Literature

Hays wallchart

Hays Chemical Distribution has eased product selection for its customers with the publication of a free A3 wallchart listing all its organic and inorganic chemicals.

For further information Enter F212

Literature miscellaneous

Two new brochures on the expanded Glascol polymers range for paint/ink from **Allied Colloids**. One details 21 Glascol polymers for water based inks and the other covers 13 polymers for water based paints.

For further information Enter F213

A Selection Guide from **Aqualon (UK)** details their full range of cellulose-based water-soluble polymers. Properties and applications of Blanose, Natrosol, Combizell and Culminal for paints, and Klucel for printing inks are among those included.

For further information Enter F214

Degussa, new edition on **flattig agents** OK 412, OK 500 and HK 400. English/French/German.

For further information Enter F215

An audio course on rheology by the **American Chemical Society**. Instructor Prof. H. Markovitz, Chemistry Dept, Carnegie-Mellon University. 7 cassettes (7½hrs) + 245pp manual \$714,000.

For further information Enter F216

Chemicals: list of HSC/HSE publications

The latest edition of the Health and Safety Executive's Chemicals Subject Catalogue is now available. It lists all relevant HSC/E publications including those relating to the COSHH. The catalogue is available free from all HSE Area Offices and public enquiry points including 01-221 0870.

Paintmakers Association explains The Control of Pollution Act

A comprehensive guide to the recently introduced Regulations which implement sections of the Control of Pollution Act 1974 has been produced by the Paintmakers Association for its members.

Local authorities interpret the regulations on waste disposal in different ways causing problems of consistency and priority of approach for both paint manufacturers and customers. To help clear the confusion the PA publication, which was produced with the help of the Department of the Environment, sets out guidance for all PA members on the approach to waste disposal that should be followed by each local authority. To promote consistency throughout the UK, PA are also intending to send out a copy of their publication to each local authority.

The 15pp long publication "A Guide to the Control of Pollution Act and Regulations for the Paint Industry and its Customers" gives a summary of the aims of the Control of Pollution Act 1974, its impact on the paint manufacturing industry, and appropriate action of particular importance highlighting the responsibilities of paint users for the disposal of their own wastes.

A copy of the report is available to non-members of the PA at £10 per copy from: PA, Alembic House, 93 Albert Embankment, London SE1 7TY.

Meetings

OCCA NZ Convention

The 27th Annual convention will be held on 27-30 July 1989 on "OCCA NZ and the Environment" at Rotorua, New Zealand. The speakers will talk on:

The friendly world of coatings — F. Borelle, ex VP FSCT
Pollution Control: EPA regulations and their effects — B Abrahams, President S. Californian PVMA
Managing waste — A. Jamieson, Mng Dir, Waste Management NZ
Environmentally acceptable coatings — W. Schneider, Mktg

1989(6)

Manager, Ciba Geigy, Switz.
Minerals oils influence on yellow pigments recrystallisation — T. Boyce, Tech Ser Mgr, Hoechst Aust.
Stress and you — M. Edwards, Psychological Systems Ltd
Environment research in wood processing — P. McFarlane, FRI
Synthesis/Use of acetoacetylated resins — F. Del Rector, Eastman Chemicals, USA
Environmentally friendly wood finishing coatings — R. Brinson, Epiglass, NZ
Social trends and the environment — Y. Edwards, Psychological Systems Ltd
Weather report: Latex coatings — C. Boyce, Tech. Ser. Mgr, Nacan Products
Product Effects on the environment, is it a QA issue? — B. Wehmoth, Exec, off. NZOQA.

For a registration form and a full programme please write to:
OCCANZ, Auckland Section, P O Box 5192, Auckland, New Zealand or phone Brian Hamilton on NZ-09-277 8080.

People

New Harcros laboratory

Dr Roy Laundon has been appointed R&D manager for a new inorganics R&D laboratory to be opened at Durham Chemicals, Birtley, UK. The 6 strong R&D department will serve the entire Harcros Inorganics Division.

CVP appointments

Steven Rees has been appointed Coatings Evaluation Laboratory Manager for Cray Valley Products Ltd, in charge of the Decorative and Industrial Paint Laboratories. In his new position with Cray Valley, Steven, located at

S. Rees



Farnborough in Kent, will be responsible for the evaluation of surface coating resins from the R&D Laboratories at both Machen (Gwent) and the Farnborough site.

Graham Robinson has been appointed Commercial Sales Executive for CVP. Responsible for sales of surface coating materials in the Middle East, Graham will travel extensively in that area to promote existing products and develop new contacts.

Tioxide appointment

John Rackham has been appointed Works Manager at the Grimsby Works of Tioxide UK Ltd.



J. Rackham

Well-known industry figure retires from Banner

Thomas McGauley, well-known throughout the coatings industry for his work on vegetable oils and a member for OCCA for 30 years has retired from Samuel Banner & Co Ltd.



T. McGauley

Tom joined the company 44 years ago and has held a number of positions including plant manager in charge of the refinery and processing of vegetable oils. Latterly he has worked as administration manager where he was responsible for the development of data processing and computerisation of the vegetable oil division

PIMEX: A new method for worksite environment control

by J Carlsson, IBC AB, Box 5, S-770 31 Riddarhyttan, Sweden

Abstract

In Sweden a new method for visualization of different environmental factors has been developed. Video filming is combined with measuring techniques. A video mixer converts the measured value into a proportionally varying bar graph at the edge of the video image. The method, called PIMEX, has proven to be an efficient tool in the efforts to pinpoint the causes which contribute most to the overall exposure to hazardous environmental factors at worksites.

Sweden has a long history of involvement in occupational health for worksites. Legislation dealing with workers health and safety has been in effect since the end of the 19th century. There is quite a comprehensive framework of laws and regulations defining the permissible limits for factors which may be detrimental to the work environment. The National Board of Occupational Health & Safety is the central authority for these issues.

Until recently, the Board's duties mainly have been to monitor the observance of legislation and industry's adherence to the established norms. But the scope of this involvement has been broadened. The Board carries out occupational health research and conducts information and education programs in the work environment field.

Perhaps the most important redirection is an active assistance in implementing improvements at job sites.

This approach places new demands on the measuring methods and metrological instruments used to establish, for instance, exposure to airborne pollutants. It is no longer sufficient to use the accumulative techniques that until now have dominated test methodology. For in almost every case, exposure to pollutants and other environmental factors will vary a great deal during the duration of the work process. To be able to pinpoint the causes which contribute most to the overall level of exposure, direct-reading instruments must be used. The researcher is then faced with the problem of recording the relationship between instantaneous exposure levels and the work process itself. It is extremely difficult to reliably confirm findings made by a researcher who concurrently monitors meter readout and studies the sequence of steps in a work operation.

In 1984, Dr Gunnar Rosen at the National Board of Occupational Health & Safety was assigned the task of

finding a practicable working solution to this problem. This solution eventually proved to be a combination of video recording and direct-reading instruments. IBC AB, a Swedish firm active in the field of electronics engineering, was commissioned to develop a special video mixer that could amalgamate a visualized measurement and a film showing the concurrent work process. This was realized by converting the analog measuring signals to create a bar graph that changes in height as the magnitude of the signal changes. This bar graph is shown directly on the screen, superimposed upon the film recording of the actual work process. The method was termed PIMEX, Picture Mix Exposure.

System configuration

The video outputs from the camera and the analog signal outputs from the direct-reading instrument are connected to the video mixer (Figure 1). The mixer converts the analog signal to a bar graph with a height proportional to the signal level. The next step is to amalgamate the camera image and the visualized instrument signal send them to the video recorder and the viewing monitor. It is also possible to display the date and time of day, certain preset values or an identification label.

Non-professional video equipment is perfectly satisfactory for this task. In cases where the filmed material is to be used for training purposes, it might be suitable to upgrade the video filming equipment. The technical quality of the unexposed film should enable it to withstand later editing.

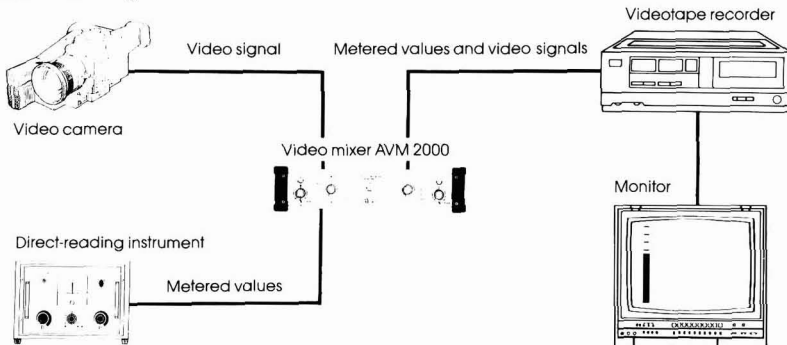
The mixer has two independent analog channels. The signal range can be adjusted across a wide spectrum to enable conformance with most analyzers found on the market.

The researcher should avoid choosing instruments with a response time of more than 10 seconds (in some applications 5 seconds) since a delayed response may create difficulties in interpreting the causal relationships.

Sample Applications Solvents

A common hazard in spray painting operations is exposure to solvents. This can be the case even in plants with good ventilation. An environmental study was carried out at a modern furniture factory where the worker used a high quality spray booth and where the general ventilation was

Figure 1
PIMEX block diagram



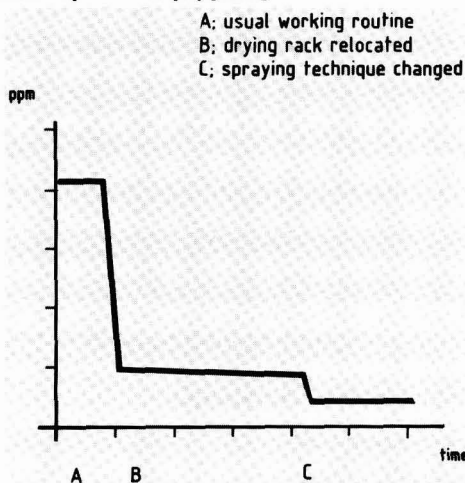
quite satisfactory. The task studied was varnishing of bookshelves with a solvent-base varnish.

The direct-reading instrument used to sample the level of airborne solvents was a Photovac Tip, which is a photoionization device. The measuring signal was telemetered from the sampler probe to the mixer. After replacing the probe's built-in accumulator with a lighterone, the equipment was inserted together with a radio transmitter in a comfortable backpack to be carried by the painter. The sampler probe was positioned near the painter's breathing zone. This arrangement allowed complete freedom of movement.

It was shown that through very simple remedies, a 90 per cent reduction in solvent exposure could be achieved (Figure 2). The biggest single contribution was made through trial and error relocation of the drying rack where the shelf units were placed after the surface-finishing operation. It was found that when the filled drying rack was removed from the immediate premises, a significant improvement of air quality could be measured.

Figure 2

Solvent exposure when spray painting



The importance of a correct handling of newly varnished items during the drying process was a well-known fact. But it is easy to be careless about seemingly negligible matters. By presenting the health hazard in a quantified and casual way, its significance can be more easily understood. Another point to remember is that ventilation conditions vary from one spray booth plant to another and the arrangement that suits one may be absolutely wrong for another. Only by on-site testing can the hazard potential be correctly defined.

Dust and other airborne particles

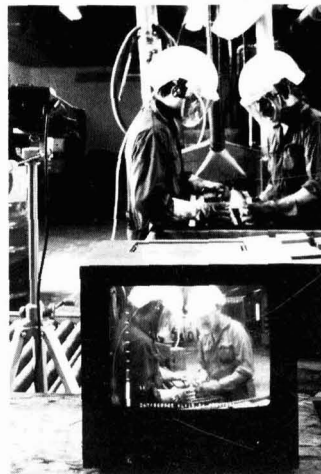
The size and number of respirable dust particles can be measured by particle counters such as MINIRAM PCM-3. Although this instrument is not portable, it is well-served for situations where the work process limits mobility.

A potential and critical health hazard related to the manufacture of lead accumulators is inhalation of lead dust. The National Board of Occupational Health & Safety has carried out a comprehensive study of the presence of airborne dust particles at a battery manufacturer (Figure 3). The study verified that the intended effect was obtained by the preventive measures introduced on-site. But an unexpected discovery was made. This concerned a work station where no

lead processing occurred and which therefore had not been included in the environmental overhaul. The operation at this work station consisted of assembling packages of lead plates in an outer casing. When the plates were lowered into the casing, there was a dramatic increase in the dust exposure. The entire apparatus functioned like a reciprocating pump, expelling dust particles toward the worker.

Figure 3

Study of airborne respirable dust at a battery manufacturer



The problem was easily remedied. But without Picture Mix Exposure the hazard might never have been discovered.

Perhaps the major advantage provided by the PIMEX method has to do with cost-effectiveness. Not only are hidden hazards brought to light, but the solutions can often be implemented on a relatively inexpensive level. It is not always necessary to reinstall a complete general ventilation or process ventilation system.

