



J  
O  
C  
C  
A

**JOURNAL OF THE  
OIL &  
COLOUR  
CHEMISTS'  
ASSOCIATION**

**PREVIEW of OCCA 26**

**FORUM FOR TECHNICAL DISPLAY AND DISCUSSION  
FOR THE SURFACE COATINGS INDUSTRIES**

**Olympia London 23-26 April 1974**

Efflorescence on gypsum glass board

*G. A. King, M. J. Ridge and G. S. Walker*

Ion exchange behaviour of some anti-corrosive paints and paint media

*W. U. Malik and L. Aggarwal*

Oxidation of copper phthalocyanine blue pigment with potassium dichromate in acid solution

*A. M. Islam, A. M. Naser, A. A. El-Mariah and A. S. Salman*

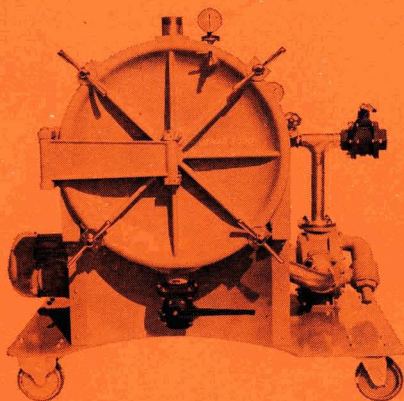


**We've come  
some way  
since then...**

**MS** **W A MITCHELL & SMITH LTD**  
54 Willow Lane Mitcham Surrey CR4 4NA 01-648 4684

**Produce binding media that  
are here to stay - permanently**

# The advanced ingredient in most paint manufacturing operations



Many of the world's leading manufacturers rely on JENAG straining equipment in their processes. Most industrial and decorative paints, copolymer emulsion resins, liquid inks and dyestuffs can be strained at output rates from 1 litre to 12,000 litres an hour, and rapid product and colour changes are simply carried out. A unique feature of the JENAG strainer is the totally enclosed self-cleaning system which ensures that the straining media remain completely free from blocking and drying out. Additionally, no expendable straining media are required, resulting in unsurpassed economy in operation and maintenance. Whatever your straining requirements may be, it will pay you handsomely to talk JENAG totally enclosed, self-cleaning, continuous, in-line straining systems.

# JENAG®

**Jenag Equipment Limited**  
17 Aston Road, Waterlooville  
Hampshire PO7 7XG England  
Telephone: Waterlooville (070-14) 54351/2/3  
Telex: 86318 Cables: Jenag Portsmouth

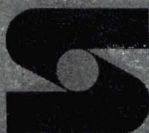


## WE HAVE THE ROYAL FLUSH OF COLOURS

After all, FLUSH COLOUR is by far the most widely used form of PIGMENT to make an ink in the United States of America. Not that we are gamblers, but wouldn't you like to have all the trumps in your hand when processing colours? Please see us at STAND 47 and we will be glad to show you our range of colour flexibility. If you prefer a "straight flush" we also can proudly introduce our fine line of DRY COLOURS. But you cannot win the game without us.

**Sun Chemical**

411 Sun Avenue / Cincinnati,



**Pigments Division**

Ohio 45232 / (513) 681-5950

*SOLE U.K. DISTRIBUTOR:*

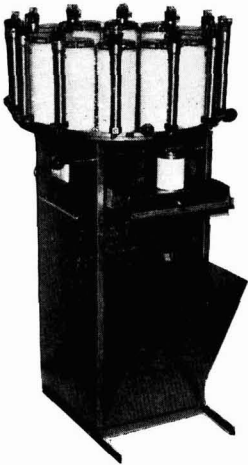
Shear Colour Ltd., 6 Addison Road, Chilton Industrial Estate, Sudbury, Suffolk.

---

# **SHORTAGE OF RAW MATERIALS? SHORTAGE OF LABOUR?**

REDUCE IDLE STOCK BY BLENDING PAINT IN SHOPS USING WORLD-KNOWN

## **Blendorama Colour Dispensers**



**THE LARGEST  
RANGE OF PUMPS**

**50ml. Single Pump  
(for retail shops)**

**TO**

**600ml. Double Pump  
(for bulk blending)**

Agent in U.K. and  
European Spare Parts and Repair  
Depot:

**Merris Development Engrs. Ltd.**  
24 Airfield Estate,  
White Waltham,  
BERKSHIRE, SL6 3QQ

See us on Stand No. 61—OCCA 1974

Agent in Holland: Internatio Alchemij  
Parklaan 26  
ROTTERDAM 2

Agent in Scandinavia: Largo Konsult AB  
Betaniagatan 5  
412 68 Göteborg  
SWEDEN

## **A. STRAZDINS PTY. LTD.**

102 AUBURN STREET, WOLLONGONG, 2500 NSW AUSTRALIA

Cables: "Blender"

---

# Proxel CRL prevents a good paint going bad.

OD25

Proxel industrial preservatives have proved their value over many years of world-wide use.

Now Proxel CRL provides, in convenient liquid form, long term protection for water-based paints against attack by micro-organisms—in manufacture, transport, and storage.

High compatibility and low toxicity make it easy to use, and it is effective in very economical concentrations.



**Organics Division**  
A new age in chemicals



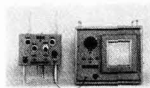
Imperial Chemical Industries Ltd., Organics Division, Hexagon House, Blackley, Manchester M9 3DA.

For full technical  
information on Proxel CRL  
contact your nearest  
ICI Sales Office.

If you're visiting the OCCA Exhibition see us on Stand No. 68

## Let me tell you the Story . . .

We first developed the Microscal Flow Microcalorimeter in order to pursue an interest in the surface properties of solids and the interactions which can take place upon them. This proved especially useful for heat of adsorption measurements, and the instrument developed into the Mark II model.

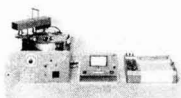


This drew attention to the need for an atmospheric instrument, so we produced the Mark 2V FMC in which not only can preferential adsorption studies be carried out, but heats of evacuation and wetting can add further interest and information to the very revealing technique already available.

The surfaces of powders bred an interest in the sizes of particles themselves, and in time this called for the Wide Angle Photosedimentometer (WAP), which later became the Wide Angle Scanning Photosedimentometer (WASP), permitting particle size distributions in the range 72-2 $\mu$ m to be measured in 20 minutes or thereabouts.



But quantitative analysis by sedimentation in the sub-micron range eluded us until the development of the Microscal Ladal X-Ray Centrifugal Scanning Sedimentometer.



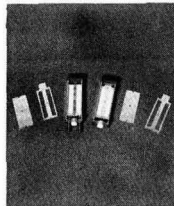
Then came the question of the random sampling of powders to obtain statistically representative portions. The one-litre Spinning Riffler (SR1) answers this purpose splendidly for small quantities, but for semi-scale operation there is now the SR40 which will divide 40 litres into as many as 40 one-litre samples.



This still did not satisfy us since, for really small quantities of powder when needed in suspension, the medium could act as an effective diluent and we have since been asked (by the UKAEA) to manufacture what we will call the Microscal (UK) Suspension Sample.



The saga continues with another kind of surface of recurrent interest. The light fastness of natural and synthetic textiles, plastics, paints, leathers etc is a field for which we are pleased to be able to offer the inexpensive Microscal Light Fastness Tester, which has been developed to include the alternative types of humidity-controlled exposure cells illustrated. To cap this we can now offer a rapid fade conversion which halves the necessary exposure time without significantly changing the correlation to daylight tests.



I could bore you by saying more, but all I wish to add is that I look forward to talking to any of you who are interested in what interests us.

**What better place to talk than at OCCA 26?**

*Yours sincerely,*

**C. E. TEMPLER,**

*Managing Director, Microscal Ltd.*

**MICROSCAL LTD., 20 Mattock Lane, Ealing, London W5 5BH**  
**Telephone: 01-567 5353**



## färg och lack

Journal for members of  
**Skandinaviska Lackteknikers Förbund**  
 (Federation of Scandinavian Paint  
 and Varnish Technologists)

Färg och Lack is received by all engineers and technicians employed in the Scandinavian Paint and Varnish Industry. This means that there is 100% coverage of the potential market. The objective of the journal is to inform about research results and other topics which are of interest to the paint and varnish industry, its technicians and suppliers in the Scandinavian countries.

The geographical distribution of readers is app.:  
 Denmark 24%, Finland 13%,  
 Sweden 32%, Norway 31%

SKANDINAVISK TIDSKRIFT FÖR  
**färg och lack**

*Advertisement department:*

20, HOLBERGSGADE DK-1057  
 COPENHAGEN K DENMARK  
 Phone (01) 14 06 11

Advertising manager Jens H. Linnemann

## print in practice

Metchim's have been printers for over 100 years. Today, in the heart of Westminster, in the shadow of Big Ben, our modern automatic presses produce vast quantities of high-class printed matter, day and night, in our 12,000 square feet factory.

**METCHIM & SON LTD**  
 GENERAL COLOUR AND PERIODICAL PRINTERS

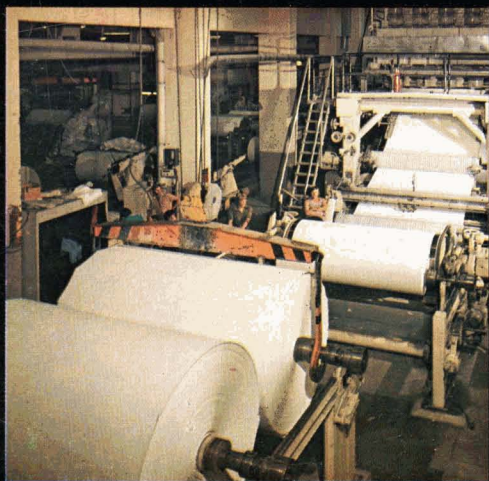
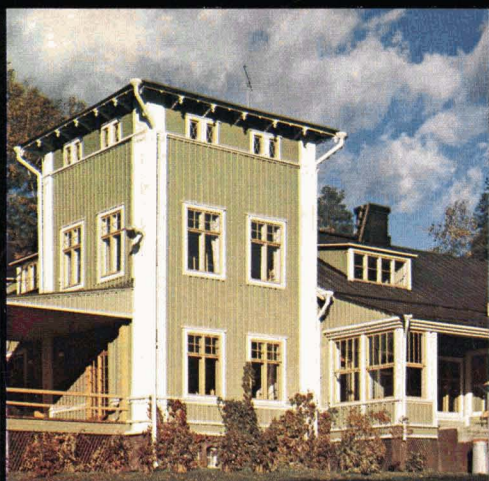
8 STOREY'S GATE, WESTMINSTER, S.W.1  
 Telephone: 01-839 2125 (4 lines)



# Finntitan TiO<sub>2</sub> meets the highest standards in all fields of application.

Just to cite one example, acrylic car finishes, highly sophisticated new protective coatings, place most exacting requirements to pigment types used in their formulation. For this purpose very few pigment grades are available combining ease of grinding, high opacity and mirror gloss with maximum exterior durability. The problem solver in this demanding case is FINNTITAN RR3, the real aristocrat among the white pigments. For other formulation problems of varying nature the range of FINNTITAN pigments will offer an equally sound and economically interesting solution.

# FINNTITAN



**KEMIRA OY**  
VUORIKEMIA, FINLAND

# TIOXIDE<sup>®</sup>

## WHITE PIGMENTS FOR INDUSTRY

You *know* they give you whiteness . . . opacity  
. . . durability. With them you make the best  
white and pastel-tinted paints.

### **Tioxide International**

LIMITED · 10 STRATTON STREET · LONDON W1A 4XP · ENGLAND

*The selling organization of the British Titan group of companies*



# JOURNAL of the OIL AND COLOUR CHEMISTS' ASSOCIATION

Hon. Editor: S. R. Finn, B.Sc., F.R.I.C.,  
F.T.S.C.

*Publications Committee:*

J. Bell  
A. W. Blenkinsop, F.T.S.C.  
B. A. Canterford, L.T.S.C.  
R. Chappell, A.R.I.C.  
N. Cochrane  
F.W. Cole, A.T.S.C.  
F. Cooper, B.Sc.  
D. Firth  
R. G. Gardiner  
J. A. Hasnip, B.Sc., A.T.S.C.  
A. McWilliam, A.R.I.C., F.T.S.C.  
B. R. Murray, M.N.Z.I.P.S., A.N.Z.I.M.  
D. S. Newton, A.M.C.T., C.G.I.A.,  
F.Inst.Corr.T., F.I.M.F., F.T.S.C.  
R. F. Nicholls  
M. J. O'Hanlon  
G. H. Robertson, B.Sc., Ph.D.  
F. D. Robinson, B.Sc., A.T.S.C.  
L. F. Saunders, F.T.S.C.  
L. H. Silver  
A. R. H. Tawn, F.R.I.C., F.Inst.Pet., F.I.M.F.,  
F.T.S.C.  
J. R. Taylor, B.Sc., F.R.I.C., F.T.S.C.  
J. W. Todd  
L. J. Watkinson, M.Sc., Ph.D., A.R.I.C.,  
F.T.S.C.

Editorial correspondence should be  
addressed to the Hon. Editor, *JOCCA*,  
49 Elms Drive, Kirk Ella, Hull HU10 7QH.

General correspondence should be  
addressed to:

R. H. Hamblin, M.A., F.C.I.S.,  
Director & Secretary,  
Oil & Colour Chemists' Association,  
at the address below.

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

Assistant Editor: C. A. Tayler, B.Sc.

Annual subscription to non-members:  
£15 (\$38), post free by surface mail,  
payable in advance.

Single copies £1.50 (\$3.80), post free by  
surface mail, payable in advance.

Published by

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

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

Contents

Vol. 57 No. 4

April 1974

*Transactions and Communications*

Owing to the illness of the translator, the papers published in this issue do not include translations of the summaries in Russian.

В виду болезни переводчика нет возможности опубликовать выдержки статей на русском языке.

**Efflorescence on gypsum glass board . . . . . 127**

*G. A. King, M. J. Ridge and G. S. Walker*

**Ion exchange behaviour of some anti-corrosive paints and paint media . . . . . 131**

*W. U. Malik and L. Aggarwal*

**Oxidation of copper phthalocyanine blue pigment with potassium dichromate in acid solution . . . . . 134**

*A. M. Islam, A. M. Naser, A. A. El-Mariah and A. A. Salman*

**Reviews . . . . . 139**

**Information received . . . . . 140**

**Section Proceedings . . . . . 141**

**Notes and News . . . . . 142**

**OCCA 26 EXHIBITION PREVIEW . . . . . 143**

**Forthcoming Events . . . . . 150**

In order not to delay publication of this Exhibition Preview issue, as a result of the reduced working week, a number of items have been held over to later issues.

APR 1974

**C O L O U R S**

**O**

**R**

**Y**

**for**  
**PAINTS**  
**PRINTING INKS**  
**PLASTICS**  
**ETC.**

**HORACE CORY & CO LTD**  
**NATHAN WAY, LONDON, SE28 0AY**

## Transactions and Communications

# Efflorescence on gypsum glass board

By G. A. King, M. J. Ridge and G. S. Walker

CSIRO, Division of Building Research, Physical Chemistry Section, Graham Road, Highett, Vic. Australia, 3190

### Summary

The efflorescence found on gypsum glass board\* consisted of sodium sulfate. Very small amounts of sodium methyl silicate are added to gypsum plaster to reduce the tendency of the cast to absorb water. During drying, the sodium of the silicate is converted into sodium sulfate, and if too large amounts of the additive are used, this sodium sulfate added to that already present

in the gypsum, may be sufficient to cause efflorescence. The problems associated with this phenomenon, which have been experienced by several manufacturers, have now ceased after a reduction in the amount of silicate to about 0.1 per cent on the weight of the calcined gypsum.

### Keywords

*Types and classes of structures or surfaces to be coated*  
wall board\*

*Raw materials: extender pigments*  
gypsum

*Properties, characteristics and conditions primarily associated with structures or surfaces being coated*  
efflorescence

## Le problème de l'efflorescence sur la surface de plaques de plâtre renforcé par fibres de verre

### Résumé

L'efflorescence qui se trouve sur la surface de plaques de plâtre renforcé par fibres de verre est composée de sulfate de sodium. On ajoute de très faibles quantités de méthyle silicate de sodium au plâtre de gypse afin de diminuer la tendance mise en évidence par la pièce coulée à absorber l'eau. Pendant le séchage, le sodium à partir du silicate est converti au sulfate de sodium, et dans le cas où l'on utilise les quantités trop importantes d'adjuvant, le

sulfate de sodium qui en résulte et en plus celui qui se trouve déjà dans le gypse peuvent être suffisants pour provoquer l'efflorescence. Les problèmes associés à ce phénomène et qui ont été rencontrés par divers fabricants, ont cessé dès que la diminution de la teneur en silicate jusqu'à 0.1% à peu près, basé sur le poids du gypse calciné.

## Ausblühungen auf Gips-Glasplatten

### Zusammenfassung

Die auf Gips-Glasplatten gefundenen Ausblühungen bestanden aus Natriumsulfat. Um die Tendenz zur Absorbierung von Wasser durch den Abguss zu reduzieren, werden dem Gipsstück sehr geringe Mengen von Natriummethylsilicat zugesetzt. Das Natrium des Silicates wird während des Trockenvorganges in Natriumsulfat umgewandelt; wenn aber zu hohe Zusätze gemacht

werden, kann dieses Zusätzliche zusammen mit dem bereits im Gips vorhandenen Natriumsulfat genügen, um Ausblühungen zu erzeugen. Die mit diesem Phänomen zusammenhängenden, von verschiedenen Erzeugern beobachteten Probleme verschwanden nach Verringerung der Siliconatmenge auf etwa 0.1% des Gewichts des kalzinierten Gipses.

## Introduction

Ref. 1, 2

The efflorescence on gypsum surfaces is usually due to sodium sulfate<sup>1</sup> and has been virtually unknown on gypsum sisal board for at least 15 years. It began to be noticed on the newly developed gypsum glass board in July and August 1972, although this material had been used in considerable amounts, particularly in Melbourne, during the previous year without any sign of the phenomenon. Actually, efflorescence has occurred on only a small percentage of the total sheeting fixed, (less than 0.1 per cent of jobs) but has caused concern as its incidence is concentrated in a few districts, where it has been a frequent but intermittent phenomenon. It has occurred on sheets during drying, at the edges of flush joints and beneath wads of fibre and gypsum plaster used for attaching the sheeting to the building framework.

Efflorescence on gypsum surfaces may cause trouble with paint films.<sup>2</sup> So far, no such difficulties have been encountered with gypsum glass board, probably due to the material drying quickly and the efflorescence forming before the paint is applied. Nevertheless, it was decided that the matter should be investigated despite its comparative rarity and the results obtained are set out in this paper.

## Experimental

Ref. 3-5

### The capacity of gypsum glass board to produce efflorescence

Samples of sheeting were laid face downwards with supports at each end. Wet patches were produced on the faces of the sheets either by placing lots of unset plaster (100-200g) or

\*A number of lining boards based on cast gypsum are in use in Australia or are in the process of development. The nomenclature is becoming confused and in this paper a systematic terminology based on composition and constitution is used. They are all called "gypsum boards" after the main constituent, and distinctions are made according to the minor ones. The board (called variously "gypsum board", "gypsum wall board", or just "wall board") consisting of a layer of cast gypsum between two layers of paper is called "gypsum paper board". Sheets of cast gypsum reinforced with sisal (traditional fibrous plaster) are designated "gypsum sisal board", and those reinforced with glass fibres as "gypsum glass board", which may be singly or doubly reinforced.

by pouring water on to the backs of the sheets. In susceptible specimens, efflorescence developed around the edges of the damp patches as they dried out. Tests were carried out in a room with static conditions of about 20°C and 65 per cent RH.

When specimens were cast in the laboratory, they were about 400mm × 600mm in size and 6-10mm thick. A solids/water ratio of 100/70 was used. About 3 per cent of glass fibres were added to prevent breaking. The specimens were dried before testing.

#### Chemical analyses

Sulfates, in general, were detected by dissolving the sample in water and adding hydrochloric acid and a solution of barium chloride. Sodium sulfate, in particular, was detected by shaking a powdered sample in water, filtering, adding barium chloranilate to the filtrate, filtering again, and observing the port wine colour in the clear solution. A blank was used for comparison.<sup>3</sup>

Chloride in cast or calcined gypsum was determined by Surkevicius's method.<sup>4</sup> Recent work has confirmed that small quantities (>0.001 per cent as NaCl) can be determined reliably in this way.<sup>5</sup>

Sodium, in cast or calcined gypsum, efflorescence, water and glass fibres, was determined by atomic absorption spectroscopy. The procedure for the first two materials was:

Samples (0.5g) were dissolved in 10ml concentrated nitric acid and made up to 250ml with water free from sodium. Standards were made by dissolving the same quantity of gypsum (free from sodium) in nitric acid, adding selected amounts of sodium chloride and making up to 250ml. The results given in this paper are accurate to ±0.001 per cent. In view of the similarity of the compositions of the tests and standards, it seems unlikely that the results could be subject to serious systematic error. In the case of glass fibres, estimation was carried out after digestion in hydrofluoric acid and extraction with nitric acid.

Sodium sulfate in cast or calcined gypsum was estimated quantitatively from the difference in the contents of sodium and chloride. Alkali in sodium methyl silicate was determined by titration with N/10 HCl using methyl orange as indicator and chloride by Volhard's method.

#### Materials used in experiments in the laboratory

Calcined gypsum (designated  $G_1$ ) was a commercial product and contained 0.06 per cent  $\text{Na}_2\text{SO}_4$ . Specimens for experiments on efflorescence were cast with distilled water.

All reagents and additives, except the sodium methyl silicate, were of analytical grade. The "sodium methyl silicate" used in industry is actually a preparation containing 30 per cent solids, which include 14 per cent sodium as NaOH, but is referred to as sodium methyl silicate in this paper. The preparation (distinguished as  $P_1$ ) of sodium methyl silicate used in experiments in the laboratory

contained 13.0 per cent free alkali as NaOH, 0.12 per cent NaCl and no detectable sulfate.

## Results

*Ref. 6, 2, 7, 8*

#### Identity and quantity of the efflorescence

Chemical examination of a number of samples of efflorescence found on gypsum glass board showed that soluble sulfates, sodium salts or sodium sulfate were the major components. For example, Sample 1 (collected in the field) was a sulfate completely soluble in water and Sample 2 (also collected in the field) contained much sodium sulfate.

Sample 3, which was produced in a test in the laboratory on a commercial gypsum glass board, was found to contain sodium (as  $\text{Na}_2\text{SO}_4$ ) equal to 50 per cent of the efflorescence.

A number of other samples taken at various times behaved as in the three cases above, and on the basis of all this evidence, it was concluded that the current problem must have been due to sodium sulfate.

In one house where a number of patches of efflorescence occurred, the loose white material was collected, ignited at 800°C and weighed. The weight of cast gypsum from which the efflorescence had been obtained was estimated from the area and thickness, using a density of 1.1g cm<sup>-3</sup> (ie, that derived from a plaster with a solids/water ratio of 100/70)<sup>6</sup>. The yield of efflorescence expressed as a percentage of the weight of the supporting cast gypsum is given in Table 1 for a number of patches, and it is seen that it amounts to less than 0.01 per cent of the weight of the substrate.

Table 1  
*Anhydrous efflorescence as a percentage of the substrate*

Patch of surface	1	2	3	4	5
Dehydrated efflorescence %	0.005	0.002	0.006	0.003	0.009 (mean 0.005)

#### Quantity of sodium sulfate necessary for efflorescence

The best evidence suggests that the probability of the development of efflorescence on cast gypsum becomes significant when the content of sodium sulfate reaches a value of about 0.1 per cent (Ref. 2, Hoffmann, private communication; Ridge, unpublished data). However, the conditions used by Hoffmann in his experiments were quite different from those prevailing in the problem under consideration here and earlier workers did not measure the amount of sodium sulfate present in the calcined gypsum. Consequently, experiments were carried out to confirm that a content of 0.1 per cent  $\text{Na}_2\text{SO}_4$  will produce efflorescence.

With calcined gypsum  $G_1$ , specimens were cast with no added sodium sulfate and enough of it to produce casts containing 0.1, 0.2 and 0.4 per cent  $\text{Na}_2\text{SO}_4$ . When dry, they were tested for efflorescence. The results are given in Table 2 and it can be seen that 0.1 per cent sodium sulfate leads to definite efflorescence but the sample containing 0.05 per cent (due to the gypsum) gives none.

Table 2

Relationship between content of sodium sulfate and efflorescence

Sodium sulfate added as such		Sodium sulfate introduced as sodium methyl silicate	
Total Na <sub>2</sub> SO <sub>4</sub> %	Efflorescence	Total Na <sub>2</sub> SO <sub>4</sub> %	Efflorescence
0.05*	None	0.05*	None
—	—	0.07†	None
0.10	Efflorescence	0.10	Efflorescence
0.20	Efflorescence	0.20	Efflorescence
0.40	Efflorescence	—	—

\*Amount of sodium sulfate derived from the calcined gypsum.

†Produced by the addition of 0.12 per cent of P<sub>1</sub> sodium methyl silicate roughly in accord with the recommendations of the Division of Building Research.

### Source of sodium sulfate

The only possible sources of sodium sulfate in the efflorescing sheeting are (a) the glass fibre, (b) the water used in fabricating, (c) the calcined gypsum, (d) additives such as sodium methyl silicate, retarders, etc., and (e) accidental contamination, such as that of the glass or calcined gypsum during transport. Each of these was examined with the following results.

(a) Glass fibres: Gypsum glass board is reinforced with 3-4 per cent by weight of drawn fibres of "E" glass, the composition of which in the "direct-melt" process is: SiO<sub>2</sub>, 53.2; Al<sub>2</sub>O<sub>3</sub> + Fe<sub>2</sub>O<sub>3</sub>, 14.8; CaO, 21.1; MgO, 0.3; Na<sub>2</sub>O, 1.2; K<sub>2</sub>O, 0.1; B<sub>2</sub>O<sub>3</sub>, 9.0; BaO, 0.3 per cent. If all the sodium oxide were leached out of the glass and converted to Na<sub>2</sub>SO<sub>4</sub> the cast could contain as much as 0.1 per cent Na<sub>2</sub>SO<sub>4</sub> which could cause efflorescence. However, since working temperatures are below 50°C, diffusion in the glass will be slow and complete release of sodium during drying would require the complete destruction of the fibres. No such destruction has been observed and most of the sheeting produced does not effloresce. Consequently, the glass fibres formulated as above can be dismissed as the cause of efflorescence.

The possibility was considered that the glass might sometimes deviate seriously in composition from the figures given above. Glass fibres were extracted from sheeting that readily effloresced and were found to be in good order. Analysis revealed the presence of 0.25 per cent Na<sub>2</sub>O.

(b) Water: Efflorescence has been serious only in inland cities situated on rivers. A drought was in progress when the phenomenon was first reported and salts in the water were higher than usual. Water was taken from factories in two cities where efflorescence occurred and from two where the phenomenon appeared to be absent, and analysed for sodium. The results are given in Table 3, which shows that the highest

Table 3

Sodium as sodium sulfate in samples of water

City	Sodium as Na <sub>2</sub> SO <sub>4</sub> %	Occurrence of efflorescence
A	0.0115	Yes
B	0.0073	Yes
C	0.0058	No
D	0.0073	No

concentration was 0.0115 per cent as Na<sub>2</sub>SO<sub>4</sub>. Assuming a solids/water ratio of 100/70 the water would contribute only 0.0076 per cent Na<sub>2</sub>SO<sub>4</sub> to the cast provided that all the sodium were in the form of the sulfate, which it is almost certainly not.

(c) Gypsum: The quantitative determination of sodium sulfate depends upon having homogeneous samples that can be analysed independently for sodium and chloride, and the values meaningfully subtracted. It soon became apparent that gross segregation occurred in the casts, efflorescence being the extreme form, of course, and the method described in the Experimental Section could not be applied. Consequently, effort was concentrated on calcined gypsum which is a much more uniform product.

It has been shown recently that gypsum can contain more sodium sulfate than was previously thought to be the case.<sup>8</sup> The contents of sodium and chloride given in Table 4 for

Table 4

Salts in samples of calcined gypsum taken from various factories

Sample	Sodium as NaCl %	Chloride as NaCl %	Estimated Na <sub>2</sub> SO <sub>4</sub> %
A <sub>1</sub>	0.085	0.032	0.064
A <sub>2</sub>	0.110	0.126	—
A <sub>3</sub>	0.072	0.059	0.016
A <sub>4</sub>	0.077	0.030	0.057
A <sub>5</sub>	0.090	0.088	0.002
A <sub>6</sub>	0.052	0.048	0.005
A <sub>7</sub>	0.146	0.105	0.050

a number of samples of calcined gypsum taken from factories and jobs affected by efflorescence, show that there are appreciable differences in their equivalence. The derived contents of sodium sulfate are also given. In general, there is more sodium than is equivalent to the chloride. In one case, chloride exceeded sodium and the manufacturer is known to "aridize" (add calcium chloride) during calcination. The highest value for sodium sulfate was 0.064 per cent which according to the experimental evidence, however, is most unlikely to cause efflorescence.

(d) Additives: Sodium methyl silicate is added to the sheets in the factories affected by efflorescence. Retarder is used in one factory, but it can be ignored as a source of sodium sulfate as it was not a sodium salt, and the quantity used is very small (> 0.01 per cent). The same consideration applies to the release agent used to facilitate lifting from the casting benches.

Sodium methyl silicate reacts with carbon dioxide during drying to give sodium carbonate which undergoes double decomposition with calcium sulfate to give sodium sulfate and calcium carbonate. The recommended addition of silicate is about 0.1 per cent, based on the weight of the calcined gypsum, and would contribute about 0.02 per cent Na<sub>2</sub>SO<sub>4</sub>. If this were added to the highest content (0.064 per cent) of sodium sulfate so far detected in commercial calcined gypsum, the contribution to the cast (ie the dihydrate) would be 0.071 per cent Na<sub>2</sub>SO<sub>4</sub> which is approaching the value of 0.1 per cent.

It is possible, in fact, that larger amounts of silicone than recommended are being used in industry and to test the possible effects, specimens were cast from calcined gypsum G<sub>1</sub> with selected amounts of P<sub>1</sub> sodium methyl silicate

to give a total sodium sulfate content of 0.07\*, 0.10 and 0.20 per cent, on the weight of dihydrate. These were tested for efflorescence. The results are given in Table 2 and confirm that a total content of about 0.1 per cent  $\text{Na}_2\text{SO}_4$  is needed for efflorescence.

The specimens made with silicate in the laboratory, like some found in industry, were highly water-repellent, whereas some industrial specimens giving efflorescence were readily wetted. It is possible that some of the sodium methyl silicate used in industry is not very effective.

#### Examination of practices in factories affected by efflorescence

Efflorescence occurs mainly in two inland centres, although a few cases have occurred in other areas. Visits were paid to the two centres experiencing trouble and two others that were not, in order to measure the amounts of sodium methyl silicate actually used. The results were as follows:

Factory 1. A number of casting benches of different sizes were in use and each had its own appropriately sized ladle for the addition of the silicate. In practice, the ladles were not always used with the bench for which they were intended. Measurement of the capacities of the ladles and the sizes of the benches revealed that the addition of silicate could vary from 0.165-0.35 per cent which could contribute 0.035-0.08 per cent  $\text{Na}_2\text{SO}_4$  to the cast. Some of the sheets were highly water-repellent and this manufacturer had trouble with efflorescence.

Factory 2. Measurements showed that 0.28 per cent silicate was used, contributing 0.06 per cent  $\text{Na}_2\text{SO}_4$  to the cast. Sheets were highly water-repellent and this manufacturer also had trouble with efflorescence.

Factories 3 and 4. Silicate was added to the extents of 0.06 per cent and 0.12 per cent for factories 3 and 4 respectively and neither factory was troubled by efflorescence.

It was suggested to the managers of Factories 1 and 2 that the amount of silicate be reduced to about 0.1 per cent. Enquiries made several months later revealed that the problem had ceased to exist.

## Discussion

Ref. 2

It is clear from Table 2 and the work of Hoffmann<sup>2</sup> that the presence of 0.1 per cent  $\text{Na}_2\text{SO}_4$  can lead to efflorescence. It is also clear that some manufacturers of gypsum glass board are using excessive quantities of sodium methyl silicate and that efflorescence ceases when the addition is reduced. However, the highest possible contamination of sodium sulfate from sodium methyl silicate found in the detailed investigation of practices in factories was 0.08 per cent which seems unlikely to be responsible for the spectacular efflorescence that has been observed. The situation, however, becomes quite different when it is considered that the calcined gypsum can contain up to 0.064 per cent  $\text{Na}_2\text{SO}_4$  (See Table 4). It seems then that the sporadic but spectacular efflorescence that had been observed on gypsum glass board was the result of excessive additions of sodium methyl silicate coinciding with high contents of sodium sulfate in the calcined gypsum. Other factors, such as the porosity of the cast, humidity and temperature, would have some effect on the form of the efflorescence, but none would develop if the content of sodium sulfate were sufficiently low. Also, the use of highly effective silicate would tend to reduce the occurrence as no efflorescence would occur if, say, dampness from wads of gypsum plaster and glass fibre used for attaching the sheeting to a suspending system did not penetrate to the surface.