Future developments

The on-going development work with PIMEX is directed toward new areas of application, especially economic ones. Initial experiments using electromyogram instruments to record measurements of muscle stress have been so promising that a decision has been made to develop EMG apparatus which is directly adapted for use together with the PIMEX mixer. There is also a need for telemetry equipment that is suitable for harsh industrial environments, where disturbances can be considerable. A prototype of this rugged version is being field tested.

Around twenty PIMEX systems are now in operation at research institutes and worksites to improve the occupational environments of Swedish industry. Experience gained from these field tests and applications will be followed up carefully by the Board to further improve tomorrow's work environments.

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Control of dust pollution in paint and pigment manufacture

by J Whitehead, DCE Limited, Humberstone Lane, Thurmaston, Leicester LE4 8HP, UK

Both during the manufacture of pigments and the preparation of paints, inks and dyes, there are many processes that create dust which can be hazardous to the environment if adequate steps are not taken to provide well engineered dust control systems covering all points in the process where dust may be emitted.

A wide variety of raw materials are used to produce the full colour spectrum demanded by consumers, both domestic and industrial. These materials are of varying particle size and shape and some of them may even be toxic. Consequently, this dictates the design parameters, as any control equipment must cope with the worst case presented.

The hazard to the environment takes two distinctly separate parts. The first being danger to the health of operators in the working area and the second being atmospheric pollution. Good suction hood design and correct air volume assessment is fundamental if we are to control the dust created and provide a good working environment. Good filtration equipment is required if we are to protect the outside environment. These two very different aspects of a dust control plant should be considered separately.

Protection of the working environment

The whole fundamental essence of the new COSHH Regulations is that control of substances in the future will be governed purely by monitoring the exposure of the workforce to harmful concentrations in the working environment. Under COSHH the onus will be on the employers being able to show by production of the results of personnel sampling, that the concentration of harmful substances in the operator's breathing zone is less than the stipulated value. It is therefore vitally important that all possible dust releases are identified and effectively controlled at source.

Dust can be created at many sources in the manufacture of pigments and paint. The principle ones being where powders are being tipped, weighed, milled, mixed and handled generally.

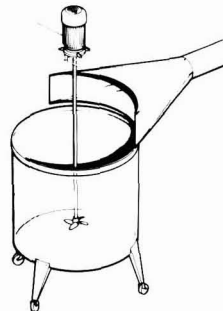
In starting to assess the way in which control should be applied to a dusty operation, the dust control engineer must first study the operation closely to ensure that his solution will not seriously inhibit existing and well proven working practices and therefore avoid providing a solution which is acceptable from a dust control point of view but is unacceptable to the plant operator. Once the designer has observed the operation closely, he must seek to design a system which utilises the minimum amount of control air possible, yet provides a good level of control of the dust. This may take the form of providing local hoods at each individual point of the operation or the use of an enclosure around a number of these dust creating sources. In some cases it may be decided to use a combination of these two different approaches. Consideration should also be given to the need for access for cleaning and maintenance and in general, all designs should have an absolute minimum of ledges or "dust traps" as equipment often has to be cleaned down frequently to prevent contamination between different products.

The use of a local peripheral hood applied to a paddle mixer is shown in Figure 1. This hood is designed to pull a curtain of air over the top of the mixing drum to capture the dust created when powders are being added and during the initial period of mixing before these colour powders have been totally mixed into the liquid in the drum.

The hood is shaped around the periphery of the drum to ensure that the hood face is as close as possible to any

possible point of dust escape as the effectiveness of an open face hood diminishes rapidly as the distance from the face increases.

Figure 1
Paddle mixer



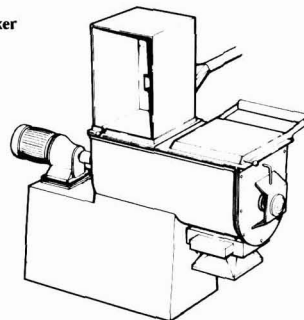
A simple formula for calculating the quantity of air (Q) required to provide a capture velocity (V) for a dust at a varying distance (X) from an open face hood of area (A) is:

$$Q = V (10X^2 + A)$$

This simple formula is only applicable to square or round faced hoods: as the calculation becomes more complex for rectangular faces, but it shows quite clearly that hoods must be positioned as close as possible to the dust source to minimise the quantity of control air involved. On large diameter paddle mixers it is often necessary, therefore, to restrict the open top of the mixing drum, thus limiting the aperture through which powder can be tipped and allowing the hood to be positioned adjacent to this aperture.

Control of the dust created when loading a ribbon mixer, as illustrated in Figure 2, is by the use of an enclosure rather than a local proximity hood. Using an enclosure, the dust

Figure 2
Ribbon mixer



control engineer is seeking to contain the dust created by employing a controlling air velocity of typically 0.5 to 1.5m/sec across the open face of the enclosure through which the powder is being loaded. This is a very effective method of dust control as an enclosure eliminates the possibility of cross draughts which can be detrimental to the effectiveness of local proximity hooding. Open doorways, movements within the vicinity of the dust source or air currents created by heaters or other air moving equipment can all serve to create draughts that can reduce the efficiency of local hooding.



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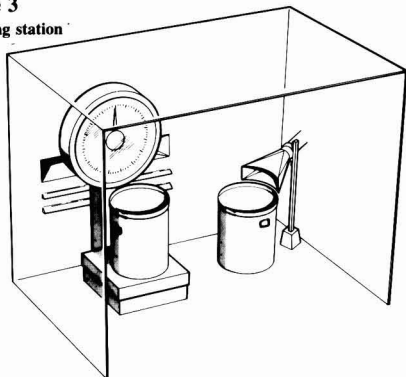


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Often a combination of local hooding and an enclosure is required to give the most effective solution. In Figure 3 the weight scale and powder kegs are completely enclosed in addition to the local hooding behind the scale and at the top of the keg. The local hooding will control the majority of the dust created while the enclosure will eliminate any adverse effects from cross draughts and contain dust caused by spillages.

Figure 3

Weighing station



In this particular example an enclosure alone could be used, but the combined approach will give cleaner conditions within the enclosure without any need to increase the quantity of control air required.

System design

When the method of dust capture or containment and the quantity of control air has been decided, the designer must consider whether to employ a number of small dust filter units positioned adjacent to the individual dust creating sources or a larger centralised plant which serves all of the dust sources.

The use of the smaller individual unit type dust collectors does have a number of attractions. It reduces the quantity of ductwork required, allows a degree of flexibility should all dust creating sources not be operative at a single time, and is usually able to return the cleaned air directly back into the working environment thereby conserving valuable heat without the need for a complex return air duct system. These units will, of course, take up some working floor space and provide additional noise sources within the workshop. The advantages of using this type of equipment must therefore be assessed against any disadvantages in each particular application before a decision can be made as to whether this type of approach should be utilised.

The alternative is the use of a centralised system where all the dust creating sources are ducted together by a ductwork system which will convey all the dust laden air to one large central filter, frequently sited outside of the working environment. This ducting system must be designed in such a way as to ensure that the dust laden air is conveyed without any possibility of dust being deposited anywhere in the system. This should be achieved without the use of excessive velocities which will incur higher than necessary power requirements. The ducting system should be accurately balanced so that irrespective of the size and length of each "leg", the correct proportion of the total air volume is drawn from each entry point.

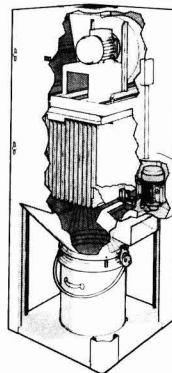
Dust collector

The majority of dust collectors used in the industry are of the fabric filter type and can either be intermittently or

continuously rated. Intermittently rated collectors may be used if they can be stopped after 3 or 4 hours to allow for cleaning down under no flow conditions. Figure 4 shows an intermittently rated collector which has a motorised vibrating mechanism which shakes the filter bags to remove the accumulated layer of dust on the fabric surface once the exhaust fan has been stopped. These are generally available in a range of fabric area sizes up to around 50m² although it is possible to bank two or more collectors together to provide higher capacities.

Figure 4

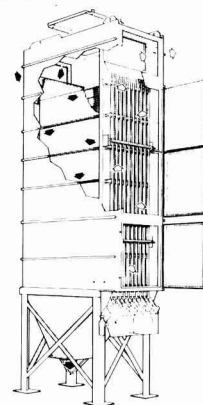
Intermittently rated unit dust collector



Where the dust creating processes are in operation for periods that are generally in excess of 4 hours or where the dusts involved quickly build up a resistance to air flow on a fabric due to their size, shape or the sheer quantity involved, a continuously rated collector must be used. This type of collector, as shown in Figure 5, employs reverse jets of compressed air which clean each filter element in turn on a

Figure 5

Continuously rated dust collector

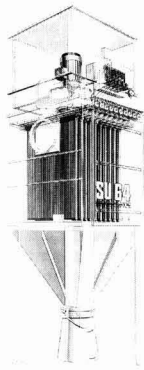


continuous and recycling basis, thus removing dust from the surface of the fabric on a regular basis without the need to stop the collector. Continuously rated collectors are usually built in a modular construction based on cells of between 10 and 20m² of fabric area which enables virtually any size of collector to be manufactured to suit each particular application.

Within the last 18 months, a new type of continuously rated filter which employs a rigid sintered plastic element as its filtering media has been introduced. This "Sintamatic" filter

(Figure 6) is able to achieve much lower outlet emission levels than conventional fabric filters and due to the PTFE impregnated into the surface of the element has very good cake release. The elements are so reliable that the collector is virtually maintenance free and the risk of bag failure is eliminated.

Figure 6
Sintamatic dust collector



Reckitt Colours in Bletchley recently selected Sintamatic collectors to serve various parts of their pigment manufacturing process because of the low dust retention qualities of the filter elements, which greatly assists cleaning down between product changes, and the long life of the elements, which removes the need for unpleasant regular bag changes.

Protection of the atmosphere

Once the dust collector has separated the entrained dust from the control air, the cleaned air will either be discharged back into the working environment or discharged to atmosphere. In either case a good level of filtration efficiency is essential to avoid increasing the dust level in the working area or creating atmospheric pollution.

In each particular application, great care should be taken in studying the dusts involved to ensure that the dust collector is correctly sized. It must contain sufficient filtration surface area commensurate with the volume of air being handled and the type of dust concerned. The most appropriate air to cloth ratio, i.e. volume of air being handled divided by the filtration surface area, will differ from one dust to another. In general terms, the finer and most difficult dusts require a lower air to cloth ratio for successful operation, so more surface area is required per unit of volume than coarser and easier dusts.

If insufficient surface area is provided there will be a greater than necessary pressure loss over the filter resulting in a decrease in the volume of control air and an increase in particle penetration through the filter. The former will give less effective control of dust at the source and the latter high emission levels from the collector.

In these days of stringent emission standards and an ever increasing "green" awareness, excessive emission levels will no longer be tolerated. Depending on the nature of the dusts involved, a secondary filter may be required after the dust collector to either ensure that emissions are within the desired limits or merely to act as a "policeman" to prevent high

emissions, should a filter bag fail. The new Sintamatic filter's inherent high efficiency and security from failure can be a great help in achieving guaranteed low emission levels without the need for secondary filtration.

Correctly designed and installed dust control equipment should be beneficial not only to the workforce, who enjoy a healthier working environment, but to management and the neighbourhood as well.

Management obtain savings from a reduction in production losses brought about as a result of absenteeism, reduced maintenance and cleaning down time and your neighbours will benefit from a less polluted atmosphere. ■

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Incineration of chemical waste

by L. E. Baker – Technical Director, Rechem International Limited, Charleston Road, Hardley, Hythe, Southampton SO4 6ZA, UK

Incineration of chemical wastes is a strategically vital part of the overall spectrum of hazardous waste options and whilst it perhaps enjoys more than its fair share of controversy, it remains the most effective – if not the only – really satisfactory way of disposing of some of the most difficult and intractable chemical materials.

Incineration involves the thermal oxidation of a substance, such that the molecular integrity of that substance is destroyed, and its components are converted into gases and/of incombustible solid residues. The equipment required to carry out this process properly and effectively will depend upon the nature of the wastes to be destroyed, the quantities involved, and the environmental standards within which the plant is expected to operate.

The incineration plant itself can be divided into three parts:

- (1) The high temperature zone in which thermal oxidation takes place: i.e. the incinerator itself.
- (2) The gas clean plant which removes undesirable products of combustion to acceptable levels.
- (3) Pre-treatment and waste feeding arrangements to ensure wastes are introduced safely and effectively.