The highest contents of sodium sulfate observed so far in commercial calcined gypsum is only 0.064 per cent. This is derived from the original gypsum deposit. However, calcium sulfate dihydrate crystals containing 0.8 per cent  $\text{Na}_2\text{SO}_4$  have been grown in the laboratory (unpublished data) and an investigation of this salt in natural gypsum is being made.

[Received 12 July 1973]

## References

1. King, G. A., Walker, G. S., and Ridge, M. J., *Building Materials and Equipment*, 1972, **15**, 40.
2. Hoffmann, E., *JOCCA*, 1961, **44**, 32.
3. Hoffmann, E., *Z. analyt. Chem.*, 1960, **177**, 353.
4. Surkevicius, H., *Mater. Res. Standards*, 1961, **1**, 642.
5. King, G. A., Ridge, M. J., and Walker, G. S., *J. appl. Chem. Biotechnol.*, (in press).
6. Adami, A., and Ridge, M. J., CSIRO Aust. Div. Build. Res. Rep. No. FI-12, 1966.
7. Oleesky, S. S., and Moore, J. G., "Handbook of Reinforced Plastics of The Society of the Plastics Industry Inc.," Reinhold, New York, 1964.
8. Maclagen, D. S., and Ridge, M. J., *Chem. Ind.* (in press).

\*0.12 per cent of the preparation of sodium methyl silicate, i.e. approximately the recommended amount.



# **A better scrub-resistance for printing inks with VEBA-waxes**

In many printing processes the colour film is subjected to a strong mechanical stress. The scrub-, abrasion-, and scratch-resistance as well as the slip-friction are real problems, the modern solution of which is offered by VEBA-WAXES. These hard synthetic paraffins and polyethylene waxes are supplied as fine powders of uniform particle size. They may be directly incorporated into

printing inks like pigments. This is applicable for all printing processes. Do you want to learn more about the advantages of VEBA-WAXES? Then, please, ask for further information, free samples, and technical advice.

## **VEBA-CHEMIE AG**

Dept. WD97 · 466 Gelsenkirchen-Buer · F. R. Germany  
Phone (02322) 366-3910 Telex 824647



**Behind every Beetle Resin  
there's a BIP specialist** One of BIP's back-room boys who maintain the quality and reliability of Beetle amino-resins by proving and testing them in countless applications. The backbone of BIP's technical advisory service, they are always available to help solve your particular problems.

BIP Chemicals make the widest amino-resin range in Europe, and supply over half the resins used in the British paint industry - when you consider that they do the same with purpose-formulated resins for paper, textiles, adhesives, laminating and reinforced plastics, you're dealing with a company that can anticipate your problems almost before you're faced with them.

For full details of the amino range and more, write or phone:



**Chemical Division  
British Industrial Plastics Limited**

P.O. Box 6, Popes Lane, Oldbury, Warley, Worcs. B69 4PD. Telephone: 021-552 1551. Telex: 33347.

# Ion exchange behaviour of some anti-corrosive paints and paint media

By W. U. Malik and L. Aggarwal

Department of Chemistry, University of Roorkee, Roorkee, India

## Summary

The ion exchange capacity of alkyds and pigmented alkyds when exposed to a corrosive environment of 5 per cent sodium chloride solution in a salt spray chamber has been measured at different intervals. It was found that both the alkyds and pigmented alkyds

having good corrosion protection efficiency, show a very slow change in the ion exchange capacity with time. The method developed is a useful tool for following the progressive deterioration of paint systems.

## Keywords

*Types and classes of coatings and allied products*  
corrosion resistant coating

*Raw materials: binders (resins etc.)*  
alkyd resin

*Processes and methods primarily associated with manufacturing or synthesis*  
ion exchange

*Properties, characteristics and conditions primarily associated with materials in general*  
electrical resistivity  
permeability

## Le comportement en tant qu'échangeurs d'ions de certaines peintures anti-corrosion et de certains milieux pour peintures

### Résumé

On a dosé aux divers intervalles, l'efficacité en tant qu'échangeurs d'ions des alkydes et des alkydes pigmentées, en les exposant à un environnement corrosif d'une solution de 5% de chlorure de sodium dans un appareil à brouillard salin. On a trouvé que les alkydes et les alkydes pigmentées à la fois sont des protecteurs

anti corrosif bons et efficaces et qui montrent en même temps un très lent changement de leurs caractéristiques d'échangeurs d'ions en fonction du temps. La méthode mise au point par les auteurs est un outil commode pour suivre la dégradation progressive des systèmes de peintures.

## Ionenaustauschverhalten Lackfarben und Bindemittel

### Zusammenfassung

Die Fähigkeit von Alkydharzlösungen und pigmentierten Alkydharzlacken zum Ionenaustausch wurde, wenn einer korrosiven Umgebung aus 5% Natriumchloridlösung in einer Salzsprühkammer ausgesetzt, in verschiedenen Zeitabständen gemessen. Es wurde festgestellt, dass beide, gute antikorrosive Schutzwirkung

besitzende Alkydharzlösungen und pigmentierte Alkydharzlacke im Verlauf der Zeit nur eine sehr langsam vor sich gehende Veränderung in ihrer Fähigkeit Ionen auszutauschen, zeigen. Die entwickelte Methode ist ein wertvolles Mittel, um die fortschreitende Verschlechterung des Anstrichsystems zu verfolgen.

## Introduction

Ref. 1-6

Serviceable anticorrosive paints may take several years to test. Many attempts have been made to discover means of reducing the duration of the test by using accelerated test methods or by means of electro-chemical tests. One important contribution towards this end was made by Cherry and Mayne,<sup>1-4</sup> who showed that the slow change in electrical resistance of paint films immersed in electrolyte solution was due to the continuous ion exchange process; in the case of alkyd resins, for example, the exchange of firmly attached hydrogen ions of the carboxyl group with the more mobile metallic ions of the surrounding electrolyte solution. Maitland and Mayne<sup>5</sup> found that studies of the changes in electrical resistance of paint films can be used to predict their anticorrosive ability. Further investigations by Bacon,<sup>6</sup> who tested about 300 pigmented paints, showed that the changes in electrical resistance of paint films with time correlate well with their performance in the marine environments. Changes in the ion exchange capacity with time should, therefore, have some relationship with the ability of paint films to prevent rust.

This paper describes the work which has been done to find out the relationship between the rust preventive abilities and the change with time of the ion exchange capacities of some alkyd resins and anticorrosive paints, when exposed to the corrosive environment of salt solution in the salt spray chamber.

## Experimental

Ref. 7-9

Three linseed oil based alkyd resins *A*, *B* and *C* with high, medium and low ion exchange capacities in turn, were selected as binders. The pigments used were red lead, titanium dioxide, zinc chromate, chromium—manganese oxide (IP-1971) and iron oxide. The studies were carried out using 25 per cent pigment volume concentration (PVC). The weights used in the various paint formulations were calculated from the densities of the pigments and the binders, based upon the total solids in the binders. Cobalt (0.1 per cent) and lead naphthenates (0.3 per cent) were added as driers. All pigments used were of commercial grades and no extenders were added to the systems. Pigments were dispersed in the binders by ball milling.

Mild steel and glass panels, 15 × 10cm, were used. The glass panels were thoroughly washed and dried. Mild steel panels were pickled in 10 per cent sulfuric acid at 50°C for half an hour, washed thoroughly in running water and allowed to dry in air for 24 hours. The dried panels were scrubbed with emery paper, cleaned first with benzene and then with acetone and dried. The panels were coated with test binders and paints to give a controlled film thickness (40 μm). Only one side of the panels was coated with the test paint, and in the case of the steel panels the reverse side was given a thick coat of an aluminium pigmented epoxy paint. The coated panels were allowed to dry for three weeks.

The panels were placed with their test surface upwards in the salt spray chamber. A 5 per cent solution of sodium chloride was sprayed for 800 hours. Paint films were detached from the glass plates after intervals of 0, 200, 400, 500, 600 and 800 hours. The detached films were then washed with water, dried and kept in a desiccator.

The ion exchange capacity was measured by the method described by Ulfvarson and Khullar.<sup>7, 8</sup> The solution (200mg of film in 50ml of 0.1M sodium chloride, pH 6.0) was titrated periodically against standard sodium hydroxide solution, using an Elico (India) pH meter model LI-10. The experiment was performed at 50 ± 1°C. Nitrogen was bubbled through the solution during the experiment to eliminate the effects of carbon dioxide.

The extent of corrosion was noted by the method described by Gardner<sup>9</sup> in which 10 on the scale indicates a perfect surface with no corrosion of the metal substrate or damage to the film, whilst 0 indicates deterioration of the film and corrosion of the metal substrate.

## Results and discussion

The ion exchange capacity of the alkyd resins, calculated as mol kg<sup>-1</sup>, are given in Table 1. It was observed that the ion exchange capacity fell slowly in the case of alkyd C which had a low ion exchange capacity, and rapidly in the case of alkyd A having high ion exchange capacity (Fig. 1), as the time of exposure to the corrosive environment is increased. An alkyd which shows a slow change in ion exchange capacity with time should have a greater corrosion resistant efficiency, therefore, and this is evident from Table 1.

The ion exchange capacities of pigmented paint films, calculated as mol kg<sup>-1</sup> of binder, are given in Table 2. It is apparent from this Table that zinc chromate and red lead pigments decrease considerably the ion exchange capacity of the pigmented films, as can be seen by comparison with the ion exchange capacities of the unpigmented films of the three binders used in this study. Chromium—manganese

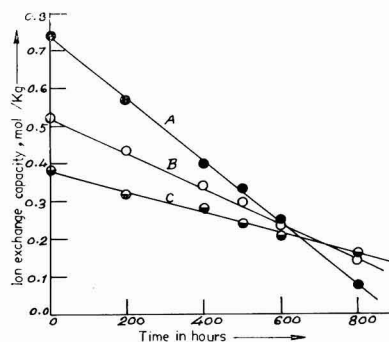


Fig. 1. Change in the ion exchange capacity of binder films with time

oxide and titanium dioxide have a moderate effect, whereas iron oxide has the least effect on the ion exchange capacities. The decrease in the ion exchange capacity of pigmented paint films can be explained in two ways.

Firstly, the pigments are basic in nature, so they can react with the acid groups of the binder in the film, resulting in the decrease of the ion exchange capacity. The other explanation may be that all the pigments are either soluble to some extent or contain water soluble salts, which possibly dissolve in the water taken up in the swollen film and thus neutralise the acid group of the binder concerned. This point of view is supported by the fact that a pigment having high conductivity, when suspended in water decreases the ion exchange capacity to a greater extent than does a pigment having low conductivity. Thus, zinc chromate being highly basic and soluble in water, decreases the ion exchange capacity to zero in all the three binders.

It is further to be observed that the change in ion exchange capacity of a pigmented paint film with time depends upon the nature of the binder as well as the pigment present. All the pigments used show a small change in the ion exchange capacity in binders B and C, whilst the change is comparatively high in binder A. Zinc chromate pigmented paints do not show any ion exchange capacity and have the best corrosion resistance efficiency. In red lead, the change in exchange capacity is very slow and thus it shows good rust preventive ability. In case of chromium—manganese oxide and titanium dioxide, the change in the ion exchange capacity is medium, whilst iron oxide, which shows a sharp fall in the ion exchange capacity (Fig. 2), is the least resistant to corrosion. It is also clear from Table 2, that the corrosion protection ability of a paint depends upon the change of the ion exchange capacity with time: the smaller the variations in ion exchange capacity with time, the more efficient is the corrosion protection.

Table 1  
Ion exchange capacity of binder films

Alkyd	Time in hours						Degree of protection efficiency
	0	200	400	500	600	800	
Ion exchange capacity, mol/kg of binder							
A	0.74	0.57	0.40	0.33	0.25	0.07	3
B	0.52	0.43	0.34	0.30	0.24	0.14	5
C	0.38	0.32	0.28	0.24	0.21	0.16	7

Conditions: 0.1M NaCl solution, temperature 50 ± 1°C, pH 6.0.

Table 2  
Ion exchange capacity of paint films

Alkyd Pigment	Paint No.	Time in hours								Degree of protection efficiency	
		0	200	400	500	600	800				
Ion exchange capacity, mol/kg of binder											
A	Red lead	1	..	..	0.15	0.15	0.14	0.13	0.12	0.10	7
	TiO <sub>2</sub>	2	..	..	0.36	0.31	0.25	0.23	0.19	0.14	3
	Zn CrO <sub>4</sub>	3	..	..	—	—	—	—	—	—	9
	Cr-Mn oxide*	4	..	..	0.28	0.24	0.21	0.21	0.18	0.15	3
	Fe <sub>2</sub> O <sub>3</sub>	5	..	..	0.56	0.46	0.37	0.34	0.27	0.19	2
B	Red lead	6	..	..	0.08	0.08	0.08	0.07	0.06	0.04	9
	TiO <sub>2</sub>	7	..	..	0.24	0.22	0.20	0.19	0.15	0.10	5
	Zn CrO <sub>4</sub>	8	..	..	—	—	—	—	—	—	10
	Cr-Mn oxide*	9	..	..	0.20	0.19	0.18	0.18	0.16	0.12	6
	Fe <sub>2</sub> O <sub>3</sub>	10	..	..	0.34	0.28	0.23	0.21	0.17	0.11	3
C	Red lead	11	..	..	0.08	0.08	0.08	0.08	0.07	0.05	9
	TiO <sub>2</sub>	12	..	..	0.14	0.13	0.12	0.11	0.09	0.04	5
	Zn CrO <sub>4</sub>	13	..	..	—	—	—	—	—	—	10
	Cr-Mn oxide*	14	..	..	0.11	0.11	0.10	0.09	0.08	0.04	7
	Fe <sub>2</sub> O <sub>3</sub>	15	..	..	0.20	0.19	0.16	0.14	0.12	0.03	4

Conditions: 0.1M NaCl solution, temperature 50 ± 1°C, pH 6.0, PVC 25%.

\*IP-1971.

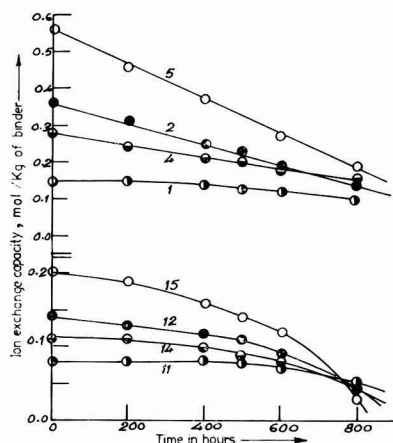


Fig. 2. Change in the ion exchange capacity of paint films with time

This method can be utilised, therefore, to evaluate the corrosion protection efficiency of paints and paint media.

The method of relating the changes in ion exchange capacity to the rust preventive ability of paint films is su-

prior to other electrochemical methods, since local defects present in the film do not interfere with the measurements.

[Received 3 September 1973]

## References

- Cherry, B. W., and Mayne, J. E. O., "Ionic conduction through varnish films 1st International Congress on Metallic Corrosion," 1961 London: Butterworths, pp. 539.
- Cherry, B. W., and Mayne, J. E. O., "Proceedings of the second International Congress on Metallic Corrosion," Published by NACE, Houston, Texas, pp. 680.
- Cherry, B. W., and Mayne, J. E. O., *Off. Dig.*, 1961, **33**, 435.
- Cherry, B. W., and Mayne, J. E. O., *Off. Dig.*, 1965, **37**, 13.
- Maitland, C. C., and Mayne, J. E. O., *Off. Dig.*, 1962, **34**, 972.
- Bacon, C., Smith, J. J., and Rugg, F. M., *Ind. and Eng. Chem.*, 1966, **12** No. 5, 111.
- Ulfvarson, U., Khullar, M. L., and Whallin, E., *JOCCA*, 1967, **50**, 254.
- Khullar, M. L., and Ulfvarson, U., IXth Fatiepec Congress, 1968, Sect. 3, 165.
- Gardner, H. A., "Physical and Chemical Examination of paints, varnishes, lacquers and colors," HAG Laboratory Inc., 1950, 199.