In any particular case, the design or selection of the elements of an incineration plant will take account of factors such as:

- Overall quantity of waste
- Physical form (solid/liquid/sludge)
- Chemical composition
- Type of packing used for wastes
- Desired stack emission standards

There are many different types of incineration chambers, some particularly well suited to solid waste burning, others much more appropriate for liquid (or at least pumpable) inputs. Where solid wastes are to be incinerated, the chamber should enable the material to burn out at suitable temperatures with an adequate supply of air, and provide some form of mixing or movement to help achieve complete combustion. Three types of chamber used for solids incineration are:

- (1) Rotary Kiln – Flexible in scope, but expensive to operate and maintain. The most frequent choice for multi-purpose incinerators – particularly where external funding is provided.
- (2) Multiple Chamber – An effective compromise, with proven performance.
- (3) Fluid Beds – Limited in scope, but effective in the right applications. The integrity of the mineral bed is of prime importance and imposes severe restrictions on operating temperature and chemical compositions of wastes (i.e. to avoid fluxing).

The control of the final emissions from the incinerator stack depends upon both the efficiency of the gas cleaning plant and the efficiency with which combustion of the waste takes place in the incinerator chambers.

Destruction efficiency is widely recognised as depending upon three main factors:

- (1) Combustion temperature(s)
- (2) Residence (or dwell) time at that temperature
- (3) Availability of sufficient oxygen to ensure full oxidative degradation and turbulence in the combustion zone(s)

It will be readily appreciated that the thermal degradability of a waste will vary with molecular structure, and that consequently, not all wastes need the same severity of incineration conditions to ensure effective destruction. In practice it is usual to "validate" an incinerator for particular

types of waste, by carrying out controlled test burns coupled with sophisticated sampling and analysis of emissions. This procedure will enable the range of suitable operating conditions for various types of waste to be demonstrated and it is then assumed that by maintaining these conditions thereafter, satisfactory destruction standards will be achieved.

In Rechem's case, test burns have been carried out with the most thermally refractory of substances – polychlorinated biphenyls – and the conditions established for their destruction maintained for all operations – even if PCBs are not handled at the time.

The control of incinerator conditions is therefore seen to be of vital importance. Rechem have moved to computer control, with input data coming from temperature, oxygen levels, draught and emission data – these controlling modulating burners, fuel inputs and air dampers. If temperatures fall below pre-set points agreed with the regulatory authorities, waste feed streams are shut off until temperatures are restored.

Whilst it is essential that the combustion zones of the incinerator effectively destroy the wastes themselves, effective destruction will itself produce acidic products of combustion and inert particulate which must be removed to acceptable levels prior to release to atmosphere.

Gases leaving the incineration chambers of hazardous waste incinerators will invariably be at 1,000°C or greater, and must be cooled prior to the gas cleaning stage. Two methods are employed:

- (1) Heat exchangers, which both cool the gases and recover energy – usually as steam – for power generation, district heating etc.
- (2) Evaporative cooling of the gas with an aqueous system.

Removal of acidity from the combustion gases involves contact in one form or another with water (for subsequent neutralisation) or with an alkali such as caustic soda solution or lime slurry.

Particulate removal may be affected by a number of methods, differing in their efficiencies and in the types of particular for which they are most suited. The electrostatic precipitator is probably the most frequently utilised technology, but venturi agglomerators, wet spray methods, bag filters and cyclones are used in some cases.

The whole question of providing arrangements for storing, pre-processing, and feeding wastes requires much careful thought.

Storage arrangements, both for bulk and packaged items, should permit reasonable working quantities of various types of waste to be stored safely, with proper segregation of properties and characteristics, and in such a way that they may be subsequently taken to the incinerator in the optimum manner.

The incinerator itself will work best under condition of consistent and stable feeds and it is therefore desirable to pretreat wastes in such a way as to produce consistent blends of compatible liquids; semisolids and viscous materials require much more sophisticated equipment, and macerators and shredders may have to be employed.

Some wastes cannot, and others should not be blended, and these must therefore be provided with segregated storage, and dedicated pumps, delivery pipework and burners. Wastes which fall into this category may be highly reactive with other wastes (e.g. acid chlorides), malodorous

(e.g. mercaptans), or environmentally persistent (e.g. PCB) and preferably not mixed with other streams.

Although all hazardous waste incinerators exist to provide a disposal service, the framework of control and finance within which they must do so varies enormously from country to country. Of course, some incinerators are provided by the major chemical manufacturing companies for their own "in-house" requirements, and their role is both limited and comparatively clear-cut. It is amongst the incineration operations created to service a wider client base that the difference of approach manifest themselves.

These differences can be best illustrated by posing three questions:

- (1) On what basis has the initial capital investment been provided?
- (2) What is the commercial premise on which the subsequent operation is conducted?
- (3) What determines whether, and in what quantity, wastes come to the plant?

A vital consideration in the planning and operation of an incinerator business is the type and size of market requiring to be serviced. The extent to which a waste producer opts to use a particular disposal facility depends on what choice he has, and on what constraints may be placed on him. Factors to take into account would be the availability of alternative facilities, controls over selected disposal methods for certain types of waste, and geographical or regional constraints.

In the UK all waste disposal sites are licensed under the Control of Pollution Act, the licence specifying the types of waste which may be handled. Generally speaking, a producer of waste may make arrangements for its disposal at any site licensed for that type of waste, irrespective of location within the UK. Furthermore, in issuing disposal licenses, the site or facility already exists within the area. In other words, even if there was a surfeit of disposal sites, a Licensing Authority could not refuse a disposal licence for a further site providing all the peripheral and technical requirements were met.

A feature of the UK waste market during the late 1970s and early 1980s was the encouragement given to the use of landfill for a steadily broadening range of chemical type wastes. Government funded research had provided the basis for a policy which, over a five or six year period, saw many wastes switch from incineration, as the preferred means of disposal, to landfill. As more and more landfill operations were permitted to accept chemical wastes, incineration plants experienced much greater competition from an intrinsically cheaper option, and found it increasingly difficult to attract sufficient business to remain commercially viable.

At the other extreme, some European countries operated much more rigid policies where the density of waste was carefully controlled. In some cases, regulations dictated

which type of disposal method should be used for particular classes of wastes, and often also specified to which waste disposal facility wastes should go. There are well documented examples where whole countries, or major regions of countries, establish a disposal framework in which there is no scope for choice or doubt, and where the method and location of disposal are precisely defined. Such arrangements have obvious benefits in terms of the strategic planning of facilities and waste disposal requirements.

The middle and late 1980s have seen the commercial fortunes of incineration plants improve dramatically. Concerns over excessive use of landfill, and criticism of lack of control at many landfill sites, as manifested in the various Hazardous Waste Inspectorate reports, has helped create a climate in which many companies have begun to think again of having their wastes incinerated. Incineration capacity had declined significantly as a result of the closure of various facilities, due in turn to the previous lack of sufficient business. As the demand for incineration services had started to grow once again, there has been difficulty in meeting this demand within the available UK capacity, at least for certain categories of waste. This has meant that for the first time in at least a decade, incinerator operators have enjoyed high plant utilisation, and levels of profit which have encouraged thoughts of expansion, modernisation and further developments. ■

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Risk assessment in the surface coatings industry

by Graham Matthews, Consultant Occupational Hygienist at Casella (London) Ltd, Bridge Wharf, Caledonian Road, Kings Cross, London N1 9RD, UK.

The control of substances Hazardous to Health Regulations (COSHH) have recently been published and will come into effect from the 1 October 1989. The COSHH regulations will require all companies, of whatever size, to assess the risks involved in their operations, then if required to reduce the risks, there are other duties such as health surveillance, monitoring, information education and training, however, the corner stone of the regulations is the assessment. In the surface coatings industry the assessment can be an involved and costly process due to the complexity of the mixtures present. Table 1 shows some of the compounds that could be encountered in a small paints and wood preservatives operation. Clearly, risk assessment is not straight forward. Due to the nature of the operation the solvent mixture will be spread over as large an area as possible and the solvents will be allowed to evaporate, whereas the evaporation area is minimised in most other processes as a method of control.

Table 1

A list of some of the compounds that may be found in a paint and wood treatment operation. (This is not an exhaustive list and is only intended to act as an example of the range of chemicals that can be encountered).

Alcohols: methanol, 2 methyl-1-propanol and diacetone alcohol.

Petroleum derived solvents: White spirit, Stoddard solvent, Varsol, mineral spirit and 140 flash solvent — all essentially the same solvent; petroleum ether 30°C-60°C, rubber solvent 45°C-125°C, varnish makers and painters naphtha 95°C-160°C, mineral spirit 150°C-200°C and stoddard solvent 160°C-210°C up to 30% aromatics (toluene xylene and ethyl benzene).

Ethylene glycol, propylene glycol, diethylene glycol and ethylene glycol monomethyl ether

Butane-2-one, 4 hydroxy-4 methyl pentane-2-one, iso butyl acetate and n butyl acetate, toluene, xylene, C9 aromatic hydrocarbons, formaldehyde, isocyanates, pigments, dyes and mouldicide-N-dichloro fluoro methyl thio-N,N-dimethyl-N-phenyl sulphamide/chromium VI.

An additional problem for the employer is the decoding of all the trade names which describe mixtures or compounds but provide little information as to the chemical structure.

The regulations require the employment of a competent person for the assessment, clearly the level of competence in the surface coatings industry must be relatively high and the ideal risks assessor will be an occupational hygienist who will be able to design a suitable risk assessment strategy. It should be added that the COSHH regulations require little more than that required by the Health and Safety at Work Act 1974, except that it states how an employer should comply with the 1974 Act. Both the Health and Safety at Work Act and the COSHH regulations require the manufacturer to supply hazard information based on chemical content, as without this data the risk assessment cannot proceed.

The various compounds in the mixture will have differing toxicological effects and different target organs, though the major effect will be on the central nervous system, in addition the main route of uptake for some components will be by inhalation while for others the main route will be by skin absorption.

In some cases toxicologists are aware of synergistic effects, for example, carbon tetrachloride and ethanol are both hepatotoxic, however, when combined their effect is far greater than the sum of the two. This is an example of a two component system, in the coatings industry the operator may well be exposed to a 100 components simultaneously and the chances of a synergistic or potentiating effect is possible.

With narcotic solvents it is acceptable to take the sum of the narcotic components as a fraction of their occupational exposure standard and if the sum is less than unison then the environment will be in compliance.

The analysis of a multicomponent system is very complex and potentially harmful substances may be shrouded by high concentrations of relatively low toxicity materials, therefore the occupational hygienist must take care to identify the materials from the manufacturers literature in order to give the analyst a good chance of detecting the components of interest.

It has been suggested that solvent manufacturers could supply vapour data in the same way as the manufacturer supplies fume data for welding rods. It is possible to anticipate the concentration of a mixture at a given point in the working environment provided that an accurate analysis of the solvent is obtained and that one marker compound has been quantified in the air. This method requires knowledge of the vapour pressures of all the components in the mixture and the concentrations can be predicted using Henry's law. This approach may prove satisfactory as long as only one solvent mixture is in use, which is rarely the case, if more than one solvent mixture is in use then the marker compound must be unique to that particular solvent. This is all well and good provided that the manufacturer does not change the composition of his product.

At present the only way to quantify the components in the breathing zone of an operator is to sample the air and collect the vapours on an adsorbent such as activated charcoal or porous polymer followed by capillary gas liquid chromatography. Once the components in the breathing zone have been identified then the toxicological data will have to be reviewed to enable the risks to be assessed. The competent person will use validated methods for monitoring, colour change tubes are not validated for assessments, however, they may provide a useful indicator for the factory supervisor on a day to day basis.

The other major route of uptake will be via the skin, and careless handling of solvents may result in this route being the major source of risk, uptake through skin absorption is a much more difficult route to assess as the only way to measure this quantitatively is by using biological monitoring. In practice uptake through the skin is assessed visually, and the occupational hygienist will identify work practises which are likely to result in skin contact with hydrocarbon solvents. It should be remembered that excessive skin contact can cause dermatitis.

The other routes of uptake are by injection and ingestion both of which are possible, especially ingestion, and supervisors must be aware of the emergency procedures in the event of accidents.

Approved personal protective equipment is essential in this environment and it should be remembered that some solvents pass quickly through some gloves, some manufacturers of personal protective equipment will supply solvent permeation data for their products.

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Local exhaust ventilation must be designed to a high standard and with a great deal of thought, in addition the systems performance must be checked and a maintenance programme must be designed. While the solvents are evaporating the materials can be removed to a fume booth or ideally treated in a fume booth, in the case of a dip tank this could be situated within a fume booth.

Companies are becoming aware of COSHH and are considering monitoring but monitoring is only a part of the COSHH regulations, some monitoring records will have to be kept for 30 years; information, instruction and training are also essential elements of COSHH.

Essentially during an assessment the competent person will assess the suitability of local exhaust ventilation, the level of training, other control measures and any medical surveillance, an assessment will not be successful unless all the headings in the regulations are addressed.

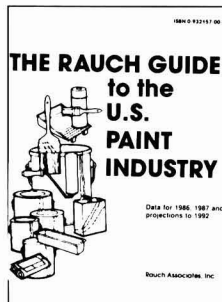
Also of concern is the environmental issue and an assessment would also consider the emissions from the premises. Ventilation can be ducted to activated charcoal beds and the solvents can be recovered, care must also be taken to prevent solvents contaminating the water course.