# Oxidation of copper phthalocyanine blue pigment with potassium dichromate in acid solution

By A. M. Islam, A. M. Naser, A. A. El-Mariah and A. A. Salman

Chemistry Department, Faculty of Science, Al-Azhar University, Cairo, Egypt

## Summary

The behaviour of copper phthalocyanine blue pigment towards oxidation with potassium dichromate in sulfuric acid medium has been studied. Copper phthalocyanine, phthalimide and phthalic

anhydride are completely and quantitatively oxidised to carbon dioxide and water. The controlled oxidation of the pigment to phthalimide has also been studied and this method is evaluated.

## Keywords

Raw materials: prime pigments and dyes  
copper phthalocyanine pigment  
phthalocyanine blue

Processes and methods primarily associated  
with analysis, measurement or testing  
oxidation

## L'oxydation des bleus de phtalocyanine de cuivre par le dichromate de potasse en solution acide

### Résumé

On a étudié l'oxydation des pigments bleus de phtalocyanine de cuivre par l'acide sulfurique. La phtalocyanine, la phtalimide et l'anhydride phtalique sont complètement et quantitativement oxydés à l'acide carbonique et à l'eau. D'ailleurs on a étudié

l'oxydation réglementée du pigment à la phtalimide et l'on a évalué cette méthode dont on peut se servir pour effectuer le dosage quantitativement de l'acide carbonique.

## Oxidation von blauem Kupferphthalzianinpigment mit Kaliumdichromat in Saurer Lösung

### Zusammenfassung

Das Verhalten von blauem Kupferphthalzianinpigment bei Oxidation mittels Kaliumdichromat in Schwefelsäure wurde untersucht. Kupferphthalzianin, Phthalimid und Phthalsäureanhydrid werden völlig und quantitativ zu Kohlensäure und Wasser oxidiert. Die

kontrollierte Oxidation des Pigments zu Phthalimid wurde ebenfalls geprüft, und diese Methode beurteilt: sie kann zur quantitativen Bestimmung der Kohlensäure verwendet werden.

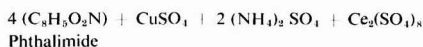
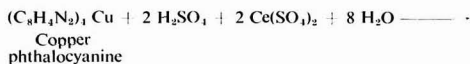
## Introduction

Ref. 1-14, 4, 3

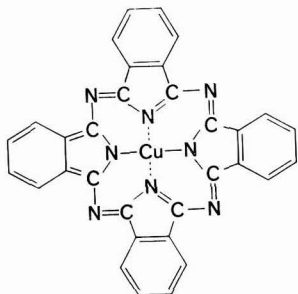
The phthalocyanine pigments are some of the most important coloured pigments due to their outstanding properties. They have remarkable resistance to alkalis, concentrated sulfuric acid and normal stoving conditions. Their tints are very light fast and have excellent durability in exterior finishes, so they are used in paints, lacquers, enamels and plastics. Their stability to light, acids and alkalis also makes them valuable pigments for printing on paper and textile goods.<sup>1</sup>

permanganate and ceric sulfate. The oxidation product was identified in most cases as phthalimide.<sup>3</sup> These oxidations are irreversible and the oxidation products cannot be reduced to the original pigment again, except in traces or as transient intermediates which are rapidly hydrolysed.<sup>1-8</sup> Copper phthalocyanine can also be oxidised by benzoyl peroxide, diacyl peroxide, organic hypochlorites, chlorine or bromine in methanol, or concentrated nitric acid in nitrobenzene to give well-defined oxidation products.<sup>9-11</sup> These products are soluble in organic solvents and can be reduced back to the original pigment.

The oxidation of the pigment with ceric sulfate is used in its quantitative estimation.<sup>1</sup> It is found that the oxidation of one molecule of copper phthalocyanine blue requires one oxygen atom, which is donated by one molecule of ceric sulfate, and phthalimide is the final oxidation product according to the following equation:



When potassium permanganate was used to replace the ceric sulfate at the boiling point for the oxidation of the pigment, variable results were obtained.<sup>3</sup> There was no explanation for the higher results. As a matter of fact, 80 per cent of the calculated amount of phthalimide was estimated



Although copper phthalocyanine pigments resist atmospheric oxidation at temperatures above 100°C, when dissolved in sulfuric acid they are easily oxidised by various oxidising agents such as sodium hypochlorite,<sup>2</sup> potassium

# CHEMOLIMPEX



**HUNGARIAN TRADING COMPANY FOR CHEMICALS**

**H-1805 BUDAPEST**

**P.O.B.121**

ask you the favour of getting acquainted with their  
export range of

ALKYD RESINS

AMINE RESINS

COLOPHONY-BASED RESINS

DRYERS

POLYESTER RESINS  
*for the furniture industry*

ORGANIC PEROXIDES

*at the*

**26th O C C A  
EXHIBITION**

**OLYMPIA, LONDON — STAND 38**

**we have a  
very  
comprehensive  
range of  
solvents...  
if you are  
not in touch  
with us - you  
should be!**

Aromatic Hydrocarbons  
Aliphatic Hydrocarbons  
Aromatic Naphthas  
Special Boiling Points  
Alcohols  
Glycol Ethers  
Acetates  
Ketones

**why not  
'phone or write?**

**Samuel Banner**



LIVERPOOL: 59/61 Sandhills Lane, L5 9XL  
Telephone 051-922 7871 · Telex 627025

LONDON: Newton Road, Stratford, E15 1LR  
Telephone 01-534 4321 · Telex 897766

GLASGOW: 289 Castle Street, G4 0ST · Tel. 041-552 0723



**OIL & COLOUR  
CHEMISTS'  
ASSOCIATION  
AUSTRALIA**

publishes monthly

**PROCEEDINGS AND NEWS**

**Advertising rates and  
subscription forms  
obtainable from:**

**D. S. MYLES**

**44 Beaver Street, East Malvern,  
Victoria 3145, Australia**

**Annual subscription rate \$A9.00**

**Editorial comment welcomed**

**Honorary Editor**

**L. A. HILL**

**13 Melby Avenue, Balaclava,  
Victoria 3183, Australia**



in the solution when nitric acid was used as the oxidising agent.<sup>3</sup>

## Experimental

Ref. 15-17, 19, 20

### Preparation of copper phthalocyanine blue pigment

The pigment was prepared by heating phthalic anhydride (2g), urea (3g), cupric chloride (0.4g) and a few milligrammes of ammonium molybdate in a silica crucible until the strong blue colour was developed. The crude pigment was pulverised and dissolved in cold concentrated sulfuric acid and precipitated by dilution with distilled water. After filtration through a sintered glass funnel, the precipitate was washed several times with water, followed by ethyl alcohol and finally with ether and dried in an oven at 120°C.<sup>15</sup> The pigment was ground in an agate mortar and the purity was determined electrolytically using the Fischer controlled potential electro-analyzer, model 140.<sup>16</sup> The purity of the prepared pigment was found to be 96.8 per cent.

### Oxidation of copper phthalocyanine blue pigment

The oxidation studies of the pigment using potassium dichromate were carried out by either volumetric or gravimetric analysis.

#### Volumetric analysis

Preliminary experiments were carried out by complete dissolution of the pigment in cold concentrated sulfuric acid followed by rapid addition of excess 0.1N dichromate solution at various temperatures and back titration of the excess standard against standard ferrous ammonium sulfate using sodium diphenylamine sulfonate as the indicator.<sup>17</sup> The results are recorded in Table 1. The study was then extended to include phthalimide, and phthalic anhydride, which are the possible oxidation intermediates, in addition to copper phthalocyanine blue. They were separately refluxed with 6N potassium dichromate solution in 50 per cent (by volume) sulfuric acid for 3 hours. The dichromate solution consumed was determined by back titration of the excess dichromate against 0.1N ferrous ammonium sulfate using sodium diphenylamine sulfonate as the indicator. A blank was conducted at the same time under the same conditions. The results are given in Table 2.

#### Gravimetric analysis

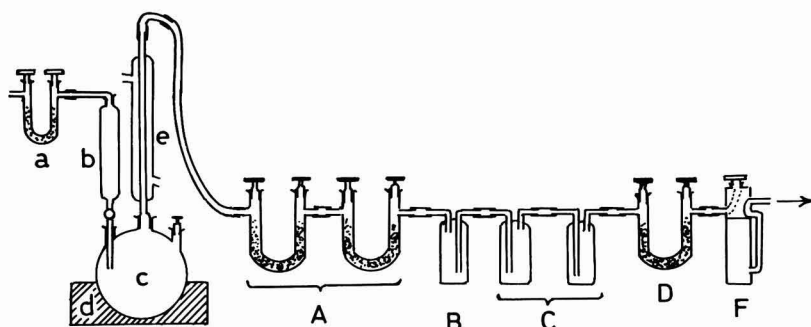
A parallel study was also made by estimating the amount of carbon dioxide evolved during the oxidation of the pigment. It was determined gravimetrically by absorbing the evolved gas in a Nesbitt tube filled with self-indicator soda asbestos and dehydrating agent.<sup>19, 20</sup> The apparatus used is shown in Fig. 1. The results obtained from the oxidation of copper phthalocyanine blue pigment, and the possible oxidation intermediates (phthalimide and phthalic anhydride) are shown in Table 3.

Table 1  
Controlled oxidation of copper phthalocyanine blue pigment to phthalimide using 0.1N potassium dichromate in sulfuric acid medium

Weight of pigment mg	Titre of 0.1N pot. dichromate ml	Calculated weight, mg	Consumed oxygen atoms	
			Found	Calcd.
(a) at 100°C for 15 minutes				
63.7	51.5	1,483	23.3	1
33.2	19.8	570	17.2	1
47.7	41.6	1,199	25.1	1
45.1	90.7	2,612	57.9	1
28.6	66.7	1,921	67.0	1
37.2	81.6	2,350	63.0	1
(b) at 60°C				
60.0	3.1	89.3	1.5	1
67.0	3.3	95.0	1.4	1
71.2	2.3	66.2	0.9	1
78.8	3.5	100.8	1.2	1
99.9	5.8	167.0	1.7	1
133.7	7.2	207.4	1.8	1
(c) at room temperature				
60.0	2.9	83.5	1.4	1
67.0	3.0	86.4	1.3	1
89.2	3.7	106.6	1.2	1
71.2	3.2	92.1	1.3	1
91.1	3.8	109.4	1.2	1
69.3	3.3	95.0	1.4	1
(d) at 0°C				
118.9	4.4	126.7	1.1	1
114.3	4.4	126.7	1.1	1
111.8	4.4	126.7	1.1	1
107.4	4.1	118.1	1.2	1
103.5	4.4	126.7	1.2	1
104.6	4.2	121.0	1.2	1
(e) at 0°C and in sulfuric/phosphoric acid mixture (2 : 1 by volume)				
47.8	1.7	49.0	1.1	1
35.0	1.2	34.6	1.0	1
43.7	1.5	43.2	1.0	1
103.8	3.6	103.7	1.0	1
11.7	0.4	11.5	1.0	1
97.8	3.4	97.9	1.0	1

Table 2  
Complete oxidation of copper phthalocyanine blue pigment, phthalimide and phthalic anhydride to carbon dioxide and water using 6N potassium dichromate in sulfuric acid medium

Weight of sample, mg	Titre of 0.1N pot. dichromate ml	Calculated weight, mg	No. of dichromate moles	
			Found	Calcd.
(a) Copper phthalocyanine blue pigment				
28.1	57.1	27.0	19.5	20.3
40.6	84.1	39.7	19.9	20.3
22.1	45.7	21.6	19.9	20.3
23.8	51.5	24.3	20.8	20.3
18.6	39.8	18.8	20.5	20.3
19.0	40.8	19.3	20.6	20.3
(b) Phthalimide				
33.4	63.5	31.3	4.7	5.0
32.6	64.5	31.6	4.8	5.0
27.0	56.5	27.7	5.1	5.0
120.0	235.6	115.5	4.8	5.0
80.1	169.3	83.0	5.2	5.0
86.1	181.6	89.0	5.2	5.0
(c) Phthalic anhydride				
33.6	67.5	33.3	5.0	5.0
37.0	73.4	36.2	4.9	5.0
54.0	106.6	52.6	4.9	5.0
19.6	38.7	19.1	4.8	5.0
36.3	78.0	38.5	5.3	5.0
29.9	61.2	30.2	5.1	5.0



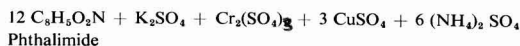
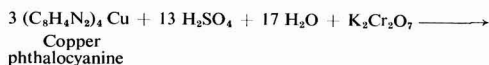
- a - Soda lime trap  
 b - Separating funnel  
 c - 3-neck flask  
 d - Heating mantle  
 e - Double surface-condenser  
 A - CaCl<sub>2</sub> tubes  
 B - Empty trap  
 C - Conc. H<sub>2</sub>SO<sub>4</sub> traps  
 D - Mg. perchlorate U-tube  
 F - Nessbitt tube

Fig. 1. Apparatus for the determination of CO<sub>2</sub> evolved during the oxidation process

Table 3

Gravimetric estimation of carbon dioxide evolved during oxidation of copper phthalocyanine blue, phthalimide and phthalic anhydride

Weight of sample mg	Weight of CO <sub>2</sub> mg		Calculated weight mg	Number of CO <sub>2</sub> moles	
	Found	Calcd.		Found	Calcd.
<b>(a) Copper phthalocyanine blue pigment</b>					
8.8	22.5	21.5	9.2	33.5	32.0
6.0	16.8	14.7	6.9	36.6	32.0
31.3	76.8	76.4	31.4	32.0	32.0
26.2	64.2	64.0	26.3	32.1	32.0
25.3	60.9	61.7	25.0	31.5	32.0
38.0	90.1	92.7	36.9	31.0	32.0
<b>(b) Phthalimide</b>					
65.2	144.3	156.0	59.5	7.4	8.0
62.5	137.0	149.7	56.4	7.3	8.0
52.1	118.1	124.7	48.7	7.6	8.0
21.2	48.7	50.7	20.1	7.7	8.0
27.7	64.3	66.3	26.5	7.8	8.0
34.9	80.6	83.5	33.2	7.7	8.0
<b>(c) Phthalic anhydride</b>					
47.4	104.0	112.7	43.7	7.4	8.0
31.2	67.8	74.2	28.5	7.3	8.0
32.0	69.1	76.1	29.1	7.3	8.0
33.5	76.2	79.6	32.6	7.7	8.0
39.0	91.1	92.7	40.3	7.9	8.0
31.8	72.9	75.9	30.7	7.7	8.0



From the data obtained in Table 1, it can be concluded that controlled oxidation of the pigment to phthalimide with potassium dichromate is greatly affected by the temperature, and the best results are obtained at 0°C. For this reason, replacing part of the sulfuric acid with phosphoric acid would lead to a decrease in the heat of dilution of the acid and consequently might give better results. This prediction is confirmed<sup>18</sup> as shown in Table 1. Better results were obtained and calculation of the relative mean deviation for this set of experiments shows it to be 1.07 per cent, which is much less than that for sulfuric acid alone under the same conditions (13.1 per cent).

More reproducible results were obtained when complete oxidation of copper phthalocyanine blue, phthalimide and phthalic anhydride were carried out with 6N potassium dichromate in 50 per cent sulfuric acid for three hours, as in Table 2. It was clear that the great deviation of results from theoretical values, especially those at higher temperatures, could be due to formation of the carbon dioxide which was detected. Accordingly, phthalimide cannot be the final oxidation product of copper phthalocyanine blue in an acid medium.

From the results in Table 3, the average number of dichromate moles consumed and the average number of carbon dioxide moles evolved when copper phthalocyanine blue, phthalimide and phthalic anhydride (or acid) are oxidised with 6N potassium dichromate solution in 50 per cent (by volume) sulfuric acid medium, are shown in Table 4.

It should be noted that there is no decarboxylation occurring during the oxidation of copper phthalocyanine blue with potassium dichromate, since benzoic acid does not undergo this oxidation under the same conditions.

## Discussion

Ref. 18

The quantitative oxidation of copper phthalocyanine blue with both ceric sulfate and potassium permanganate had been studied previously. Good results were obtained with the former and variable results with the latter oxidising agent. The present work deals with potassium dichromate as an oxidising agent and its behaviour under different conditions.

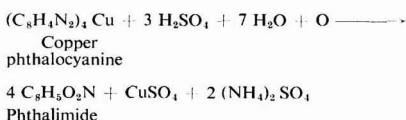
Assuming phthalimide to be the final oxidation product, the hypothetical equation for the oxidation of the pigment with potassium dichromate is as follows:

Table 4  
Analysis of dichromate and carbon dioxide

Substance	Number of dichromate moles consumed		Number of carbon dioxide moles formed	
	Found	Calcd.	Found	Calcd.
Copper phthalocyanine blue	20.2	20.3	32.8	32.0
Phthalimide	5.0	5.0	7.6	8.0
Phthalic anhydride	5.0	5.0	7.6	8.0

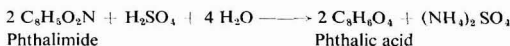
After this survey of the results of the present work, the authors suggest three different steps to explain the oxidation of the pigment in acid medium.

The first step requires only one oxygen atom as in the following equation:



This equation has been proved by the oxidation of the pigment with ceric sulfate and also from the results in presence of a mixture of sulfuric and phosphoric acids at 0°C.

The second step, which requires no oxygen atom since the oxidation of both phthalimide and phthalic anhydride gives the same number of potassium dichromate moles, can be represented by the following equation:

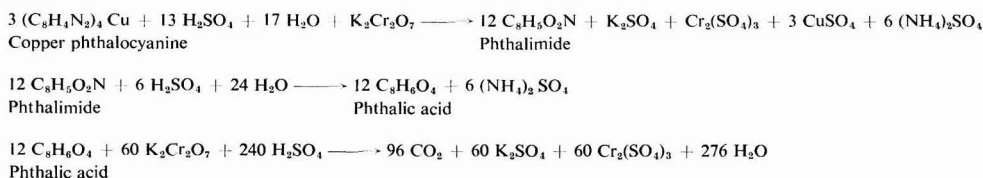


The third step was obtained during the oxidation of phthalic anhydride (or acid) to carbon dioxide; it was shown that each molecule of phthalic acid requires 15 oxygen atoms (5 moles of potassium dichromate) as shown in the following equation:

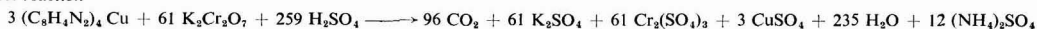


This step probably proceeds through initial hydroxylation, which involves the introduction of a hydroxyl group (activating group) in the benzene nucleus of the phthalic residue. The reaction mechanism and the identification of the reaction intermediates are still under investigation.

The sequence of the oxidation reactions occurring during the oxidation of copper phthalocyanine blue pigment can be represented by the following series of reactions:



Net reaction



## Conclusions

Controlled oxidation of copper phthalocyanine blue pigment to phthalimide is achieved by using 0.1 N potassium dichromate as the oxidising agent and a sulfuric/phosphoric acid mixture as solvent at 0°C. This method gives promising results as a method for the quantitative estimation of the pigment.

Further oxidation of the pigment leads to the evolution of carbon dioxide and this explains the higher results obtained with both potassium dichromate and permanganate.

Accordingly, the pigment is first oxidised to phthalimide, which is then hydrolysed to phthalic acid under the same conditions. Finally, phthalic acid is oxidised completely to carbon dioxide.

[Received 23 June 1973]

## References

- Moser, F. H., Thomas, A. L., "Phthalocyanine compounds," 1963, NY: Reinhold Publishing Cor., p. 2.
- Fleysher, M. H., and Ogilvie, J., US Patent 2,276,175, 1942.
- Dent, C. E., and Linstead, R. P., *J. Chem. Soc.*, 1934, 1027.
- Dent, C. E., Linstead, R. P., and Lowe, A. R., *J. Chem. Soc.*, 1934, 1033.
- Linstead, R. P., and Wesis, F. T., *J. Chem. Soc.*, 1950, 2981.
- Barrett, P. A., *J. Chem. Soc.*, 1939, 1820.
- Cooke, A. H., *J. Chem. Soc.*, 1938, 1774.
- Cahill, A. E., *J. Amer. Chem. Soc.*, 1951, 73, 2847.
- Pederson, C. J., US Patent 2,662,895 1953; CA 48, 4849 (1954).
- Pederson, C. J., *J. Org. Chem.*, 1957, 22, 127.
- Pederson, C. J., US Patent 2,662,896 1953; CA 48, 4849 (1954).
- Ibid.*, US Patent 2,662,892 1953; CA 48, 4850 (1954).
- Ibid.*, US Patent 2,681,347 1954; CA 48, 1803 (1954).
- Baumann, F., Bienert, B., and Rosch, G., US Patent 2,683,643 1954; CA 49, 5850 (1955).
- "Paint Technology Manuals," Part 6, Chapman & Hall, London, 1966, p. 279.
- Vogel, A. I., "A Text Book of Quantitative Inorganic Analysis," 1961, NY: John Wiley & Sons Inc., p. 608.
- Ibid.*, *Idem*, p. 350.
- Salman, A. A., MSc, Thesis, Faculty of Science, Ain Shams University 1971.
- Wilson, C. L., and Wilson, D., "Comprehensive Analytical Chemistry," Vol. I, 1962, NY: Elsevier Publishing Co., p. 141.
- "Standard Methods of Analysis of Iron, Steel and Associated Materials," 1961, London: The United Steel Companies Limited, p. 23.

A1 - Ashox

## Next month's issue

The Honorary Editor has accepted the following papers for publication, and they are expected to appear in the May issue of the *Journal*.

**An appraisal of artificial weathering methods for assessment of the durability of paint films** by *C. E. Hoey and H. A. Hipwood*

**Flow and ageing of polyvinyl chloride pastes** by *Raj K. Khanna*

**Water absorption by polymeric films** by *I. Anzur, U. Osredkar and I. Vizovisek*

## Corrigenda

### Anti-mildew coatings

Dr O. Pauli has advised the following amendments to his paper "Anti-mildew coatings 1. Review" (*JOCCA*, 1973, 56, 285-288).

On page 286 under "Barium metaborate," only reference 6 should have been given.

Under Dithocarbamates on page 287, references 8-13 should read 7-13.

### The determination of copper, mercury and arsenic in antifouling paints by means of X-ray fluorescence

The following alterations should be made to the above paper by C. L. Miniussi and R. H. Perez (*JOCCA*, 1974, 57, 83-87):

*Page 85, column 1, line 12:* "6 seconds" should read "64 seconds".

*Table 1, sample 9:* The value for  $D^2$  should be 0.04.

*Page 87, paragraph 3:* The four concentrations given as "g<sup>1</sup> l<sup>1</sup>" should read "g l<sup>-1</sup>".

*Page 87, paragraph 4:* "10 per cent mercury" should read "10 per cent mercuric oxide".

# Reviews

## Epoxy resins chemistry and technology

Edited by C. A. May and Y. Tanaka

Marcel Dekker Inc., New York, 1973. Pp xii + 801. Price \$59.50.

This comprehensive review of epoxy resins is covered by twelve chapters which have been contributed by competent experts, ranging from the purely academic to the industrial technologist. A good balance has been achieved by the contributors and this reflects creditably upon the joint editors.

The book is not intended as a first introduction to epoxy resins but it will prove to be invaluable to the chemists, physicists and technologists, already familiar with this class of compounds. Polymer and resin chemists will find the first four chapters, extending over three hundred pages, an excellent source of reference to the synthesis of epoxies, their curing reactions and the modifiers and curing agents which have been evaluated to date. Chapter two, dealing with the synthesis and characteristics of epoxy resins, carries a total of 719 references, and this thorough attention to the published literature, with one notable exception, is maintained throughout the book. Physical properties are reviewed in chapter five, followed by chapters dealing with epoxy resin adhesives, epoxy resin coatings, electrical and electronic applications, epoxy laminates, epoxy plasticisers and polymer stabilisers. Analytical procedures are covered by chapter eleven and the final chapter is devoted to toxicity, hazards and handling methods.

The chapter concerned with epoxy resin coatings is perhaps the most disappointing section, for it gives only brief coverage of this major industrial outlet for more than 50 per cent of all manufactured epoxy resins. In thirty-four pages, including the introduction and a mere thirty-two references, it speeds through the various coating outlets and often refers to outdated and cumbersome formulations. A two-pack epoxy polyamide maintenance paint lists fourteen components in the base portion alone, and the only formulations offered in the powder coating sections refer to products manufactured by resin kettle mixing or by dry blended ball mill techniques.

Nevertheless, the polymer chemist will be more than satisfied by the technical content of this massive volume, and the double space printing and easy to read type make this an essential addition to the reference library shelf.

S. T. HARRIS

## Progress in polymer science, Japan

Vol. 3 S. Okamura and M. Takayanagi (Eds.), 1972, pp. xxii + 388. Price £8.15

Vol. 4 K. Imahori and Y. Iwakura (Eds.), 1972, pp. x + 278. Price £7.00

Halstead Press; Tokyo, New York, London

But for a single blemish, of which more anon, these volumes maintain the high standard set by their predecessors (*see JOCCA*, 1973, 56, 458).

In Volume 3 the emphasis on polymerisation by radical mechanisms seen in the earlier volumes is transferred to ionic and co-ordination processes. Four papers are devoted to these topics, the remaining three being concerned with structure and properties. Few, if any, surface coatings manufacturers with captive resin facilities have so far ventured into ionic and Ziegler-Natta techniques so the papers on these subjects will be of only passing interest to all but the polymer science enthusiasts. The chapter on polypeptides related to collagen is fascinating but again is unlikely to offer much to surface coatings technologists in general. It is the remaining two chapters, by Wada and Hayakawa on relaxation processes, and by Nagasawa and Fujimoto on the preparation, characterisation and viscoelastic properties of branched polymers, which will be those most likely to persuade readers to buy this volume. The first of these reports studies on the mechanical and dielectric relaxation of partially crystalline polymers and, in discussing their interpretation in terms of modern theories, postulates (on questionable grounds, some may think) the co-existence of crystalline, amorphous and "intermediate" phases in such systems. The branched polymers treated in the second of these papers are those having relatively long branches including comb, cruciform and star structures in which this reviewer has several times expressed interest.

Volume 4 contains five papers, three on synthesis and two on structure and properties, all but the last (on metallo-enzyme models) being of direct interest to *JOCCA's* readers. Yoda *et al.* present another chapter in the story of thermo-stable polymers, concentrating on those prepared by cyclo-polycondensation, though there is a disappointing lack of quantitative results. Iwakura *et al.* provide a strong stimulus to the imaginative resin formulator in their brief review of pseudoxazolones, of their ring opening reactions and of their copolymerisation with oxygen. Okawara *et al.* disappoint with their paper on polymers containing reactive functional groups. Some interesting new syntheses are presented but the treatment is superficial and, for the first time in this series, the editors seem to have fallen down on their job. Block and graft polymers, so long in the commercial doldrums, are now very much in the news and the contribution by Kawai *et al.*, which is largely concerned with domain formation, is timely and should be compulsory reading for any serious student of the modern polymer scene.

A. R. H. TAWN

# Information Received

## Chemicals EDC announces new studies

The Chemicals Economic Development Committee has decided to form a new working party under the chairmanship of Mr S. Woodhams, to establish and supervise sector groups for the major product areas of the industry. A specially important group will cover the organics (including petrochemicals) sector—enabling the EDC to keep in direct touch with the providers of essential base chemicals and intermediates.

The organics sector group will liaise with the Energy Advisory Group recently established by the National Economic Development Office to assess the result of the changed energy prospects. This will provide a basis for consultation with the chemical industry about its energy problems.

Other sector groups would cover inorganics, pharmaceuticals, toilet preparations, paint, soap and detergents, synthetic resins and plastics materials, synthetic rubber, dyestuffs and pigment and fertilizers.

## English China Clays offers titanium dioxide substitute

In order to offset a world shortage of titanium dioxide, English China Clays of St Austell has increased production of its "M100" high performance pigments extending clay and is promoting it to paint manufacturers as a part substitute for titanium dioxide. M100 is a calcined clay which the makers claim gives improved brightness, opacity and scrub resistance compared with most other extenders.

## Revertex to build liquid butadiene telomer plant

As a result of a successful technical and commercial development of the "Lithene" liquid butadiene telomers, Revertex Limited is building a plant at its Stallingborough, Lincolnshire, site. The plant is due on stream in Autumn 1974. In addition, to assist in process development and to support market development in the UK and Europe, a new pilot plant is operating at Stallingborough.

## New caprolactam plant in Iran

National Petrochemical Company (Iran), Bayer AG and Inventa AG für Forschung und Patentverwertung (Zurich/Switzerland) have signed a statement declaring their intention of setting up in Iran a caprolactam production plant in the form of a joint venture. The capital investment is expected to be in the order of US \$125 million. NPC will hold 50 per cent, Bayer 35 per cent, and Inventa 15 per cent of the new company's shares.

## Ambosol sales to Hoechst UK

The sale of synthetic magnesium silicate under the trade name "Ambosol" has been transferred by mutual agreement from Chemitrade Limited, Berkeley Square, London W1, to the Chemicals Division of Hoechst UK Limited, Hounslow, Middlesex.

## Allied Chemical Corporation centred in Haasrode

Allied Chemical Corporation has now consolidated its European headquarters at Haasrode in the Louvain Industrial Research zone. Previously, its operations were established in three locations in the greater Brussels area.

## Literature

### Laboratory instruments from Copley

A new illustrated product list containing over 80 illustrations and covering a range of general and specialised laboratory instruments is now available from F. Copley & Sons of Nottingham. Instruments include moisture testers, thermostats, washing machines for glassware, microscopes and balances.

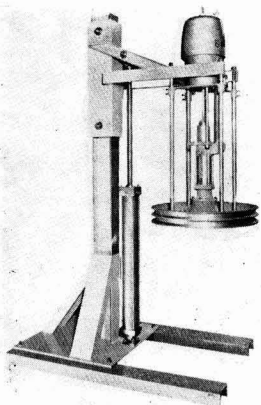
### Polymer emulsion testing

Vinyl Products Limited, Carshalton, Surrey, has recently published a new edition of its Technical Service Report G2 summarising the company's tests used in the quality control of "Vinacryl" and "Vinamul" polymer emulsions.

## New products

### Steetley filling machine

The Industrial Equipment Department of the Steetley Company Limited has developed a fully automatic filling system complementary to its "Karr" and "Graco" semi-automatic filling units.

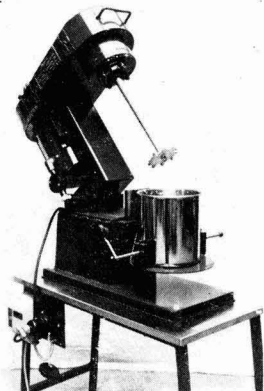


### A new single post ram mounting for Graco transfer pumps

The Industrial Distribution Department can now supply a new single post ram mounting for Graco transfer pumps for emptying more easily straight sided mixing vessels. Emptying rates depend on the product, but will generally be between one and ten gallons per minute.

## Laboratory disperser

A new variable speed disperser, model "LVS 10-1", which is being marketed by Russell Finex Ltd., has been designed specially for laboratory use. It is powered by a 1hp motor operating on 400/440 volts three-phase current and has a speed range of 1,500 to 6,500 rpm.



### The Russell-Finex disperser for laboratory work

### Spex

Glen Creston, Stanmore, Middlesex, has launched a multi-purpose spectrometer/monochromator/spectrograph. In its simplest form this instrument, the "Spex 1870", is a high-resolution 1/6.9 spectrometer/monochromator covering a wide spectrum from ultra-violet to infra-red and having digital readout of wavelength in Angstrom units. By placing a camera at the exit port, the spectrometer is converted to a spectrograph. The latest addition to the many accessories is a vibrating mirror for time-resolved derivative or correlation spectra, or continuous line-to-background ratios. Accessories are interchangeable between the new instrument and earlier Spex models.

### Apex dosing units

A range of fully packaged automatic dosing units, each comprising a low-pressure polypropylene storage tank with a top mounted dosing pump is now being marketed by Apex Fluid Equipment Limited, Wembley, Middlesex. The system is known as the Apex "Doset" and the storage tanks range from 60 to 1,000 litres capacity, with other sizes available to order.

### New glaze stains from Degussa

The Ceramic Colours Division of Degussa, Frankfurt am Main, has introduced the following new basic stains: 203 10572 green (Cr-Mg-Co-Zn-Al), 203 10576 intensive green (Cr-Al-Co), 203 10577 blue-green (Al-Co-Cr), 202 20415 cobalt blue (Co-Al-Si), 203 30419 praseodymium yellow (Zr-Si-Pr), 203 30420 spectral yellow (Zr-Si-Pr), 201 30424 amber yellow (Zr-V), 203 80058 violet (Sn-Cr-Ce).

### Hull

#### New developments in colour instrumentation

A meeting was held on Monday 7 January at the Dorchester Hotel, Hull. The Section chairman, Mr F. D. Robinson, introduced Mr R. P. Best of Instrumental Colour Systems Limited, who gave a lecture entitled "New developments in colour instrumentation."