There is a rapidly growing awareness of occupational health and environmental issues and these areas are likely to come high on the list of public concern. While a company will plan ahead to accommodate the COSHH regulations, companies should consider the environmental aspect as E.E.C. directives are sure to appear in great numbers over the next few years.

Consultancies will form an essential service to industry over the next few years, and in the case of environmental assessments, employers should satisfy themselves that the consultancy has the competent person to carry out the COSHH assessment as described in the regulations. ■

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Toxic hazard from burning polymers

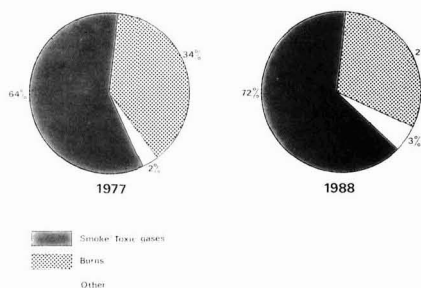
by P. J. Fardell, Fire Research Station, Borehamwood, Hertfordshire WD6 2BL, UK

Introduction

Statistics indicate¹ that a major cause of loss of life and serious injury in fires is the mobile fire atmosphere, which may contain toxic and irritant gases, solid and liquid particulates as "smoke" together with other life-threatening factors such as reduced oxygen and hot gases².

Further, the proportion of deaths and serious injuries from these sources in the UK is growing (e.g. 64% in 1977 to 72% in 1986)³ (See Figure 1).

Figure 1
UK fatalities in dwellings.



Historically (about 20 years ago) the subject of "Combustion Toxicity" was studied with a view to changing the chemical nature of materials (usually synthetic polymers) and thereby improving "Toxicity" of the combustion products. This philosophy developed at a time when 'Polymer Engineering' seemed to offer this possibility. Early work in the field therefore concentrated on improving the understanding of the fundamental chemical processes^{4,5} involved in thermal degradation leading to the production of toxic gases and the biological effects of those gases and the other hazards listed above⁶.

Today it is recognised and accepted by many that the toxic hazard in fire is brought about not just by the 'toxicity' of the materials burning as fuels but by a combination of many other "fire" properties including the end-use environment.

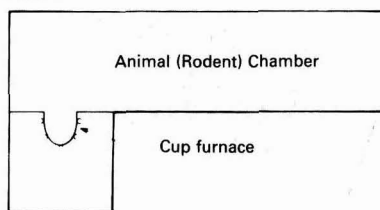
This emphasis on end-use rather than material properties as measured in (for example) small scale toxicity tests is particularly relevant for the consideration of surface coatings where by definition the materials used are in direct contact with other materials which may be inert or flammable and affect profoundly the contribution of the surface coating to the toxic hazard in fire.

Toxicity testing

Approximately 15 years ago while the 'fundamental' studies of polymer degradation during heating, were in progress, the toxic hazard problem became so prominent in many countries, that a small scale toxicity test was called for which could take its place among other 'reaction to fire' tests for use by regulators, specifiers, architects, etc, and generally be used to guide the choice of materials for particular applications.

This period saw the development of many small-scale protocols⁷⁻¹⁰, usually consisting of a bench scale furnace for the fire model coupled to a chamber where animals could be exposed to the atmosphere produced. New York State in the USA already has such a test on its building code enforcement "books"¹¹. Figure 2 shows a typical design, originating from the United States.

Figure 2
Typical combustion toxic potency test – the USA NBS (now NIST) cup furnace method.



However, far from providing a wide spectrum of toxicity from different materials the results mostly showed that toxicity from the vast majority of materials lay in a relatively narrow band¹².

Furthermore, the relationship between the decomposition conditions in the furnace and those in "real" fires were not clear.

This has led in the UK to a reappraisal of the rôle of small scale tests in toxic hazard assessment given in a publication from BSI¹³ and shows how fires can be classified into six different types on the basis of a small range of chemical and physical properties (see Table 1). Using this classification the fire model used in toxicity tests can be assigned to a particular fire type, aiding choice of test method for use as part of a toxic hazard assessment. Table 2 shows how the 'Potts Pot' method (Figure 1) has been treated in this way.

Table 1
Summary of fire classifications used to assess the relevance of small scale fire models used in toxic potency tests to the existing title.

	Oxygen (%)	CO, CO ₂	Temperature (°C)	Irradiance (kW/m ²)
(i) Smouldering (non-flaming)	21	N/A	400-1000	N/A
(ii) Oxidative decomposition (non-flaming)	5-21	N/A	500	25
(iii) Pyrolytic decomposition (Non-flaming)	5	N/A	1000	N/A
(iv) Developing fire (flaming)	10-15	100-200	400-600	20-40
(v) Fully developed (flaming, low ventilation)	1-5	10	600-900	40-70
(vi) Fully developed (flaming, well ventilated)	5-10	50	600-1200	50-150

Modelling and predicting toxic hazard

A further publication from BSI, expected mid 1989, will provide guidance to fire safety practitioners in assessing the toxic hazard from a given scenario¹⁴ and emphasises the need to take into account many factors connected with the fire, and not just results from toxic potency tests.

This sets out as a series of logical steps the range of factors which should be considered in a hazard assessment:-

- (i) define circumstances (i.e. the particular scenario)
- (ii) assess probability of the scenario occurring
- (iii) describe local growth of fire
- (iv) describe developed burning
- (v) define the toxicity of the fire effluents
- (vi) draw together steps (i) to (v)
- (vii) report

Table 2
Relevance of the NBS (now NIST) small scale combustion toxic potency test to six fire "types".

Fire type	Known relevance	Comments
Smouldering (non-flaming)	Uncertain	In some cases smouldering involves a bulk effect where insulation is necessary to conserve heat. This is not easy to reproduce but may be possible with high loadings of cellular polymers
Oxidative decomposition (non-flaming)	Yes	The method seems to give oxidation reactions by oxygen access to the pot by diffusion and convection
Pyrolytic decomposition (non-flaming)	No	Restricted oxygen concentrations cannot be simulated in the pot without very special measures
Developing (flaming)	Yes	The flame stabilizes within and on top of pot. Lift off and/or extinction of flame will occur as soon as the oxygen concentration falls to less than about 13% V/V in the chamber
Fully developed (flaming, low ventilation)	No	The natural oxygen limit of flaming of 13% V/V precludes the simulation of severe fires. Post-flame reactions cannot be produced.
Fully developed (flaming, well-ventilated)	No	As for fully developed (flaming, low ventilation) but see the note

NOTE: The use of direct radiation of the exposed sample in the modified method may simulate severe well-ventilated fires, as it allows free access of oxygen

Conclusion

The move towards an integrated approach to combustion toxicity which places less emphasis on material properties as measured in small scale tests and more on end-use considerations with the presence of other burning materials will enable better assessments to be made of the rôle of a particular material in contributing to the life threat in fire.

This is likely to be particularly important in the field of surface coatings where intimate contact with other materials is inevitable.

Each step incorporates a guide as to how that particular aspect can be objectively considered and how matters might be improved. The analysis of toxic hazard uses a "mass loss" calculation which from an estimate of the development of the fire in terms of the mass loss of the fuels involved and the known cumulative biological effects, provides an estimate for the time to incapacitation or death for the chosen scenario. Figure 3 shows how this data can be plotted and these times read off.

The worked example which has been included does in fact show the effect of changing the surface coating materials in a building and how this can lengthen the time available for escape.

Future developments

The mass loss model incorporated in the BSI document although providing a guide to build-up of hazard with useful objective data with which to make decisions on the safety or otherwise of a building in fire, does not take into account the detail of the various hazards present in the fire atmosphere.

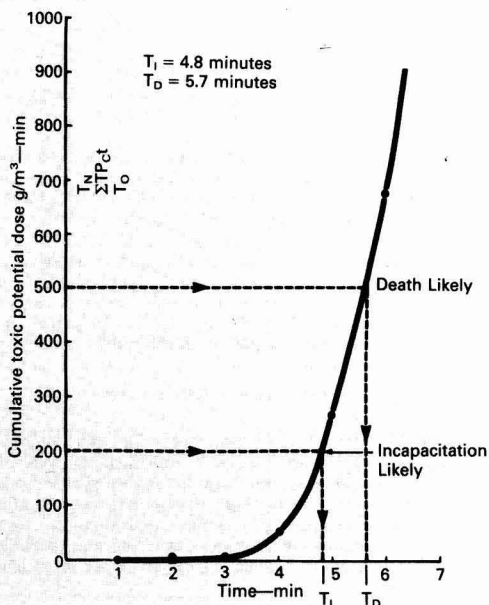
Various refinements to the basic mass loss model are being developed which will enable a relatively sophisticated analysis of the growing life threat in fire to be carried out. Foremost in this field is the "Fractional Effective Dose" model which considers:

- Narcotic gases (e.g carbon monoxide, hydrogen cyanide, reduced oxygen).
- Sensory and respiratory irritants (e.g. acrolein).
- Heat (radiative-skin burns, convective-respiratory burns).
- Smoke.

The hazards are considered in terms of their combined contribution to the build up of a life threatening atmosphere at successive small time increments into a fire¹².

Figure 3

Mass loss toxicity model. The cumulative toxic potential is calculated from the increasing mass loss of "fuels" as the fire progresses combined with the known biological effects for materials of "usual toxic potency".



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Raymond B. Seymour, Distinguished Professor, Department of Polymer Science, University of Southern Mississippi, Southern Station Box 10076, Hattiesburg, MS 39406-0076, USA reports:

Sixteenth Annual Water-Borne Symposium sets attendance record at New Orleans

In contrast to the less than 50 delegates, who attended the first Water-Borne and Higher-Solids Symposium sponsored by the Department of Polymer Science of the University of Southern Mississippi at New Orleans, LA in 1973, over 500 delegates attended the 16th annual conference in February 1989. Short courses on Degradation, Thermal Analysis, Coatings Technology and Water Soluble Polymers which qualify for academic credit were presented prior to the coatings conference. Extra curricular activities included a plantation tour for spouses, a social hour and Mardi Gras festivities for all attendees. Over 600 attended both the conference and short Courses which were organized by Drs. G. L. Nelson, C. E. Hoyle and R. F. Storey.

In his plenary lecture, Dr. James Stoffer of the University of Missouri-Rolla, discussed improvements in properties of coatings and composites that are possible when silane coupling agents are added to higher solids coating solutions, including aqueous systems. He emphasized the importance of decreasing surface tension and forming covalent bonds at the interface. For additional information, consult E. Plueddemann, "Silane Coupling Agents", Plenum Press, New York, 1982; H. Isida, "Interfaces in Polymer, Ceramic and Metal Matrix Composites", Elsevier, New York, 1988.

The role of silicone additives on system compatibility, surface tension, thermostability, wetting and slip resistance of high solids coatings and the history of silicones were discussed by Dr Edward Orr of BYK-Chemie USA.

Drs. W. P. Yang, L. C. DeBolt and T. Yokoyama of Sherwin Williams reported their investigation of the anhydride/hydroxyl chemistry of ambient cured reactive coatings and demonstrated that the hydroxy functionality affected the modulus, T_g , swelling and gel time of these coatings. Additional information may be found in L. W. Hill, "Mechanical Properties of Coatings", Federation of Societies for Coatings Technology, Philadelphia, 1987.

Dr. D. F. Pulley of the Naval Air Development Center at Warminster, PA, discussed the impact of volatile organic compounds (VOC) regulations on end use applications of coatings. Newly developed compliance coatings are equivalent to the performance of previously used noncompliant paints.

Dr. J. W. Gooch of Georgia Tech Research Institute, Atlanta, GA, discussed the development of aircraft coatings in compliance with the April 1987 amendment to California rule 1124 which limited VOC for primers and topcoats to 350g/l and 600g/l, respectively. Additional information may be obtained from G. Fujiharo, *Modern Paint and Coatings*, Sept. 1988.

The causes of overbake softening of polyester-melamine enamels was investigated by Dr. L. W. Hill of Monsanto and Drs. S. Gan, R. D. Solimeno and F. N. Jones of North Dakota State University. These investigators used tensile dynamic thermal analysis (DMTA) to monitor changes in T_g of these coatings as deterioration occurs as a result of the cumulative effects of changes in bonding. For additional information see L. W. Hill and K. Kozlowski *J. Coat. Technol.*, 59 (791) 63 (1987).

Dr. W. D. Arendt of Velsicol Chemical supplied data to

show that isodecyl benzoate was an excellent coalescent for latex coatings. For additional information see L. S. Smith, Water-Borne and Higher-Solids coatings Symposium, 1987.

Drs. G. Vandezande and A. Rudin of the University of Waterloo, Canada, reported that the particles size distribution in vinyl acetate/butyl acrylate latices had little effect on the properties of the coatings. However, the minimum film temperature (MFT) increased with particle size in both mono and polydispersed emulsion systems.

Ms. Violet Stevens of Dow described a new generation of styrene/butadiene latices which possess superior moisture barrier properties, tannin blocking, enamel holdout at higher pigment volume concentrations (PVC) and lower temperature coalescence.