Mr Best commenced with a short account of the physics associated with the measurement of colour, explaining how the sensation of colour experienced by the observer was related to the energy spectrum of the illuminant, the sensitivity of the eye and the nature of the specimen.

Discussing colour measurement by reflectance spectrophotometry, Mr Best stated that it is important to obtain accurate results at low reflectance values. In some instruments, the quantity of stray light received by the detector could sometimes exceed that reflected from the specimen and in modern instruments the quantity of stray light was calculated by an associated computer and automatically deducted from the measured reflectance.

The lecturer referred briefly to commercially available spectrophotometers and colorimeters and then reviewed the use of the analogue computer, COMIC, for colour matching. This had been used successfully with pale tints where the scatter coefficients of the minor constituents could be ignored,

### Newcastle

#### Masonry coatings

A meeting was held in the Royal Turks Head Hotel, Newcastle upon Tyne, on 3 January, when Mr G. W. Rothwell, of the Building Research Establishment, presented a paper on masonry coatings.

Mr Rothwell began by outlining the main criteria for the successful coating of masonry, as well as the reasons for the increasing necessity for them. The need for surface cleaning was stressed, particularly where mould releasing agents had been used for pre-cast units. Blasting had been found to be the only really successful method. Where a system required a sealer, the correct choice was critical since this could lead to very premature failure. As a general rule, solvent types had been found to be superior to emulsion types due to the latter's initial high water sensitivity.

Fungal growth was also discussed; solution of the basic

### Scottish

#### A trade journalist speaks his mind

Mr D. Eddowes, editor of *Polymers Paint and Colour Journal*, gave a talk entitled "A trade journalist speaks his mind" on Thursday 17 January 1974.

He first indicated the different approaches of trade journals and the national press, and the influence that each had in their respective fields.

Recalling that he had first visited Scotland some 25 years ago as a liaison officer for the Paint Research Station, he drew comparisons between the situation in the paint and related industries at that time and the present. He mentioned especially the many mergers that had occurred and queried

but less successfully when this assumption was no longer realistic. With the introduction of digital computers for the solution of colour difference equations, time shared computers had been popular at first, but the trend was now towards in-house mini computers.

The lecture was followed by a discussion period, after which a vote of thanks for an excellent lecture was proposed by Mr A. J. Ford. The meeting was attended by 18 members and 10 visitors.

J.A.H.

#### The Humber bridge construction

A joint meeting with the Institute of Chemical Engineers South Humberside Group was held at the Barrow Haven Inn, Lincolnshire, on Thursday 13 December when Mr J. H. Hyatt, of Freeman Fox and Partners, gave a lecture on the construction of the Humber bridge.

The high interest which the lecture aroused in the audience of about 40 people was reflected in the range of questions which were put to Mr Hyatt during the discussion period. A vote of thanks for a most enjoyable lecture was proposed by Mr F. D. Robinson.

J.A.H.

problem by the method of construction was always preferable in Mr Rothwell's experience, due to the limited time during which fungicides had been found to be effective.

Various test methods for alkali resistance, weathering, discolouration and flexibility were discussed. Whilst accelerated weathering was thought to be of limited use, various trends in discolouration, staining and chalking could be detected.

In general, textured coatings were found to be superior to smooth coatings in terms of cracking properties. The presence of fibres had, in practice, been found not to impart any useful properties.

The talk was well illustrated with colour slides and a number of interesting questions were raised. A vote of thanks was proposed by Mr C. N. Finlay.

J.B.

whether or not some of them had been worthwhile and successful.

Attempting to give some indication of trends in the paint industry during 1974, he commented on the existing raw material situation which appeared to him to present some anomalous features.

Going on to the development of technology within the industry, he criticised the slow adoption of polyurethane and powder coatings in the UK compared with Europe, and the reluctance of most companies to develop into fields outside coatings which, nevertheless, demanded similar know-how and processing techniques. Finally, he commented

briefly on the function and future of the Paint Research Association and OCCA.

In the ensuing discussion, it was noted that despite the various mergers and closures which had occurred, small specialised paint companies continued to be formed.

## West Riding

### Epoxy resin curing agents

A meeting was held on Tuesday 8 January 1974 at the Griffin Hotel, Leeds. Dr C. G. Tilley, of Anchor Chemical Co. Ltd., presented a paper on the subject of epoxy resin curing agents.

Dr Tilley outlined the factors influencing the choice of curing agents with regard to the properties of the resin/curing agent system in both the uncured and cured states. Aliphatic polyamines were among the earlier materials to find application as curing agents, although they had tended to be replaced by derivatives such as polyamides and adducts with epoxides, acrylics, and ketones etc.

A number of cyclo-aliphatic polyamines were available and the range had increased over the past 4-5 years. Their rate of reaction with epoxy resins was slower than that of the straight aliphatic amines. They would give a full cure at elevated temperatures but some modification was required for curing at room temperature. Commonly used additives were salicylic acid as an accelerator and benzyl alcohol as a diluent and flexibiliser. Chemically modified types were now becoming of some importance.

As to the future of the industry, one speaker suggested that by the end of the year, the natural forces of supply and demand were likely to bring about some stabilisation of the raw material situation both in terms of availability and price.

G.H.R.

Aromatic amines had been growing steadily in importance. They were almost all solids and were of importance in heat cured structural applications but had been adapted for use with liquid resins at room temperature. Particular characteristics were that they had a longer pot life than aliphatic amines, and could be varied over a wide range by the choice and amount of accelerators such as phenols or organic acids.

Other compounds used included heterocyclic and tertiary amines. Dicyandiamide had found increasing use in powder coating formulations and laminates. This curing agent when used unmodified gave systems having a very long pot life and requiring heat cure. For use in powder coatings, it was normally accelerated with, for example, imidazole, although there was some loss of properties.

Dr Tilley pointed out that he had made little or no reference to many other curing agents, some of which, for example polyamides, were very widely used.

A vote of thanks was proposed by Mr T. Apperley.

R.A.C.

## Notes and News

## Register of Members

The following elections to membership have been approved by Council. The Section to which new members are attached is given in italics.

### Ordinary Members

- ARMER, DOUGLAS MORTIMER, 6 Howard Close, Dunchurch, Rugby, Warwicks. (*Midlands*)
- BARRELL, JACK, AMCST, MIOP, 143 Heywood Road, Castleton, Rochdale, Lancs. OL11 3BS. (*Manchester*)
- BEARD, DEREK, ARIC, PhD, 55 Riverside Road, Eaglesham, Renfrewshire G76 0DQ. (*Scottish*)
- BRAIDWOOD, CAMERON, 44 Hart Street, Linwood, Renfrewshire. (*Scottish*)
- CLEMENT, JACQUES, PCUK, 25 Boulevard de l'Amiral Bruix, 75782 Paris Cedex 16, France. (*General Overseas*)
- CROMBIE, CLARK, 188 Copland Road, Glasgow G51 2UN. (*Scottish*)
- DARLING, ANTHONY EDWIN, 9 Shepherds Way, Wellington Park, Crowthorne, Berkshire. (*Thames Valley*)
- DAVIES, BARRY, 85 Shaw Head Drive, Failsworth, Manchester. (*Manchester*)
- FORD, HAROLD PETER, 32 Denham Way, Denham, Bucks. (*Thames Valley*)
- GRIFFITHS, OWEN DAVID, 4 Orpington Villas, Newbridge Road, Hull. (*Hull*)
- HARDING, PETER, LRIC, API, 80 Cleveland Road, Midanbury, Southampton SO2 2AD. (*London*)
- HARRIES, CLEDWYN RONALD STEPHEN, BSC, 14 Turmore Drive, Welwyn Garden City, Herts. (*London*)
- HARTY, DAVID BASIL, 15 Greenoaks Avenue, Sherwood Hills, Campbelltown, NSW 2560, Australia. (*General Overseas*)
- IBBETSON, PETER LESLIE, 18 Norfolk Gardens, Duffield Road, Derby. (*Midlands*)
- LANG, JAMES, 37 Cochran Street, Paisley, Scotland. (*Scottish*)
- LEE, CHANG HO, Sejong Chemical Co. Ltd., 151 Sarihyun-Ri, Byukje-Myun, Goyang-kun, Kyungki-Do, Korea. (*General Overseas*)
- LOOI, WENG YUN, BSc, No. 385 Jalan 17/19, Happy Garden, Petaling Jaya, Selangor, Malaysia. (*General Overseas*)
- MCILWRAITH, JOHN RODGER, BSc, 26 Montcliffe Road, Chorley, Lancs. PR7 0EW. (*Manchester*)
- MILES, ALAN KENNETH, PhD, 21 Earnsdale Avenue, Darwen, Lancashire. (*Manchester*)
- NOLAN, MICHAEL MELVYN, 109 Greenwood Estate, Togher, Cork, Ireland. (*Irish*)
- PERCY, ERIC JAMES, PhD, 150 Ridge Langley, South Croydon, Surrey CR2 0AS. (*London*)
- STEED, DEREK ELLIS, 2863 Ritterhude bei Bremen, Stendorfer Strasse 5, West Germany. (*General Overseas*)
- STREATFIELD, GORDON ROBERT, BSc, ARIC, Blythe Colours Ltd., Cresswell, Stoke-on-Trent. (*Midlands*)
- WELLUM, J. F DE C, BSc, 12 The Green, Elston, Newark, Notts. (*Midlands*)
- WEZELBURG, TH. D, Saenredamstraat 32, Assendelft, Holland. (*General Overseas*)

### Associate Members

- MEDCALF, DESMOND, 1 Cowper Drive, Dublin 6. (*Irish*)
- OFFORD, ROBERT GEORGE WILLIAM, 46 Worple Road, Staines, Middlesex. (*London*)



# HARDMAN'S

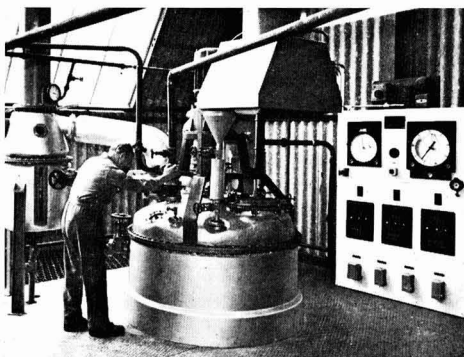
## varnishes

Illustrated is part of additional Plant recently installed to give an essential boost to our varnish production. This will give us the necessary capacity to meet the ever-increasing demand.

Each batch is monitored by Honeywell control panels which ensure uniformity of quality, to your own specifications or our own formulations.

Please write for full information giving details of your special requirements, to :-

**E. HARDMAN, SON & CO. LTD.**  
 Bedford Street, Hull. Tel. 0482 23902  
*'Varnish Makers to the Paint Industry'*



**AT YOUR SERVICE** to develop finer, more durable products

The fast, economical weather tests of

**SUB-TROPICAL TESTING SERVICE, INC.**

established 1929

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

Our 45th year



Send for free  
 Sub-Tropical colour  
 brochure

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

*(List of representative clients given upon request)*

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

Mr. C. Hubbard Davis, President, Sub-Tropical Testing Service, Inc. Phones: (305) 233-5341 - 235-3111  
 P.O. Box 876, 8290 S. W. 120th Street, Miami, Florida, U.S.A. 33156 Cable: SUBTROPIC, Miami

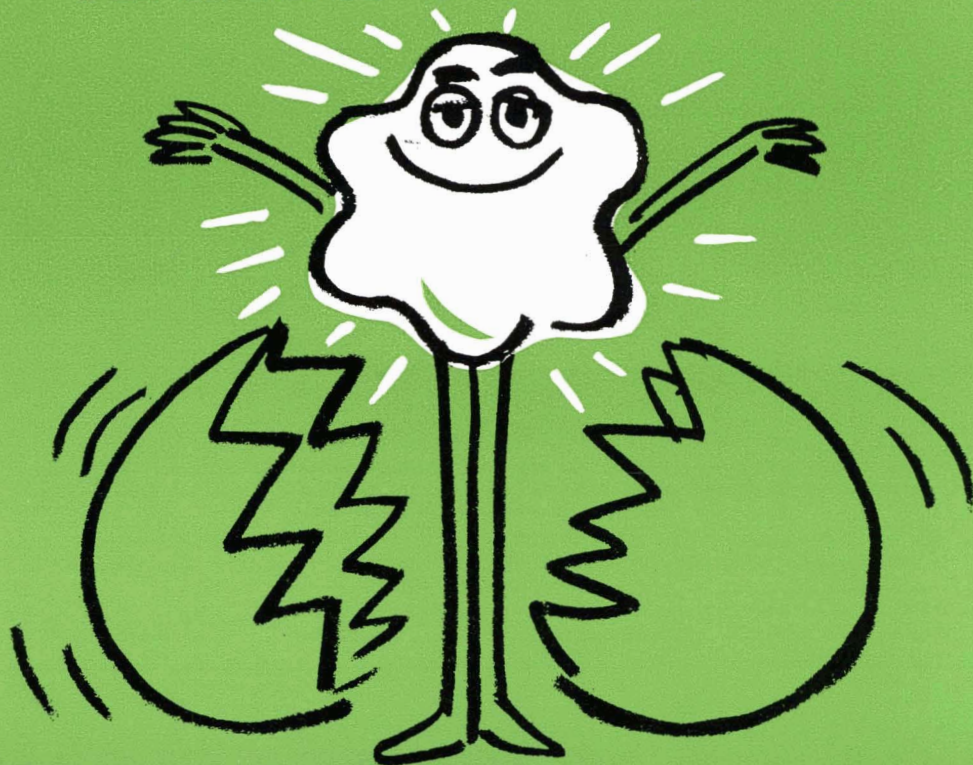
The technical resources of Resinous Chemicals, one of Britain's leaders in the field, are now teamed up with those of the parent company, Farbwerke Hoechst of Germany. The result is a range of resins offering advanced qualities, performance and scope of application which are unrivalled in Europe. RCL-Hoechst resins help put the gloss and durable toughness into surface coatings for a host of modern products such as cars, washing machines, fridges etc., and they also provide modern printing inks with extra colour retention, viscosity, rapid setting and gloss. Full details and

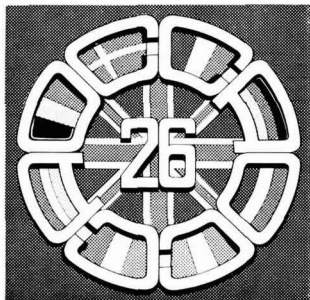


data sheets from Resinous Chemicals Division, Wellington Mills, Dunston, Gateshead NE11 9HQ, County Durham.

# RCL

# RCL AND HOECHST ARE PROUD TO ANNOUNCE THE BIRTH OF EUROPE'S MOST ADVANCED RANGE OF RESINS





## OCCA 26 Exhibition Preview

### Shortages of raw materials enhance the value of this unique forum for technical display and discussion in the surface coatings industries

23-26 April 1974, Empire Hall, Olympia, London

Never has the value of the Association's annual Technical Exhibition been so apparent as during the present shortage of raw materials for the surface coatings industries, since the Exhibition provides a unique forum for technical discussion between the personnel using these resources and the suppliers. Grasping this opportunity to explain to the technical personnel in the industries the optimum use of those resources available, many companies are using this splendid platform to show how they are helping their clients during these critical times.

At the Exhibition this year, over 120 companies from the United Kingdom and 13 overseas countries (Australia, East Germany, Finland, France, Holland, Hungary, Italy, Poland, Romania, Spain, Switzerland, USA and West Germany) will be represented.

Manufacturers of resins, pigments, extenders, additives, solvents, oils, machinery, laboratory machinery, and instruments and other miscellaneous items will be present, as shown in graphical form later in this preview.

In addition, there have been numerous requests from intending visitors throughout the world for advance copies of the Official Guide to the Exhibition, although the Association wishes it to be known that copies of this publication will be freely available at the entrance to the Exhibition hall.

The Association is particularly pleased to be welcoming to its Exhibition a delegation of Japanese paint manufacturers who will want to discuss arrangements for production under licence in Japan.

#### Aims of the Exhibition

The Exhibition Committee wishes the aims of the Exhibition as stated in the Invitation to Exhibit, to be as well known as possible, and accordingly these are reproduced below.

The aim of the Exhibition is the presentation of technical advances in those industries supplying the paint, varnish, printing ink, colour, linoleum and other allied industries. The technical advances may relate to: new products, new knowledge relating to existing products and their uses, or in suitable cases, existing knowledge which is not generally available in the consuming industries.