According to Drs. M. Edge, N. S. Allen and T. S. Jewitt of Manchester Polytechnic (UK) cellulose esters continue to play a significant role as coatings for archival objects. They described innovations which provide advantages of these coatings over the more widely used synthetic resin coatings. For additional information see C. V. Horie "Materials for Conservation: Organic Consolidants, Adhesives and Coatings", Butterworths, London, 1987.

Drs. J. Pacansky and R. J. Waltman of IBM Almaden Research Center used a 175 KV electron beam, under a nitrogen atmosphere, to study the increase in carbonyl content and polydispersity of polyvinyl butyral by IR and GPC analysis. They also measured the decrease in tensile strength and ductility of these PVB films as a function of absorbed doses of EB. For additional information see C. E. Hoyle, J. M. Torkelson eds., "Photophysics of Polymers", ACS Symposium Series, 358, Washington, D. C., 1987.

Drs. F. J. Kosnik of Interez used water, in place of monomers, as a means of reducing epoxy-acrylate oligomer viscosities in radiation curable system. For additional information see R. R. Kemmerer, et al, Radtech Conference Proceedings, 1988.

The casting of hybrid films from multicomponent solutions containing titanium alkoxides, polybutyl methacrylate and aqueous isopropyl alcohol was described by Drs. K. A. Mauritz of the University of Southern Mississippi and C. K. Jones of EXXON Research. A crystallization exotherm related to anatase formation was observed at temperatures above the organic degradation temperature. For additional information see K. A. Mauritz, C. K. Jones, R. F. Storey, *PMSE*, 85 1079 (1988).

A FDA approved, 2 coat solvent-based epoxy modified PVC coating for the interior of baby food containers was described by Drs. P. Palackdharry and L. Seibel of the Dexter Corp.

Drs. R. Laible and D. V. Beelen of AKZO, Stuttgart, West Germany described metal filled water-borne acrylic-polyurethane compliance automotive coatings.

Dr. W. Tippl of Wien, Austria described a water-borne protective coating for steel and concrete based on vinyl chloride polymers which crosslinked with pigments such as zinc salts of phosphoric, boric or nitroisophthalic acids.

Drs. P. J. Palackdharry and M. J. Flament-Garcia of

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Dexter Corp., Waukegan, IL, described compliance epoxy/phenolic water-based coatings for drawn wall ironed (DWI) food containers. For additional information, on DWI, see E. Morgan, "Tin Plate and Modern Can Technology", Pergamon, New York, 1985.

Drs. R. G. Vance, N. H. Norris and C. M. Olson of Dow demonstrated that the coupling performance of glycol ether solvents can be used as a predictive tool for the evaluation of water reducible alkyd coatings.

Aqueous ceric ion initiation was used to graft vinylidene chloride-methyl acrylate copolymers on polyvinyl alcohol by Drs. R. F. Storey and L. J. Goff of the University of Southern Mississippi. Relatively homogenous films were obtained when the concentration of methyl acrylate in the copolymer was increased to 40 mole percent. For additional information, see R. F. Storey, D. Sudhafer, L. J. Goff, *PMSE*, 58 565 (1988).

The effect of the nature and concentration of the components of water dilutable alkyd/melamine paints and the effects of salts on the mobility of titanium oxide pigments particles were investigated by Dr. M. Cremon of Sachtleben Chemie, Duisburg, West Germany. He concluded that an adsorbed polymer layer stabilized the system through coiling of the polymer chains and that this adsorption was related to the ionic strength of the polyelectrolyte. For additional information, see D. Horn, et al, in *Organic Coatings, Science and Technology*, Vol. 8, Dekker, New York, 1986.

According to W. J. Blank of King Industries, Norwalk, CT, urethane diol coalescent agents diffuse into the hydrophilic regions of the dispersed phase during film formation to produce a 2 phase crosslinked coating system with reduced VOC and increased film hardness. For additional information, see W. J. Blank, *J. Coat Technol*, 60 (764) 43 (1988).

Dr. C. L. Beatty of the University of Florida discussed the properties of an ionic polyurethane-glass composite. For additional information, see C. A. Dostal, ed., "Engineered Materials Handbook", ASM International, Metals Park, OH 1987.

Dr. R. C. Hire of Olin Corp. prepared water-borne coatings and adhesives by the neutralization with aqueous tertiary amines and by the reaction of isocyanates with polyols containing carboxylic acid groups. For additional information, see J. Goldsmith, R. P. O. Fee, *Adhesives Age*, Feb. 1987.

Drs. S. D. Seneker and T. A. Potter of Mobay Corp. compared the catalytic activity of dialkyltin chloride and dialkyltin dilaurate on the reaction of 4,4'-dicylohexylmethane diisocyanate (HMDI) and polytetramethylene glycol. They concluded that the activation energy of dialkyltin dichloride was much lower than that of dialkyltin dilaurate and used this information for the preparation of hydrolytically stable films. For additional information, see E. P. Squiller, J. W. Rosthauser, *Modern Paint and Coatings*, June 1987.

Drs. B. Taub and G. H. Petschke of NL Chemicals prepared air curable, clear, weather resistant, storage stable, on component polyurethanes by the reaction of aliphatic diisocyanate prepolymers with N-2-hydroxyethyl oxazolidines. These polymers are recommended as coatings for automobile base coats and the pigmented coatings are recommended for use in aircraft, aerospace and camouflage applications.

Dr. D. A. De Santis of MMI Inc., Somerville, NJ, described a patented proprietary zirconium silica hydrogel which forms stable complexes with carboxyl groups and can be used as a pigment.

Methods for the preparation of acetoacetylated resins were described by Drs. J. S. Witzeman, W. D. Nottingham, and F. D. Rector of Eastman Chemical Inc. These investigators

recommend the use of tert-butyl acetoacetate for the preparation of melamine crosslinked coating resins with low viscosity and low VOC. For additional information, see J. A. Hyatt, P. J. Feldman, P. L. Clemens, *J. Org. Chem.*, 49 5105 (1984).

According to Drs. P. K. Kukhala, S-S Shyu and J. C. Graham of Eastern Michigan University, interpenetrating networks (IPN) of polymethacrylates have excellent solvent resistance and higher T_g values. For additional information see K. C. Frisch, *Poly. Eng. Sci.*, 25 12 (1985).

Dr. M. Agostinho of Ciba-Geigy Corp. described a new class of nonaromatic, weather resistant, crosslinked epoxy resins coatings. The preferred crosslinkers were polyamidoamines.

Drs. P. A. Callais, V. R. Kamoth and J. D. Sargent of Lucidol Division of Penwalt described high solids, acrylic polyol polymer-based light stabilizer resins with outstanding weatherability and durability. These HALS and UVA coatings can be crosslinked by the addition of melamine resins. For additional information, see W. R. Kamoth, J. D. Sargent, *J. Coat. Technol.*, 59 (746) 51 (1987).

According to Dr. R. G. Lees and associates at American Cyanamid Co., methyl acrylamidoglycolate methylether (MAGMe100) can be used as a superior crosslinking agent in aqueous or solvent born acrylic wood coatings. For additional information, see R. G. Lees, H. R. Lucas, G. A. Gelinau, *PMSE*, 55 315 (1986).

Drs. J. W. Joudrey and M. Schnall of Troy Chemicals Co., Newark, NJ, used an amphoteric dispersant to provide superior dispersion, color, jetness, tint strength and viscosity performance with several pigments in high solids coatings systems.

Drs. A. Smith, W. W. Reichert and H. Nae of NL Chemicals described a new sag control agent which helps maintain the initial high storage modulus in hot coatings systems. This rheological additive forms a network which breaks during shearing but recovers its storage modulus after spraying etc. For additional information, see C. L. Rohn, *J. Water-Borne Coat.*, p.9, Aug. 1987.

Drs. C. Blomquist, R. S. Offin and C. Crawford of Carchem Inc., Bayonne, NJ, described a second generation reactive diluent which is based on a ricinoleic derivative diol. This additive reduces VOC, improves application properties and maintains high performance properties in polyurethane and melamine coatings.

According to Drs. B. O. Fakunle and S. S. Sandhu of the University of Dayton, major improvements can be made in dynamic mechanical performance of elastomeric adhesive-sealants by the use of fumed silica and calcium carbonate fillers. These filler systems were effective when used with copolymers of vinyl acetate and ethylene (EVA) and styrene and butadiene (SBR).

The award for the best paper was given to J. S. Witzeman of Eastman Chemical Div./Eastman Kodak Co. His co-authors were W. D. Nottingham and F. D. Rector. The 17th annual Water-Borne and Higher-Solids Coatings Symposium will be held in New Orleans, LA the week before Mardi Gras in 1990.

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Parameters controlling coloration in water based dispersion paints

A. E. Berberi, E. G. Berberi Freres, Ain-Aar, Quality Control & Research Laboratories, PO Box 90389, Jdeidet El-Metn, Lebanon.

Introduction

Considerable research on the relative tinting strength of pigments, their influence on the opacity of water based coatings, their variations in the wet-to-dry sequence, their particle size and refractive index have all been carefully investigated and commented upon. In the present work the authors shall support this discussion with previous findings and extend the study to the limit where the porosity of emulsion based paints with $LAMBDA > 1$ influences severely the coloration practically to the same extent as TiO_2 . On this basis the oil absorption methods used shall be discussed and the way in which one can control the level of colourant by saving time with the computer assisted coloration of the previously known shade formulation. The influence of the physical parameters and the surface parameters of both resin and pigment, and how they could influence lighter and stronger shades within the same formula will be considered.

Discussion

This paper accounts for the parameters that control the level of colourant in any water based dispersion paint with reference to the main formulating parameters that govern the overall properties of the paint. The relation of binder efficiency of the dispersion, its latex critical pigment volume concentration (LCPVC), $LAMBDA$ the ultimate or reduced pigment volume concentration, the TiO_2 level, the overall porosity (OP) and the colourant level (Ci) of parent coloured pigment will be discussed.

The relationship of colour to the main parameters that govern the optical geometry of the paint film will be carefully examined for the case with $LAMBDA > 1$ i.e. where voids are present due to the underbound part of pigments and the air/pigment interface geometry prevails.

In such cases we have deviation from linearity in the relationship of white to coloured pigment¹ due to change in the

relative refractive index of the resin² given by Equation 1:

$$ETAb = 1.00 + .49 \times (1 - LPI) \times BI \quad (1)$$

Where

ETAb = The refractive index of resin

LPI = The latex porosity of film

BI = The binder index of the resin matrix

and the standard method of controlling coloration relied on the relative tinting strength (TS) of pigments, this method³ failed when $LAMBDA > 1$.

However, deviation from linearity was noticed but no careful attention was made to the main formulating parameters that govern the optical properties of the dried film

At different PVC levels, experimental evidence showed that the ratio of white hiding pigment to coloured one was directly related to the % overall porosity TY (%OP) of the coating with the % TiO_2 and its TS.

In all formulations the ratios of dispersant to pigment as well as coalescent to binder have been carefully controlled and fixed. The LCPVC was calculated from the OA test on the pigment mixture i.e. pigment, wetting agent and extender all together and not on the pigments separately. The OA test was carried out at an end point where maximum consistency and a putty like homogeneous non-sticky mass was reached; just enough oil was present to be adsorbed on the pigment surface.

The oil used was a special non-refined linseed oil with the following properties under normal room temperature conditions of:

Room temperature: 21°C

Relative humidity: 60%

Atmospheric pressure: 720 mmHG

Specific gravity: .930

The analytical parameters were:

A.V. (mg KOH/g): 7.73

I.V.: 200.9

SV (mg KOH/g): 212.64

The reason for using raw linseed oil

instead of refined is mainly for its residual lecithin presence and high acid value to assist wetting.

This method for calculating the OA (oil absorption) of the pigment mixture was shown to be reproducible at .15% from the actual end point — this was better than that obtained from the standard BS or Gardner Coleman Method. The porosity index as well as the % OP were computed from this LCPVC. The coloration showed to be acceptable at 1% human factor error in either MOA (mixture oil absorption) although it is reproducible down to .15% from the end point and 3% in the BI variation.

This technique, however, has been shown by many investigators³ to relate the CPVC to oil absorption⁴ to be the true oil absorption method. The influence of coalescing agent on binding power efficiency has been discussed by many workers³ and its effect on the latex critical pigment volume concentration is well known. Therefore the binder index in this work has been taken with the level of coalescing agent set at 10% on solid resin, being the appropriate level for good coalescence in the working conditions. Although the variation of binder index from one resin to another had a strong effect on the results, the relation still proved to be valid.

From Equation 1 we can derive

$$BI = \sum_{i=1}^n Bi^* Wi / Wt \quad (1a)$$

Where W_i = the weight fraction of any coalescing solvent and resin.

W_t = the total weight of coalescing solvent and resin.

B_i = the binder index of each pigment separately.

$$LCPVC = \frac{1}{1 + MOA \times SGp / 93 / BI} \quad (1b)$$

Where

MOA = the oil absorption per unit pigment mixture.

SGp = the specific gravity of the pigment mixture.

BI = the binder index of the dispersion matrix.

$$\text{And MOA} = \frac{PWT \times OA}{100}$$

PWT = the total pigment weight in the formulation.

OA = the oil absorption of the pigment mixture.

Since one is designing formulae of

LAMBDA>1 one finds despite an increase in the white hiding from wet to dry film, an increase of this hiding followed with an increase of porosity index (³) and better still with the % overall porosity of the dry film (⁶) as the LPI is given by:

$$LPI = 1 - \frac{LCPVC (1 - PVC)}{PVC (1 - LCPVC)}$$

$$LPI = \frac{LAMBDA - 1}{LAMBDA - PVCdry} \quad (2)$$

Hence the LCPVC could be considered in terms of the latex porosity index (LPI) or if we consider the film as a whole including the pigment volume solid then an overall porosity (⁷) could be more adequately represented by
 OP = PI (1 - LCPVC)
 OP = 1 - LCPVC
 PVC = 1 - 1/LAMBDA
 %OP = 100 (1 - 1/LAMBDA) (3)
 %OP = Percent Overall Porosity

Six formulae have been designed at different PVC levels but at the same solid content. The level of PVC was made to vary between 80 and 90 by 2 percent increment. The formulation of PVC 84 have been left as a control in order to follow the influence of film porosity at both ends of the colourant level. The colourant used was a water based yellow oxide stainer a consistent and high fog off gauge reading stable stainer. The tinting colours were done up to an accuracy of 2% of the total colourant. The colour difference assessment was done visually under normal sunlight. Since the conditions at the place of work were satisfactory without the use of daylight lamps. The paint samples so prepared were then applied using the same bar coater of 0032 i.e. 32 thou using the Sheen hiding power charts. All formulae have been designed at the same NVC in order to have the same dry film thickness and hence colour difference is compared at sufficient hiding. The samples were left to dry at room conditions same as stated previously.

Computation & interpretation

In Table 1 is a layout of six formulae assisted by computer in order to meet the required formulating parameters in showing the evidence of our findings; all of these formulae were designed at high %PVC where LAMBDA is >1.

In this table Formula No: 3 is taken as standard for our work in order to follow the influence of porosity at both ends.

The predicted computed ratios between TiO2 and colorant in the order

of incremented PVC matches astonishingly well with the experimental values to a high level of confidence.

The % TiO2 difference was shown to have lesser effect than the porosity of the dry film that increases the high relative refractive index of extenders and functionals.

For instance at an increment of 1% in TiO2 the incremented coloration was shown to be more than two fold over the TiO2 level i.e. 2.6% and for a 2% in TiO2 increase we observed a 5.2% (see Table 2) increase in the coloration level. This is evidence of the presence of voids

that differ between one formula and the other which is directly related to the porosity of the film, consequently altering the relative refractive index of the pigment mixture.

All these figures on the other hand showed no relation at all with the % PVC (see Table 4).

As shown in Table 2 the pigment volume concentration has no direct effect on the pigment loading as far as volume of pigment is concerned. No relation has been found to tie up the volume of pigment to its oil adsorption. (see Table 3).

Table 1

Tabulation of % parts by weight of six formulae at the same %NVC

Formulation No:	1	2	3	4	5	6
Water	29.418	29.790	30.222	30.663	31.002	31.310
Tetron	.074	.075	.076	.077	.078	.07
Orotan 25%	.072	.073	.074	.075	.076	.077
Foamaster NXZ	.024	.022	.019	.016	.013	.011
Aciticide PMDDDS	.125	.111	.096	.084	.071	.059
Microal ET	1.979	2.001	2.023	2.041	2.064	2.085
Snowwhite 6JL	42.941	43.416	43.852	44.279	44.739	45.184
R-XL	9.352	9.455	9.549	9.634	9.741	9.838
Water	1.174	1.189	1.209	1.226	1.240	1.252
Texanol	.507	.452	.396	.342	.287	.238
Viking 8020/55	9.229	8.225	7.208	6.216	5.229	4.341
Water	4.066	4.124	4.250	4.261	4.341	4.384
Bermocol 481FQ	.354	.354	.354	.354	.354	.354
Water	.264	.280	.228	.279	.303	.318
Ferrite Stainer	.421	.433	.444	.453	.462	.4
Total	100.000	100.000	100.000	100.000	100.000	100.000

Table 1a

Physical constants of formulae in Table 1

Parameters	1	2	3	4	5	6
%NVC	60.00	60.00	60.00	60.00	60.00	60.00
% NVV (Volume)	24.00	23.8	23.47	23.23	22.92	22.67
P/R Pigment/Resin)	10.69	12.13	13.98	16.35	19.66	23.95
SG (Resin Computed)	1.05	1.05	1.05	1.05	1.05	1.05
SG (Pigments)	2.801	2.801	2.801	2.801	2.801	2.801
MOA (Oil Absorption)	11.218	11.218	11.332	11.434	11.562	11.667
% PVC Dry	80	82	84	86	88	90
LCPVC	.595	.593	.590	.588	.586	.583
LAMBDA	1.346	1.381	1.424	1.461	1.503	1.542
Porosity Index	.635	.678	.726	.766	.809	.843
% Overall Porosity	25.706	27.589	29.775	31.554	33.466	35.149
SG @ 21°C	1.56	1.58	1.59	1.60	1.602	1.605
Viscosity @ 21°C (Rotothinner)	8.4	8.5	8.6	8.7	8.8	8.9
Binder Index fortified	.492	.492	.492	.492	.492	.492
PH @ 21°C	8.5	8.5	8.5	8.5	8.5	8.5
% Coalescent Resin)	10.00	10.00	10.00	10.00	10.00	10.00
TiO2 (Ratio)	.980	.990	1.00	1.009	1.02	1.03
Cn/C3 (Ratio Computed)	.95	.975	1.00	1.02	1.04	1.04
Cn/C3 (Ratio Found)	.95	.975	1.00	1.02	1.04	1.06

$$Cn/C3 = \frac{\text{Log}(\text{TiO2})n \times \text{Log}(\text{OP})n}{\text{Log}(\text{TiO2})3 \times \text{Log}(\text{OP})3}$$

Table 2**% Colorant VS %TiO2 at the same % NVC**

Formulating Parameters	1	2	3	4	5	6
% PVC Dry	80	82	84	86	88	90
P.I.	.635	.678	.726	.766	.809	.843
% O.P.	25.706	27.589	29.775	31.554	33.466	35.149
% delta Tn	0	1.1	2.1	3	4.1	5.1
% delta Cn	0	2.6	5.2	7.3	9.5	11.5
% Porosity Increase	0	7.3	15.8	22.3	30.2	36.7

Note:

P.I. = Porosity Index

% P.O. = Percentage Overall Porosity

% delta Tn = %TiO2 Variation in the Formula No:n To No:1

% delta Cn = Colorant Variation in the formula No:n to No:1.

Table 3**Tabulation of % of six formulae at the same %NVC, % PVC, %TiO2**

Formulation No:	7	8	9	10	11	12
Water	30.222	30.210	30.196	30.185	30.175	30.160
Tetron	.076	.076	.076	.076	.076	.076
Orotan 25%	.074	.074	.074	.074	.074	.074
Foamaster NXZ	.019	.019	.019	.019	.019	.019
Acticide PMDDS	.096	.091	.096	.096	.096	.096
Microcal ET	2.023	3.022	4.020	5.017	6.013	7.007
Snowwhite 6JL	43.852	42.835	41.817	40.802	39.790	38.772
R-XL	9.549	9.545	9.541	9.537	9.534	9.529
Water	1.209	1.208	1.208	1.208	1.207	1.207
Texanol	.396	.398	.400	.402	.403	.406
Viking 8020/55	7.208	7.243	7.280	7.315	7.345	7.388
Water	4.250	4.248	4.247	4.245	4.243	4.241
Bermocol 481FQ	.354	.354	.354	.354	.353	.353
Water	.228	.217	.206	.205	.195	.179
Ferrite Stainer	.444	.455	.466	.467	.477	.493
Total	100.000	100.000	100.000	100.000	100.000	100.000

Table 3a**Physical constants of Table 3**

Parameters:	7	8	9	10	11	12
% NVC	60.00	60.00	60.00	60.00	60.00	60.00
% NVV (Volume)	23.47	23.66	23.76	23.87	23.97	23.139
P/R (Pigment/Resin)	13.98	13.98	13.98	13.98	13.98	13.61
SG (Resin Computed)	1.05	1.05	1.05	1.05	1.05	1.05
SG (Pigments)	2.801	2.786	2.771	2.756	2.742	2.728
MOA (Oil Absorption)	11.332	12.411	13.859	14.781	15.500	18.259
% PVC Dry	84	84	84	84	84	84
CPVC	.590	.570	.544	.529	.519	.479
LAMBDA	1.424	1.473	1.543	1.586	1.618	1.752
Porosity Index	.726	.747	.772	.785	.794	.824
Overall Porosity	29.775	32.133	35.216	36.961	38.222	42.941
SG @ 21°C	1.58	1.57	1.557	1.556	1.555	1.552
Viscosity @ 21°C (Rot thinner)	8.4	8.3	10.25	7.4	6.90	8.0
Binder Index fortified	.493	.493	.493	.493	.493	.493
P.H. @ 21°C	8.5	8.5	8.5	8.5	8.5	8.5
% (Coalescent/Resin)	10.00	10.00	10.00	10.00	10.00	10.00
From Equation 4:						
Cn/C1 (Ratio Predicted)	—	1.022	1.050	1.064	1.074	1.108
Cn/C1 (Ratio Found)	—	1.022	1.050	1.064	1.074	1.108

The results in Table 2 show how the % colorant is influenced by the % porosity of the dried film and equally well by the level of TiO2. This difference is accentuated by the % of functional extender that have a major effect on the white dry hiding of the paint.

Six other formulae have been designed in order to follow the colorant level of addition by varying the extender and the functional at the same TiO2 level and keeping the %PVC and the % NVC constant (see Tables 3 and 4).

The TiO2 difference has been disregarded since it is \leq 3 PPT and therefore for $\text{Log}(Tn)/\text{Log}(T1)$ is $< .5$ % which does not account for a noticeable difference by an ordinary observer.

However a sensitivity analysis has been set in order to follow the result variation at a 3% human factor in the BI end point and 1% for the OA.

Therefore three possibilities have been considered:

1. The OA end point
2. The BI end point
3. The BI decrease and OA increase

As noticed from the values in Table 5 such inaccuracy in the oil absorption provides a colorant difference within the acceptable 1% tolerance as mentioned earlier.

Also Table 6 shows that the inaccuracy in the BI of 3% may affect the colour difference by not more than 1%. This is within the acceptable tolerance for any observer.

Table 7 shows that the accuracy of this technique is valid for such variations limit which is less than 2% for colorant weight.

Conclusion

Following our work on the effect of oil adsorption of pigments on the porosity of the water based coatings at sufficiently high PVC, where the reduced pigment volume concentration is > 1 the effect of the air-pigment interface affects strongly the tinting of such formulation to the same extent as TiO2 does where functional extenders act in this case as a tint increasing colorant due to their direct relation in promoting the dried film porosity and thus improving the dry white hiding.

When formulating such coatings at such porosity limits, care should be taken at the binder index of the dispersion and the fortified resin matrix. Preliminary lab tests should be carried out in order to monitor or predict tint variation when altering emulsion grades. Practice of this kind could eliminate unnecessary time in colour matching standard shades and

Table 4**% Colorant VS % OP**

Formulating Parameters	7	8	9	10	11	12
LCPVC	.590	.570	.544	.528	.519	.479
P.I.	.726	.747	.772	.785	.794	.824
% O.P.	29.775	32.133	35.216	36.961	38.222	42.941
% delta Tn	0	0	0	0	0	0
% delta Cn	0	2.2	5.0	6.4	7.4	11.0
% Porosity Increase	0	7.9	11.8	24.1	28.4	44.2

Table 5**Sensitivity to 1% error in OA end point**

Formula No	8	9	10	11	12
New MOA	12.535	13.997	14.928	15.655	18.441
LCPVC	.567	.541	.527	.516	.476
PI	.749	.774	.787	.796	.826
% OP	32.424	35.508	37.255	38.516	43.235
% Cn/C1	1.025	1.052	1.066	1.075	1.109
% delta Cn	.3	.2	.2	.1	.9

Table 6**Sensitivity to 3% error in BI end point**

Formula No	8	9	10	11	12
BI	.507	.507	.507	.507	.507
LCPVC	.577	.551	.536	.526	.486
PI	.739	.765	.779	.788	.819
% OP	31.273	34.344	36.085	37.342	42.062
% Cn/C1	1.014	1.042	1.056	1.060	1.060
% delta Cn	.8	.8	.5	.8	.2

Table 7**Sensitivity to 3% in BI decrease and 1% OA increase**

Formula No	8	9	10	11	12
New MOA	12.535	13.997	14.928	15.655	18.441
LCPVC	.560	.534	.519	.508	.469
PI	.757	.781	.794	.802	.831
% OP	33.315	36.409	38.159	39.422	44.139
% Cn/C1	1.033	1.059	1.073	1.087	1.116
% delta Cn	1.0	.8	.85	.75	1.4

hence facilitate the role of the colourist. Such differences have been extensively reported in the past where some dispersions have been commercialised as opacity promoters in the case of PVAc that exhibit a lower binder index than their acrylic counterparts.