The Committee stipulates that exhibitors present a technical theme—i.e. to display in a technical manner the technical develop-

ments in raw materials, plant or apparatus illustrated by experimental evidence. It is essential that a technically or scientifically trained person who has full knowledge of the products displayed, be available on the stand throughout the official hours of opening.

Whilst the Committee naturally encourages the showing of new products, it does not stipulate that a new product has to be shown each year, since it fully appreciates that there are occasions when this is not possible. Accordingly, the Committee draws attention to the fact that new technical data on existing products are regarded as acceptable subject matter.

#### International character

The Exhibition, which has long been known as the forum for technical display and discussion for the surface coatings industries, in 1973 attracted visitors from more than 50 overseas countries. The motif chosen for this year's Exhibition shows the flags of the enlarged European Economic Community and, by converging on the flag of the UK, symbolises the welcome extended for many years to exhibitors and visitors not only from these countries, but from farther afield to the OCCA Exhibitions in London, one of the capital cities of the European Economic Community. To further the aim of a truly international character, the Exhibition is widely advertised in technical journals both at home and overseas. Furthermore, it has been the practice for many years to issue information cards in six languages (English, French, German, Italian, Spanish and Russian) and these are widely distributed to firms and individuals in many countries. Interpreters are available at the Exhibition without charge to help both exhibitors and visitors alike.

#### Official Guide

Copies of the Official Guide have been despatched to all members of the Association, in the UK and abroad, to chemists and technologists in Europe, to technical colleges, to embassies, and chambers of commerce and, through the courtesy of the trade associations, to companies in the paint, printing ink and pigment industries in the UK. Any intending visitor may obtain a copy of the Official Guide, without charge, from the Association's offices. (Telex: 922670 OCCA Wembley; Telephone: 01-908 1086). (Due to production difficulties as a result of the three-day working week in Great Britain, the Official Guide was published later than would normally be the case.)

#### Hours of opening

There is no charge for admission to the Exhibition which will once again take place in the Empire Hall, Olympia, London W14, and will be open on the following dates and times:

Tuesday 23 April	..	09.30-18.00hr
Wednesday 24 April	..	09.30-18.00hr
Thursday 25 April	..	09.30-18.00hr
Friday 26 April	..	09.30-16.00hr

(Please note times)

#### Exhibition Dinner

Following the success of the Exhibition Dinner on the opening day in 1973, the Committee has decided to hold a Dinner at the Savoy Hotel, London WC2, on Tuesday 23 April at 19.00 for 19.30 hrs. At the request of some exhibitors, a cash bar will be made available after the function for those visitors wishing to use this facility. Applications for tickets are now being accepted at the Association's offices.

#### Travel and accommodation

The Underground train service will operate at 10- to 15-minute intervals to Olympia from Earls Court (District and Piccadilly lines), the first train leaving Earls Court at 09.00 and the last train leaving Olympia at 19.00 hours.

The Wayfarers Travel Agency Ltd., Cranfield House, 97-107 Southampton Row, London WC1B 4BQ, will be allocated a stand facing the OCCA Information Centre at the Exhibition and will be prepared to advise on, and arrange, hotel accommodation and travel facilities to the Exhibition. They will also be able to make theatre ticket reservations for the evenings of the Exhibition.

#### Visits

Much interest has been aroused by the suggestion that Sections of the Association in the UK should arrange parties, on the lines of works visits, to the Exhibition, since this would afford a much cheaper form of travel for many of the younger members. Non-members will be able to take advantage of this facility if there were places available, and those wishing to have further information on this facility should write to the Association's offices as soon as possible, in order that they may be put into contact with the Section Secretary nearest to their place of residence.

#### Admission

There will be no charge for admission to the Exhibition and, in order to assist the increasing number of both overseas visitors and exhibiting companies, interpreters will

again be in attendance. Amongst the facilities available at the Empire Hall is the Empire Restaurant (with luncheon facilities) and two licensed buffets. A special bar is available for exhibitors.

#### Banking and Postal Services

National Westminster Bank Limited has been allocated Stand 11 where full facilities will be available, including the cashing of cheques and receipts of credit, and the encashment of foreign drafts and notes, travellers' cheques and letters of credit. Credits for the cashing of cheques should be established at the West Kensington Branch of National Westminster Bank Limited, 85 Hammersmith Road, London W14, through visitors' and exhibitors' own bankers.

A Post Office Self-Service Suite will be available in the Great Hall for the sale of postage stamps and letter cards. A postbox will also be provided and collections will be made at intervals during the hours of opening. Public telephones are situated by the escalators.

#### Technical Education

As in previous years, a Stand will be devoted to Technical Education, and invitations have been extended to schools to send parties of senior science students to the Exhibition on the mornings of 24, 25 and 26 April, when they will be given a short introductory lecture by members of the Association in a separate lecture room before visiting the Exhibition. The Technical Education Stand will be staffed by representatives from the Association, technical colleges and trade associations, and details will be shown not only of courses available in the technology of the industries but also of the optional professional grade recently introduced by the Association for its Ordinary Members.

The theme of the stand this year will be "Powder coating". A leaflet with this title has been specially prepared and copies will be freely available on the stand.

#### Information Centre and Overseas Visitors

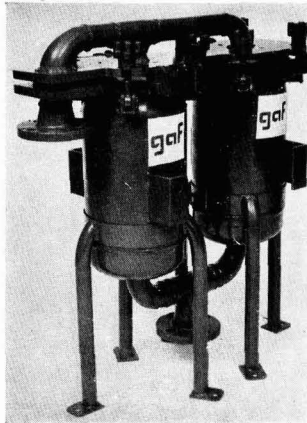
The OCCA Information Centre (Stand 18) is placed opposite the main entrance with the Interpreters (Stand 17) on one side and the Technical Education stand (Stand 19) on the other. In front of the Information Centre is one of the three seating areas which are a special feature of this Exhibition, allowing visitors an opportunity to read literature from the stands and write notes at ease. Many overseas visitors find it convenient to meet their friends at the Information Centre and the OCCA staff and the interpreters will be only too pleased to assist them in this way. The use of the public address system to find visitors is restricted to one announcement each hour (on the hour) and those wishing to use this service should give in the name of the visitor(s) concerned to the OCCA staff and make a point of being at the Information Centre when the announcement is broadcast. Overseas visitors are particularly requested to sign the special Visitors' Book at the Information Centre.

## News of Exhibitors

### GAF (Great Britain) Limited

#### Stand 46

It is expected that the new "Gaflo® RB2-A" mild steel pressure vessel will be available for the Exhibition, and will be displayed for the first time in Europe.



The new Gaflo RB2-A

### KG Dr-Ing Herbert Knauer & Co. GmbH

#### Stand 42

In addition to those items mentioned in the Official Guide, there will also be shown the new British made "Deer" variable stress rotational rheometer.

This instrument embodies several new principles of design, not the least of which is a substantially frictionless support for the rotating member and this, combined with the variable stress function, allows for the first time the sensible measurement of creep and yield values.

### Jacobson van den Berg & Co. (UK) Ltd.

#### Stand 51

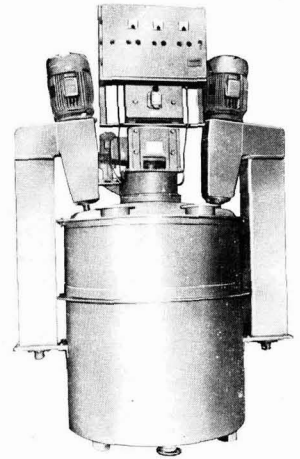
A representative from Lindeteves-Jacoberg, Frankfurt offices, will also be on the stand.

### Urachem International

#### Stand 16

The Urachem Division of Unilever acquired recently for the European market the sole distribution rights for the complete range of organic peroxides manufactured by US Peroxygen, a division of Witco Chemical Corporation, USA.

Marketing of the peroxides in Europe will be carried out through the Unilever operating companies: Scado BV, Holland; Synthetic Resins, UK; and Sheby SA, France.



The re-styled Mastermix PMD heavy duty paste mixer/disperser. The Mastermix Engineering Company will be exhibiting this and other machinery on stand 14.



Vinyl gloss paint based on Scott Bader's "Polidene 33-061" vinylidene chloride copolymer emulsion was used for the finish on the door in the photograph above. The Scott Bader display, on stand 56, will illustrate details of progress in the production of deep colours, exposure results, levelling and further improvements in viscosity control for vinyl gloss paint based on "Polidene 33-061".

**TELEPHONE MESSAGES** During the "build up" period before the Exhibition, messages can be recorded at Olympia on (01) 603 0921 through the courtesy of Recordacall Limited.

# Plan view of the Exhibition Hall at Olympia

## NEW EXHIBITOR—STAND 30

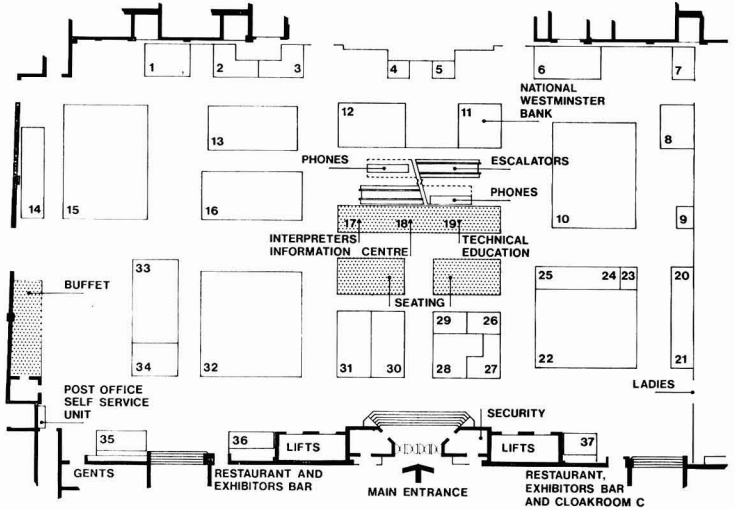
Sangamo Weston Controls Ltd., North Bersted, Bognor Regis, Sussex PO22 9BS

### *The Weissenberg Rheogoniometer*

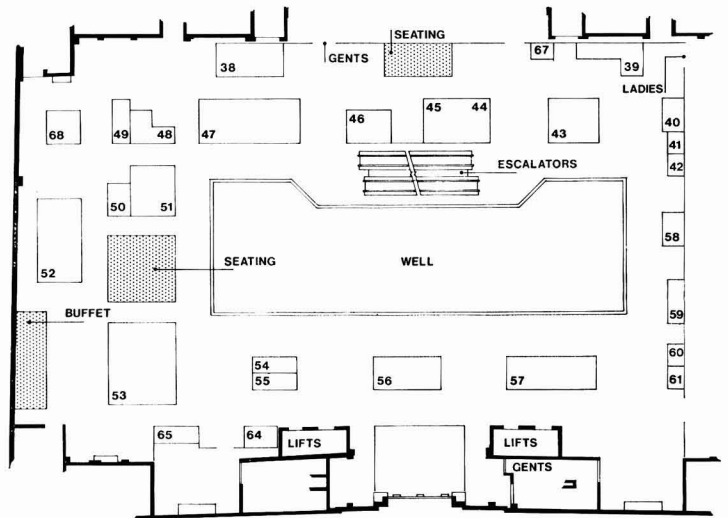
A sophisticated laboratory instrument for the complete determination of rheological properties of a wide range of materials. Measurements can be made under steady shear or oscillatory shear conditions or the two in combination. Available platen geometries include simple cone and plate, Mooney and Couette arrangements etc. Complete with solid state electronic measurement and recording equipment.

### *Transducer systems*

A range of transducers for measurement of load, pressure, displacement and proximity complete with associated electronic equipment. This includes power supplies, signal conditioning, level alarms, analogue or digital displays and recording equipment, automatic scanning and data logging.

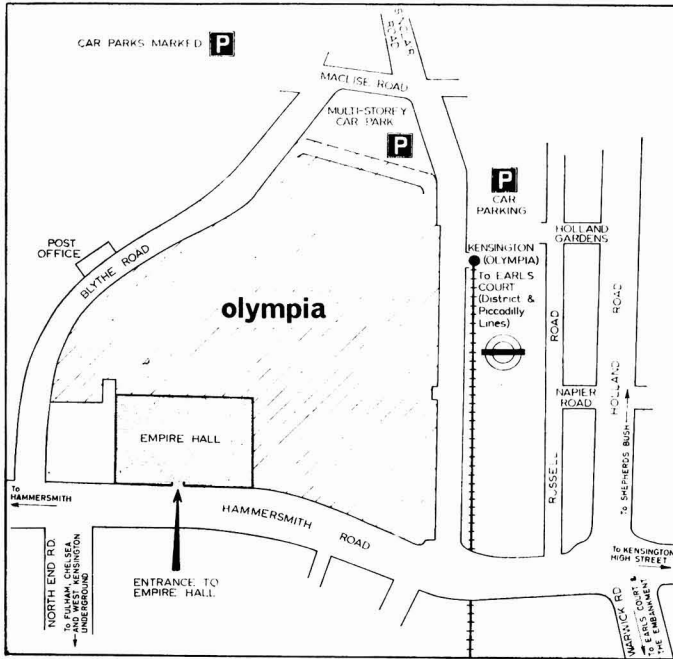


## GROUND FLOOR



## FIRST FLOOR

**Plan of Olympia**



1. For those travelling by road, there are limited car parking facilities available in the multi-storey car-park, the entrance to which is from Maclise Road, and in the British Rail car-park, access to which is from Russell Road.
2. Visitors arriving at the West London Air Terminal may board District Line trains to Earls Court, from which station a special Underground train is available at 10—15-minute intervals to Olympia.
3. Olympia can be reached from main line stations by travelling on the Underground to Earls Court, which is on the District or Piccadilly Line, and changing to the special train.
4. There are also a number of bus routes which serve Olympia:  
 Bus Nos.: 9, 27, 28, 49, 73, 91.  
 Green Line Coaches Nos.: 701, 702, 704, 705, 714 and 716A.
5. There is a Motorail Terminal at Olympia and those wishing to transport their cars should contact British Rail.

**Numerical list of Exhibitors—OCCA 26**

For position of stand, please refer to plan view of the Exhibition Hall on page 145

*Stand*

- 1 Elcometer Instruments Ltd.
- 2 R. H. Cole Ltd.
- 3 Mikropul Ltd.
- 4 Research Equipment (London) Ltd.
- 5 Alexander Cardew
- 6 Jenag Equipment Ltd.
- 7 Tin Research Institute
- 8 Willy Bachofen
- 9 Fischer Instrumentation (GB) Ltd.
- 10 Laporte Industries Ltd.
- 11 National Westminster Bank Ltd.
- 12 Torrance & Sons Ltd.
- 13 Rohm & Haas (UK) Ltd.
- 14 Mastermix Engineering Co. Ltd.
- 15 Buhler-Miag (England) Ltd.
- 16 Urachem International
- 17 Interpreters
- 18 Information Centre
- 19 Technical Education
- 20 Draiswerke GmbH

*Stand*

- 22 Montedison
- 23 Microscal Ltd.
- 24 Maschinenfabrik Heidenau VEB
- 25 Marchant Bros. Ltd.
- 26 Wayfarers Travel Agency Ltd.
- 28 Anchor Chemicals Ltd.
- 29 Ciech Polifarb
- 30 Sangamo Weston Controls Ltd.
- 31 D. H. Industries Ltd.
- 32 Toioxide International Ltd.
- 33 Joseph Crosfield & Sons Ltd.
- 34 Swada (London) Ltd.
- 35 William Boulton Ltd.
- 36 Toioxide International Ltd.
- 37 G. J. Erlich Ltd.
- 38 Chemolimpex
- 39 SCC Colours Ltd.
- 40 Carl Zeiss (Oberkochen)
- 41 John Godrich Ltd.
- 42 KG Dr-Ing Herbert Knauer & Co. GmbH
- 43 Imeco (Arcode)



**Constant quality control  
keeps Carless ahead**

**CARLESS**  
FOR HYDROCARBONS

CARLESS SOLVENTS LTD · LONDON · Telephone: 01-985 5500 · Telex: 261071



## More than just a new name.

From now on you will meet Vinoflex MP 400 – an old and tried friend – only under its new name:

**Laroflex MP.**

Laroflex MP is available in several grades; the number following the name gives value (mean viscosity) / (mPa.s) for a 20% solution in toluene, thus:

**Laroflex MP 35**  
**Laroflex MP 45**  
**Laroflex MP 60**

The name is changed, but the properties are as valuable as ever.