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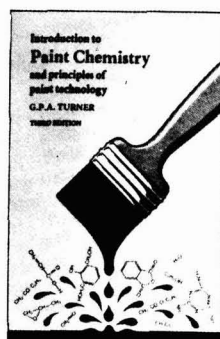
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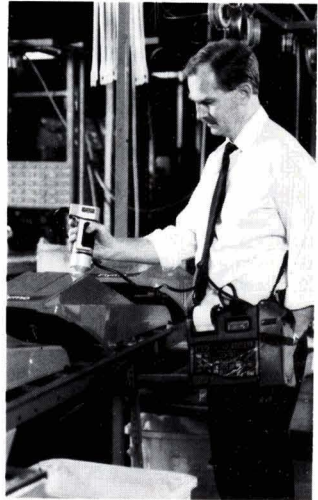
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1989 Subscriptions

I drew attention in the April General Secretary's Column to the significant number of OCCA members who at that time had not paid their 1989 Association subscription. Since then, considerable efforts have been made to recover subscriptions from members with the result that over 200 additional subscriptions have now been paid, leaving some 175 members world-wide still in arrears for 1989. UK Sections have now been asked to assist in the recovery of the remaining subscriptions outstanding and it is hoped that by the time this column is read, the number of members in arrears will be less than 100.

It is inevitable that some members will drop out each year, but such members are not allowed to lapse without considerable efforts to maintain their membership. If you know of a member unable to pay his subscription, through financial or other hardship, please encourage him to make confidential contact with me as quickly as possible. In many cases the Association is able to help.

Requests for membership information and applications for membership is at present very encouraging and all indications are that overall membership will increase by year's end. I do encourage every member to think about recruiting new members. The Association has produced an excellent recruitment folder, supplies of which are available either from Priory House or through Sections. If every member sets a target of recruiting one new member a year, then not only

would the Association expand, but the range of services offered to members would increase. Even the more modest target of a new member from each factory or office could be achieved. I am always happy to write to companies or individuals encouraging their applications for membership, but the best recruiters are individual members at their place of work. Can you help?

Section Symposia

The West Riding and Thames Valley Sections are currently organising interesting one day symposia to be held later this year.

On 14 September, the University of Leeds will be the venue for the West Riding Symposium on the interesting management technique of "The Implications of Just in Time". The Section has arranged a series of lectures from academic and industrial experts on this important subject and it is hoped to attract a good audience drawn not only from Association members, but from related industries and academe. The Section is to be congratulated on its choice of subject matter and I would recommend that you give the enclosed registration document careful consideration.

The Thames Valley Section have chosen a more conventional subject for their Symposium on "The Protection and Decoration of Exterior Timbers". The one day event will be held on 12 October at the Building Research Establishment, Watford. The Committee hope to attract speakers from both the UK and abroad and have set the registration fees at an attractive level so as to particularly encourage junior staff to attend. The registration document for this event will be mailed with the August Journal and again I can recommend the Symposium to you.

The Association is now able to offer local Sections arranging technical meetings, considerable assistance in the planning and

production of support material and generally assist with the organisation of these events. It is most encouraging that Sections are coming forward with ideas for good quality technical meetings and Headquarters is only too pleased to assist with the organisation of these meetings.

SF China '90

The Association has been appointed the UK agents for the 1990 International Surface Finishing & Coatings Exhibition to be held at the China International Exhibition Centre, Beijing from the 19-24 March 1990.

The 1990 event is the fifth exhibition in the series which commenced in 1983, and has since grown from 50 exhibitors and 8,000 attendees to a projected 135 exhibitors and 15,500 attendees.

UK companies have participated in previous exhibitions and any company wishing to exhibit should contact the Association for further details.

The Association is considering promoting a 10 day study trip to China during the exhibition period. The trip will include visits to the exhibition and surface coating companies, together with sightseeing. Please contact the Association for further information.

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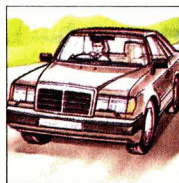
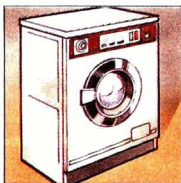
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Hull Section

TiO₂ quality control

The fourth meeting of the present session was held at the Duke of Cumberland, Cottingham, at 7.00 p.m. on 9 January 1989. Twenty-one members and guests heard Dr R. Pearce of SCM Chemicals deliver a paper entitled "Quality Control in the Manufacture of Titanium Dioxide".

Dr Pearce's talk concentrated on rutile grades produced by the chloride process on which four main sources of information were made use of:

- 1) Process control laboratory measurements
- 2) Process control in-line data
- 3) Plant operations data
- 4) Finished product performance data from laboratory measurements

It was important to realise that the fourth source gave confirmation that the product was of correct quality but did not allow adjustments.

The question of which process variables lead to changes in pigment properties and which of these properties need to be controlled was all-important. Dr Pearce outlined the actual process, starting with the raw materials and passing through various stages including chlorination, purification, oxidation and surface treatment.

He went on to link performance characteristics such as hiding power, whiteness, gloss potential etc with pigment properties; particle size and shape, aggregation, surface chemistry and crystal form etc and to demonstrate these relationships with slides and sample films.

Dr Pearce then spoke about testing methods, many of which were proprietary in nature. Gloss potential was assessed in a high PVC acrylic and instrumental measurement of dry block colour allowed early correction if necessary. Samples demonstrating these tests were passed around.

Tests should:

- 1) relate to performance in a range of applications
- 2) be highly discerning
- 3) yield objective quantitative measurements related to a defined

reference

- 4) incorporate minimum operator dependence
- 5) contain a minimum number of test variables
- 6) be rapid and cost effective

Many supplementary techniques were available for the measurement of trace elements, crystal structures, surface treatments and particle size. These included scanning electron microscopy, X-ray diffraction and plasma atomic emission spectroscopy. A number of slides were presented demonstrating some of these techniques.

Dr Pearce finally dealt with a number of questions from the audience who went on to endorse a vote of thanks proposed by Dr Crawforth.

D Robinson ■

Manchester Section

Works visit: Ellis Jones

On 20 February 1989, 24 members and guests were escorted in relays around the pigment manufacturing premises of Ellis Jones (Stockport) Ltd by Kevin Ogden, Works Manager.

After dressing accordingly in protective coats, goggles and overshoes, the manufacture of yellow, orange and red pigments from the diazo process was thoroughly explained.

Once the chemicals had been coupled under exacting conditions of temperature flow rate, etc, the pigment slurry produced was filtered to press cake prior to processing through bead mills for the water-based dispersions or being dried for several days at controlled temperatures. The dried pigment was then broken up and ground to a controlled optimum particle size before bagging and despatch to the customer.

At each appropriate stage the quality is checked in the laboratory to ensure it conforms to a known standard.

Following the short tour during which numerous questions were asked and ably answered by Kevin, a short walk was made to a local hostelry for a refreshing drink and a

most pleasant buffet.

Our thanks must be recorded to Peter Raven, Jim Toole, Mike Allen and the remaining staff of Ellis Jones who made all present — competitors as well! — most welcome.

M Nixon ■

Rotary screen printing

The last printing ink lecture of the 1988/89 session was held on Monday, 20 March 1989, at the Silver Birch, Birchwood Centre, Warrington. forty-two members and guests braved near blizzard conditions to hear a lecture entitled "Rotary Screen Printing — a Revolution in Wallcovering Production", presented by Mr G Scott of Nairn Kingfisher Ltd.

Historically, rotary screen printing can be traced back to early stencil painting techniques used by the Chinese. More complex shapes were a problem, and difficulties were overcome by joining the shapes together with fine silk thread. This developed into flatbed screen printing which was a very slow process. The next stage in development was rotary screen printing for fabrics. Because wall coverings are less absorbent than fabrics, force drying was required. Initially IR heaters were used, but this caused drying in the screens, and to avoid this, overhead driers were introduced, these have a secondary advantage of taking up less floor space.

The advantages of rotary screen printing over gravure are:

- 1) Cheaper (cylinder $\frac{1}{3}$ price)
- 2) Much lighter and easier to handle
- 3) Rapid design changes possible therefore short runs are economic
- 4) Base papers can be overall coated
- 5) White on black possible with full solid cover
- 6) Wide range of effects possible

The disadvantages compared with gravure are:

- 1) Screens prone to damage and cannot be repaired
- 2) Multi-tone work fairly crude

Therefore the method of printing depends on the design requirements.

The process of modern rotary

screen printing was described, both lacquer, and galvano screens are available, and the uses of the different types was outlined. The rheology of the ink is important, for mass-tone a Newtonian material is required. But for fine detail printing pseudoplastic inks are used. The position of the blade, blade pressure, blade angle, length and thickness, all affect the quality of the print.

The most common printing ink media are PVC plastisols, and textures can be obtained by incorporating blowing agents. Becoming more important, and expected to become more popular due to environmental pressures, are acrylic based aqueous printing inks.

To conclude the lecture, samples of different types of wallcoverings were exhibited, and the techniques used in manufacturing the different types indicated.

The talk was followed by an extensive and lively question and answer session, the vote of thanks was proposed by Mike Nixon, and the evening concluded with a buffet of the usual excellent standard provided by the Silver Birch.

Works visit: Wolstenholme

On Monday 3 April 1989, 30 members and guests visited Wolstenholme Bronze Powders, Darwen.

After being warmly welcomed by Dennis Cleaver (Technical Director) and numerous members of Wolstenholmes' staff, at a reception in the Board Room, Dennis Cleaver gave a short presentation, outlining the processes involved in the manufacture of aluminium and bronze powders which we were about to see.

The party was split into groups, each group being presented to its particular guide, fitted out with protective coats, over-shoes, masks, and ear defenders, and then conducted round the factory and laboratories, where the processes outlined by Dennis Cleaver could be viewed in operation.

Following the tour, all present were invited to participate in an excellent buffet, the non-drivers in the party being able to fully

appreciate the intoxicating beverages also provided.

Manchester Section would like to record our thanks to Dennis Cleaver and the members of Wolstenholmes staff, too numerous to mention, who made all very welcome, at this excellent and most interesting visit.

M. G. Langdon ■

Midland Section

40 years of alkyds and polyesters

The 40th anniversary meeting was held at the Clarendon Suite, Stirling Road, Edgbaston, Birmingham.

The speaker — Mr John Cornish of Croda Resins Limited — presented a paper entitled "40 Years of Alkyds and Polyesters" to commemorate the 40th anniversary of the Midland Section.

Mr Cornish began by explaining that the talk would not be a nostalgic meander down Memory Lane nor a comprehensive review of the industry but a personal view of changes and happenings over the last 40 years.

He recalled the paper presented by Dr Hanson at the first meeting entitled "The Analytical Characterisation of Alkyd Resins" which was concerned with the classical methods of organic analytical separation and determinations, and which reflected the most up-to-date methods available at that time. Forty years on, Infra-Red, Ultra-Violet, Nuclear Magnetic Resonance and Mass Spectroscopy play an important part in the determination of unknowns and the characterisation of alkyd resins. However, the speaker commented, although some methods may have changed, a successful Resin Chemist still draws on experience, skill of analysis, technique and technological background.

The speaker went on to describe the use of Gas-Liquid Chromatography in a modern resin plant where it finds its greatest use in the characterisation of resinous materials rather than in analysis of unknowns. He also discussed the use of an Infra-Red technique for the determination of OH Value. The traditional wet method was

slow, taking about 45 minutes to complete, whereas the IR method took 10 minutes to complete, so making the determination of OH Value an effective control parameter.

Mr Cornish then turned his attention to resin plants, saying that the major change had been the introduction of the reflux reactor during the 1950s.

Raw materials were then discussed. The speaker pointed out that changes in raw material availability over the last 40 years had enabled alkyds to be made from a wide variety of vegetable oils and with a considerable number of modifications.

Mr Cornish concluded by talking about in-process controls, saying that the acid value/viscosity curve coupled with written instructions are similar to those methods used earlier and that the end-point remains a matter of prediction.

However, since accurate measurements are obtained faster, the acid value/viscosity curve is a more precise representation of the reaction or process, hence a greater degree of control is obtained. SPC had also arrived in the modern resin plant — an example of its use and benefits was given as representing the most recent development in alkyd resin manufacture.

Pearlescence in the automotive industry

The second technical meeting of the Midland Section for the 1988-1989 session was held at the Clarendon Suite, Stirling Road, Edgbaston, Birmingham.

Mr S. Caffley of Cornelous Chemicals presented a paper entitled "Pearlescence in the Automotive Industry".

The speaker introduced the subject, saying that pearlescent pigments are being used in a wide variety of coatings but the largest growth area was in the automotive industry. In 1988 there were 53 pearlescent finishes available from the US motor industry compared to 1 in 1983. The Japanese market had also grown rapidly whereas the European market had, as yet, shown a much slower growth rate.

Mr Caffley described the pearl

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pigment as a wet ground mica plate onto which was deposited titanium dioxide or iron oxide to increase the refractive index of the particle. The plate-like shape and high refractive index are basic requirements for a pearl pigment.

Since they are transparent, pearlescent pigments do not 'hide' well but neither do they 'greyout' or 'muddy-up', bright organic colourants with which they are often used to produce polychromatic finishes. The two-colour effects obtained with TiO₂ coated micas arise from light interference effects, a much stronger colour is seen by reflection and a weaker complementary colour is seen by transmission. This property is used to obtain dramatic two colour effects.

Pearlescent pigments used to replace metal flake in polychromatic finishes will cause an enhanced 'flop' or 'travel' effect. This is attributed to the larger difference in light reflections at two different viewing angles when compared to a metal flake. The speaker discussed formulating with these pigments and suggested that they be incorporated by medium or low shear processes since high shear or conventional grinding processes would destroy the pigment particle.

He concluded by discussing the use of pearlescent pigments in other fields of application—including coil, powder, water-based and high solids coating.

Epoxy resins in powder coatings

The January technical meeting was held at the Clarendon Suite, Stirling Road, Edgbaston, Birmingham.

Mr Noel Moss, the Technical Manager of Ciba Geigy Plastics, presented a paper entitled "Epoxy Resins in Powder Coatings".

Mr Moss introduced his subject by mentioning the early manufacture methods of epoxy powder coatings and briefly discussing the European and world-wide powder markets before proceeding to a more detailed discussion of the chemistry associated with epoxy powder coating resins. He went on to say that since epoxy resins are used in

the majority of powder coatings and since the performance of an epoxy is affected by the type of curing agent it is important for formulators to pick the correct epoxy resin/curing agent combination.

The speaker discussed the use of Bisphenyl-A, epoxidized novolac and TGIC epoxy resins in powder applications, and how group modification, chain branching, molecular weight average, molecular distribution and compatibility with co-reactants affected performance of the product during manufacture, cure and when used as a protective coating.

Mr Moss then turned his attention to the available curing agents, describing how reactions with certain partners are used to achieve cured coatings with specific properties.

He concluded this well illustrated lecture by mentioning possible trends and uses of powder coatings in future markets.

Automotive finishing plant

The February meeting was held at the Clarendon Suite, Stirling Road, Edgbaston, Birmingham.

Mr Roy Windall of Harden Drysus presented a lecture entitled "Automotive Finishing Plants for the 1990's"

In opening he considered the future paint shop to appear quite similar to those in use today.

The areas of concern for the automotive paint plant designers are the need to reduce the contamination of the paint finish with atmospheric dirt and the need to achieve low voc emission.

The speaker discussed booth design and layout. He predicted the use of a glass-sided booth which incorporated removable filter beds in the ceiling and full width grating floors. Two booths would continue to be used, the first, for a sealer coat or for stone chip and underbody coatings. The second would remain the colour coat booth and would be fitted with programmable electrostatic guns, which achieve a paint transfer rate up to four times that of robotic systems.

Mr Windall described how bodies may be transported by inverted

power-and-free conveyors through the booths to an indirect gas fired oven constructed with welded steel seams. A pre-heat stage may be incorporated but would use radiant heaters. The passage of bodies through the plant could be monitored by computer at a remote point.

Mr Windall concluded by discussing the use of regenerative incineration to reduce voc emissions and re-use of spray booth sludge as possible paint fillers after suitable treatment. *M. J. Round* ■

Natal Section

Pigments in ancient society

Archaeological history goes back 5 million years and over the last 100,000 years pigments were used for rituals. This was stated at a fascinating talk given by Mr Dennis Purvis, a lecturer in Fine Arts at the M L Sultan Technikon, Durban, to OCCA Natal on 2 February 1989.

Mining activity started before the Iron Age and the Bombi Mining Ridge in Swaziland is the oldest mine in the world. Ores were extracted for medicinal or spiritual uses.

The role of pigments in the African context predates earliest European ancient art. Pigments were not merely used for decorative purposes but also for magical powers. Instead of ritual slaying for blood, haemetite was used as a blood stone. This most probably led to cave art and ritual ornamentation. Pigments were also used as cosmetics for the common identity of the group.

Unfortunately, scientific discussion often loses track of artistic merit.

Mr Purvis concluded his talk by answering questions from the floor and the meeting closed with a vote of thanks to Mr Purvis.

E Puterman ■

Newcastle Section

COSHH regulations

Thirty-one members and guests attended the fifth meeting of the 1988/9 session at St Mary's College,

University of Durham, to hear a lecture on the printing of metal and plastic cans. They were surprised to hear that for some unexplained reason, the speaker, Mr Degnan of Metal Box, had withdrawn and, at short notice Mr Frank Hellens, a section member and past Chairman, had stepped into the breach. He had agreed to give a talk on the COSHH Regulations—the control of substances hazardous to health. Mr Hellens noted that 14 years ago he stood in at short notice for another speaker and, curiously, that other speaker had been from Metal Box.

Mr Hellens called his presentation "COSHH For All". He set the scene by reflecting that the COSHH Bill had been passed recently and is officially in force. The regulations do not say a great deal more than did the Health and Safety at Work act 1974 (HASAWA), which demanded "the provision and maintenance of a safe working environment, as far as reasonably possible". The COSHH Regulations have the same objective and their emergence implies that industrial managers have failed to do their duty properly regarding HASAWA and that there is judged to be a need for more statutory bludgeoning.

Mr Hellens went through the major COSHH propositions, one by one, embellishing his lively address with occasional true stories pertinent to each point:

1. Companies and managers have duties regarding employees and any others who may be affected by industrial processes, on or off-site. They need to ask questions about raw materials and products, as well as processes. There are some areas exempt from COSHH because tight regulations exist already, e.g. lead, asbestos, radioactive/explosive materials, mines and quarries etc. He remarked that despite the long widespread use of such dangerous materials as benzene, asbestos and acrylonitrile, it was remarkable how few people in the coatings industry had been affected: nevertheless enough had been stricken to cause concern, such as those contracting bladder cancer from contact many years ago with 2-naphthylamine during organic pigment manufacture.

2. Managers must assess the risks of exposure to hazardous substances, review all previous assessments and look at work done to ensure there are no changes in operation which might increase hazards. They cannot rely on previous work or records—they must start afresh. Experience shows that changes are taking place in industrial processes frequently: to improve efficiency, reduce costs or substitute alternative materials and equipment. In all cases managers must assess and document the risks involved.

3. The aims of managers must be prevention/control rather than cure. Exposure to hazardous substances must be prevented as far as reasonably practical before resorting to the use of personal protective equipment (PPE). Maximum exposure levels and OELs must not be exceeded; if they are, the causes must be found and the process corrected. Respiratory equipment, when use is necessary, must be suitable and to the approved standard.

4. Managers must maintain records at all stages permanently. This presents an administrative nightmare, considering that some effects of hazardous substances can take many years to show.

5. Control measures cover the proper application and use of personal protective equipment.

6. Maintenance of control measures is mandatory. Engineering controls are typical, e.g. exhaust ventilation must be checked every 12 months. Records, including repair information, must be kept for 5 years.

7. Health surveillance is essential. Employers must monitor carefully, maintaining records of individual employee exposure possibilities for 30 years and general records for 5 years. The magnitude of such a task can be imagined when a typical medium/large company might have 250 employees handling up to 600 different raw materials and intermediates. Further, a company going into liquidation must pass all records to the Government Health & Safety Executive.

8. Proper information and training must be given to employees on the risks involved and the precautions necessary when handling individual

raw materials.

9. Information on the results of monitoring tests and health surveillance must be divulged on reasonable request, but personal details must have the particular employee's consent.

Mr Hellens summed up the essential points—Control, Monitoring and Recording. The COSHH Regulations are the most difficult, time-consuming, bureaucratic regulations ever introduced in the UK. He produced for inspection a number of HSE leaflets published to help managers implement COSHH. He, himself, felt very wary of these regulations: nevertheless, he was delighted at the thought of 60-65-year-old employees not panting from climbing stairs as a result of years of uncontrolled handling of hazardous substances.

In a good-humoured and extended question time it transpired that the regulations cover every material liable to be contacted, e.g. cleansing creams, even canteen food. The cost of COSHH was discussed at length. Mr Hellens stated that companies should not panic and start hiring people solely for the purpose of these regulations. Managers should assess their present resources and marshal them effectively. A desk analysis of raw materials used would be another necessary first step. Tighter operational disciplines such as well-fitting lids for portable tanks could not, honestly, be a cost against COSHH. On the question of a company not taking COSHH seriously he said that the HSE could in the limit close the process of the company down. All in all it would appear that the HSE want companies to operate so cleanly that atmospheric measurement would be unnecessary, as long as companies maintain records.

The vote of thanks for a very enjoyable and informative talk was given by the Section Chairman, Mr S. Lynn. *J. Bravery* ■

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BSI News

Peter Munn, OCCA's representative on several BSI Committees, reports on the following standards:

1. BS 3416:1988 Bitumen-based Coatings for Cold Application, Suitable for use in Contact with Potable Water.

This is an update of BS 3416:1975 which is now withdrawn. It takes account of technological changes in formulation of bitumen based coatings since the original standard was issued. However, it differs markedly from BS 3416:1975 in that it requires that the dry film of the coating complies with BS 6920:Part1:1988 Suitability of Non-Metallic Products for use in Contact with Water intended for Human Consumption with regard to their Effect on the Quality of the Water.

This is a major change in the philosophy behind the previous standard, and members using or manufacturing materials to the 1975 standard should therefore examine the new document to ensure that no changes to their operations are required.

2. BS 6949:1988 Bitumen-based Coatings for Cold Application, excluding use in contact with potable water.

This is a parallel standard to BS 3416:1988 and covers the ground formerly covered by BS 3416:1975, embracing technological changes since the publication of that document. It is identical to BS 3416:1988 except in respect of testing to BS 6920:Part 1:1988, and in the labelling requirements of the product. There are also differences of detail in Appendix A of both documents.

3. BS 5493:1977 Code of Practice for the Protection of Iron and steel Structures against Corrosion.

I have to report that progress on an amended Standard is regrettably little further forward. The Chairman of the Sub-Committee controlling this work has reported

that the extensive and expensive labours in 1988 have resulted in a positive regression in progress towards revising BS 5493.

In view of the time scale now being proposed for the revision of this Document, the work of the parallel CEN Committee, and the impact of the 1992 changes in the EEC, I draw the DIN standard 55-928 Anti-Corrosive Systems to members' attention for study, in advance of the CEN (European Standards Organisation) program of work.

4. New Work

The following standards are due for review:

BS 4842:1984 Liquid Organic Coatings for Application to Aluminium Alloy Extrusions, sheet and preformed sections for external architectural purposes, and for the finish on aluminium alloy extrusions, sheet and preformed sections coated with liquid organic coatings.

BS 6496:1984 Powder organic coatings for application and stoving to aluminium alloy extrusions, sheet and preformed sections for external architectural purposes, and for the finish on aluminium alloy extrusions, sheet and preformed sections coated with powder organic coatings.

BS 6497:1984 Powder organic coatings for application and stoving to hot-dip galvanised hot-rolled steel sections and preformed steel sheets for windows and associated external architectural purposes, and for the finish on galvanised steel sections and preformed sheet coated with powder organic coatings.

The area covered by BS 4842 and BS 6496 have also been proposed for work within the CEN system to result in a CEN specification. It is not clear how far these proposals can be united.

If any member has views on the status of any proposal, could they please contact me c/o OCCA, Priory House. ■

OCCA News

Robin Archer has been elected Chairman of the Natal Section. Mr Archer is a graduate of the Natal Training College, Pietermaritzburg and a BSc Chemistry graduate of the University of Natal.

Mr Archer joined S. A. Toxide, Durban, in 1980. During 1982 Mr Archer spent six months at the Central Laboratories of the Tioxide Group in North Eastern England. In December 1983 he assumed responsibility for the technical Service Department and was appointed Marketing Manager in March 1986.

Mr Archer joined OCCA as an ordinary member in 1980 and acted as Hon. Secretary from December 1983 to April 1986. Thereafter he served as vice-chairman for a year and was elected Chairman in April 1988. Later in the year, in August 1988 Mr Archer was elected to the Professional Grade as an Associate Member. ■

E. Puterman ■

New members

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

Ordinary members

Batchelor, C. D. (*West Riding*)
Burgess, C. J., BSc (*Scotland*)
Doherty, L. F. (*Natal*)
Foulger, D. L. (*Newcastle*)
Fraser, I. F., BSc, PhD (*Scotland*)
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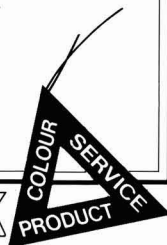
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