Laroflex MP is the only non-saponifiable vinyl chloride copolymer for weatherfast, washable, acid-resistant and alkali-resistant paints; in other words, the material to use for coatings that can be

relied on for long-lasting protection against corrosion.

Laroflex is a  
BASF registered trademark.

BASF United Kingdom Limited  
P. O. Box 4  
Earl Road, Cheadle Hulme  
Cheshire  
SK8 6QG  
Tel. 061-4857181

**Your partner in progress**

**BASF**

CDL-3035 E





Stand No.	Exhibitor	Resins	Pigments	Extenders	Additives	Solvents	Oils	Machinery	Laboratory Machinery	Instruments	Miscellaneous
38	Chemolimpex .. .. .	•			•						Organic peroxides
29	Ciech Polifarb .. .. .										Polish information stand. Literature regarding paints and lacquers
2	Cole, R. H., Ltd. .. .. .	•			•						Grinding media
44	Cray Valley Products Ltd. .. .. .	•							•		
33	Crosfield, Joseph, & Sons, Ltd. .. .. .			•							Matting agents. Anti-caking agents
31	D. H. Industries Ltd. .. .. .							•	•		
59	Diffusion Systems Ltd. .. .. .									•	
20	Draiswerke GmbH .. .. .							•			
53	Eastman Chemical International AG .. .. .	•			•						Products for powder coating formulations
1	Elcometer Instruments Ltd. .. .. .									•	
37	Erllich, G. J., Ltd. .. .. .							•	•		
9	Fischer Instrumentation (GB) Ltd. .. .. .									•	
46	GAF (GB) Ltd. .. .. .							•	•		Filtration equipment
60	Godrich-Chemcol .. .. .							•			
41	Godrich, John .. .. .								•		
68	ICI (Organics) Ltd. .. .. .				•						
43	Imeco .. .. .										Literature from Rumania
49	Industrial Colours Ltd. .. .. .		•								
54	Instrumental Colour Systems Ltd. .. .. .									•	
51	Jacobson Van Den Berg & Co. (UK) Ltd. .. .. .	•		•	•		•	•			Dispersions. Eva emulsions. Pva beads
6	Jenag Equipment Ltd. .. .. .							•	•		
52	Kingsley & Keith (Chemicals) Ltd. .. .. .		•	•	•	•					
42	Knauer, Dr. Ing. Herbert, & Co., GmbH .. .. .									•	
64	Kollmorgen (UK) Ltd. .. .. .									•	
45	Langer, Georg M. .. .. .				•						
10	Laporte Industries Ltd. .. .. .		•		•						
25	Marchant Bros. Ltd. .. .. .							•	•		
24	Maschinenfabrik Heidenau VEB .. .. .							•			
14	Mastermix Engineering Co. Ltd. .. .. .							•	•		
23	Microscal Ltd. .. .. .									•	
3	Mikropul Ltd. .. .. .							•			
67	Mixing & Dispersion .. .. .										Annual reference publication
22	Montedison Group .. .. .		•								
65	Polymers Paint & Colour Journal .. .. .										Journal and technical books

Stand No.	Exhibitor	Resins	Pigments	Extenders	Additives	Solvents	Oils	Machinery	Laboratory Machinery	Instruments	Miscellaneous
4	Research Equipment (London) Ltd. ..									•	
13	Rohm & Haas (UK) Ltd. .. ..	•									
39	SCC Colours Ltd. .. ..		•								
56	Scott Bader Co. Ltd. .. ..	•									
61	Strazdins Pty. Ltd. .. ..							•			Dispensing machines
47	Sun Chemical Corporation .. ..	•	•		•						
34	Swada (London) Ltd. .. ..		•								Daylight fluorescent concentrates and soluble toners
7	Tin Research Institute .. ..				•						Wood preservatives. Antifouling paints
32, 36	Tioxide International Ltd. .. ..		•								
12	Torrance & Sons Ltd. .. ..							•	•		
55	Torsion Balance Co. (GB) Ltd. .. ..									•	
16	Urachem International .. ..	•									
26	Wayfarers Travel Agency .. ..										Travel and accommodation
58	Winter Osakeyhtio .. ..							•			Tinting system
50	Worsdall Chemical Co. .. ..	•									
40	Zeiss, Carl (Oberkochen) Ltd. .. ..									•	

## Annual General Meeting 1974 and one-day symposium

### "Optimum use of resources in the surface coatings industries"

The Council wishes to announce the preliminary arrangements which have been made for the holding of a one-day symposium in conjunction with the Paintmakers Association of Great Britain on the occasion of the Association's Annual General Meeting, 1974.

The Association's Annual General Meeting will take place at 5.30 pm on 26 June 1974 at University College London; a notice allowing for the nomination of the three Elective Members of Council was sent to Members attached to the United Kingdom, Irish and General Overseas Sections earlier this year and completed forms must be returned to the Association's offices not later than 1 May 1974. The notice will also give the first information concerning the one-day symposium which is being arranged at the same time on a techno-commercial subject, the general heading of which is "The Optimum Use of Resources in the Surface

Coatings Industries". It is envisaged that the first session will take place from 10.00 am to 12.30 pm. Following a Reception, Luncheon will be taken at 1.00 pm and the second session will be arranged from 2.00 pm to 5.00 pm. Dinner will be taken at 7.00 pm following a Reception at 6.30 pm. It is stressed that it is not necessary for those who wish to attend only the Annual General Meeting to register for the symposium. The Agenda, Voting Paper and Annual Report will be circulated to Members in the usual way approximately six weeks before the date of the Annual General Meeting. Council has arranged the inclusive charge for the symposium, which will include both Luncheon and Dinner, Conference badge's, etc., to be £20 plus £2 VAT. Further information, including details of papers to be given will be published in the *Journal*. The Paintmakers Association will be sending application forms to their members. Non-members, who are welcome to attend the symposium, can obtain application forms from the Association's offices.

## Association Dinner Dance 1974

Earlier this year members attached to the United Kingdom, Irish and General Overseas Sections were sent the application form for the Association's Biennial Dinner and Dance to be held on Friday 31 May 1974 at the Savoy Hotel, London WC2R 0EU.

The Reception will take place at 7.00 pm for Dinner at 7.30 pm and, on this occasion, there will be two short speeches only—a Welcome by the President and a Reply on behalf of the guests—so that dancing, to the Jerome Orchestra, can commence as soon as possible and continue until 1.00 am.

The price of single tickets is £7.00 plus 70p VAT each and applications should be made by Members as soon as possible. Tables will be arranged to accommodate 12 or 10 persons each, although it may be possible to arrange a few tables for eight persons. Non-members wishing to receive forms should contact the Association's offices.

## Professional Grade

Amendments to regulations for admission to the optional professional grade for Ordinary Members

At its meeting on 26 February 1974 the Council accepted the recommendation of the Professional Grade Committee in respect of the periods of Ordinary Membership to be completed before admission to the professional grade.

The amendments, which take place immediately, reduce the obligatory periods as Ordinary Members for candidates for Associateship and Fellowship to two years in all cases, i.e. amending the regulations C9 and D2 as last printed in the *Journal* (page 463, September 1973).

Forms of application for admission to the professional grade may be obtained from the Association's offices.

## Midlands Section

### Trent Valley Branch

#### Visit to Bird's Ltd. Bakery

A visit, arranged with the ladies in mind, was made by a party of 20 members and wives to Bird's Ltd., Bakery, Ascot Drive, Derby on Thursday 17 January 1974. After a comprehensive tour of the factory that covered all types of bakery and cooked meats, the party was entertained to tea and cakes in the canteen. Mr J. R. Bourne, the Branch Chairman, thanked Mr Bird, Director, for a very interesting afternoon and as the party left each member was given a box of assorted fancy cakes.

### News of Members



A. E. Darling

Mr A. E. Darling, an Ordinary Member attached to the Thames Valley Section, has joined SCC Colours Ltd. as marketing manager after 14 years with the ICI Paints Division at Slough. His responsibilities will include research, statistics, forecasting, pigment development, product information and publicity.

## Federation of Societies for Paint Technology

### Annual Convention 1973



The photograph shows the President, Mr L. H. Silver, presenting a tankard on behalf of the Association to Mr Robert Matlack, the retiring Executive Vice President of the Federation at its Annual Convention in Chicago in November 1973.

## Forthcoming Events

Details are given of meetings in the United Kingdom up to the end of the month following publication and South Africa and the Commonwealth up to the end of the second month.

### April

#### Thursday 4 April

*Midlands-Trent Valley Branch:* Annual General Meeting followed by a lecture on "Colour television" by a speaker from Pye Television Ltd., Cambridge, to be held at British Rail School of Transport, London Road, Derby, at 6.30 p.m.

*Newcastle Section:* Annual General Meeting to be held at the Royal Turks Head Hotel, Grey Street, Newcastle upon Tyne.

*Thames Valley Section:* Annual General Meeting to be followed by a talk on "Windsor Castle" by Mrs G. Grove.

#### Friday 5 April

*Manchester Section:* Annual General Meeting, at the University of Manchester Institute of Science and Technology, Sackville Street, Manchester, at 6.30 p.m.

#### Tuesday 9 April

*West Riding Section:* Annual General Meeting to be held at the Griffin Hotel, Leeds, at 7.30 p.m.

#### Wednesday 17 April

*Scottish-Eastern Branch:* "North sea oil" speaker from the Scottish Council of development and industry.

### Friday 19 April

*Irish Section:* Annual General Meeting to be held at the Clarence Hotel, Dublin, at 8.00 p.m.

*Midlands Section:* Annual General Meeting to be held at 6.30 p.m. in the Birmingham Chamber of Commerce and Industry, PO Box 30, 75 Harborne Road, Birmingham B15 3DH.

### Tuesday 23 to Friday 26 April

OCCA 26 Technical Exhibition, Empire Hall, Olympia, London.

### Friday 26 April

*Bristol Section:* Annual General Meeting to be held at the Royal Hotel, Bristol, at 7.15 p.m.

### May

#### Thursday 2 May

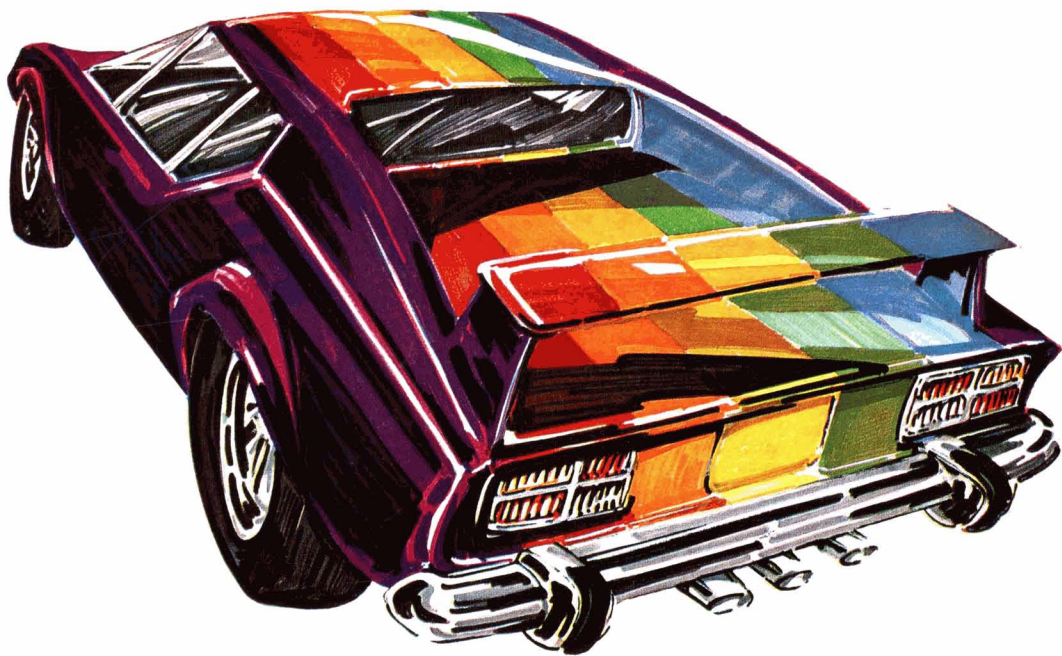
*Thames Valley—Student Group:* "Some thoughts on the future of solvents in coatings" by Mr. C. J. Nunn, Shell Research, Egham, to be held at the Main Lecture Theatre, Slough College, at 4.00 p.m.

#### Friday 31 May

Association Dinner Dance, Savoy Hotel, London WC2.

## **CIBA-GEIGY Pigments for Automotive finishes**

®Irgazin Yellow 2GLT  
Irgazin Yellow 3RLTN  
Irgazin Yellow 2RLT  
®Cromophtal Yellow A2R  
®Irgalite Orange GR  
Cromophtal Brown 5R  
Cromophtal Scarlet R  
Cromophtal Red A3B  
Cromophtal Bordeaux RS  
Irgazin Violet 6RLT  
Cromophtal Violet B  
Irgazin Blue 3GT  
Cromophtal Blue A3R  
and a comprehensive range  
of phthalocyanine  
blues and greens



**CIBA-GEIGY**

Pigments Division  
*A member of the UK Plastics and Additives Group*  
CIBA-GEIGY (UK) Limited Roundthorn Estate Wythenshawe Manchester M23 9ND

**okay . . . raw materials  
are difficult to find**

**but . . . you do find**

**STAND 16**

**of urachem international the  
export section of urachem  
division.**

**Understanding people wanting to  
assist you in this critical situation.**

**Scado B.V.**  
P.O. Box 615  
Zwolle Netherlands

**Sheby**  
P.O. Box 21  
95870 Bezons France

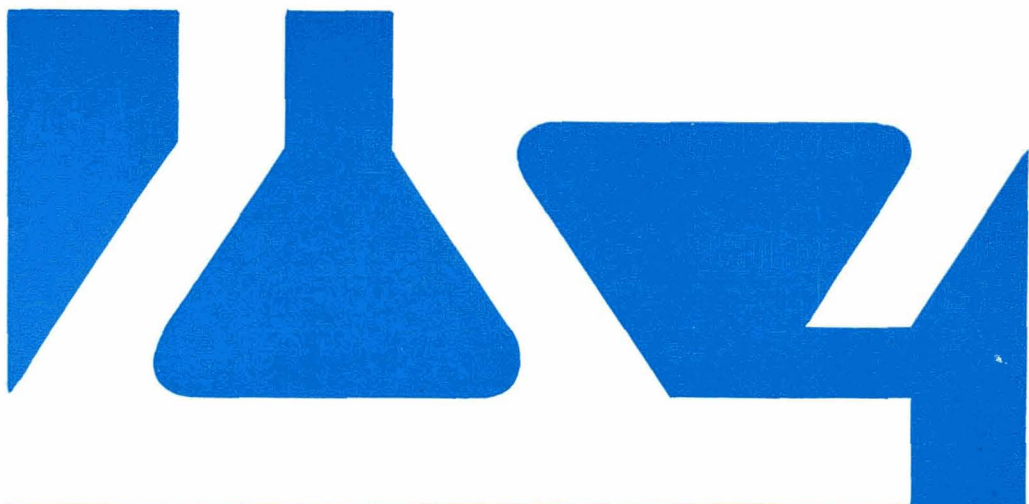
**Stabilital S.p.A.**  
260 Via Verdi  
21042 Caronno Pertusella  
Varese Italy

**Synthetic Resins Ltd.**  
Edwards Lane Speke  
Liverpool L24 9HR  
England

**Vinyl Products Ltd.**  
Mill Lane Carshalton  
Surrey England

**urachem international**  
P. O. Box 82 Zaandam Netherlands





## but . . . we're here to help you

By the way, you are on **urachem division** space now.

Almost as easily as turning this page, we can turn to manufacturing companies in six european countries utilising urachem technology.

This ensures you the best delivery schedules . . . and the best products too –

– surface coating resins – polymer emulsions – printing ink resins – polyester resins – plasticisers – stabilisers and other plastics additives.

**Scado B.V.**  
P.O. Box 615  
Zwolle Netherlands

**Sheby**  
P.O. Box 21  
95870 Bezons France

**Stabilital S.p.A.**  
260 Via Verdi  
21042 Caronno Pertusella  
Varese Italy

**Synthetic Resins Ltd.**  
Edwards Lane Speke  
Liverpool L24 9HR  
England

**Vinyl Products Ltd.**  
Mill Lane Carshalton  
Surrey England

for export enquiries:  
**Urachem International**  
P.O. Box 82  
Zaandam Netherlands

**Unilever's**  
**urachem division**  
leaders in european resin technology





La femme d'aujourd'hui  
Die moderne Frau

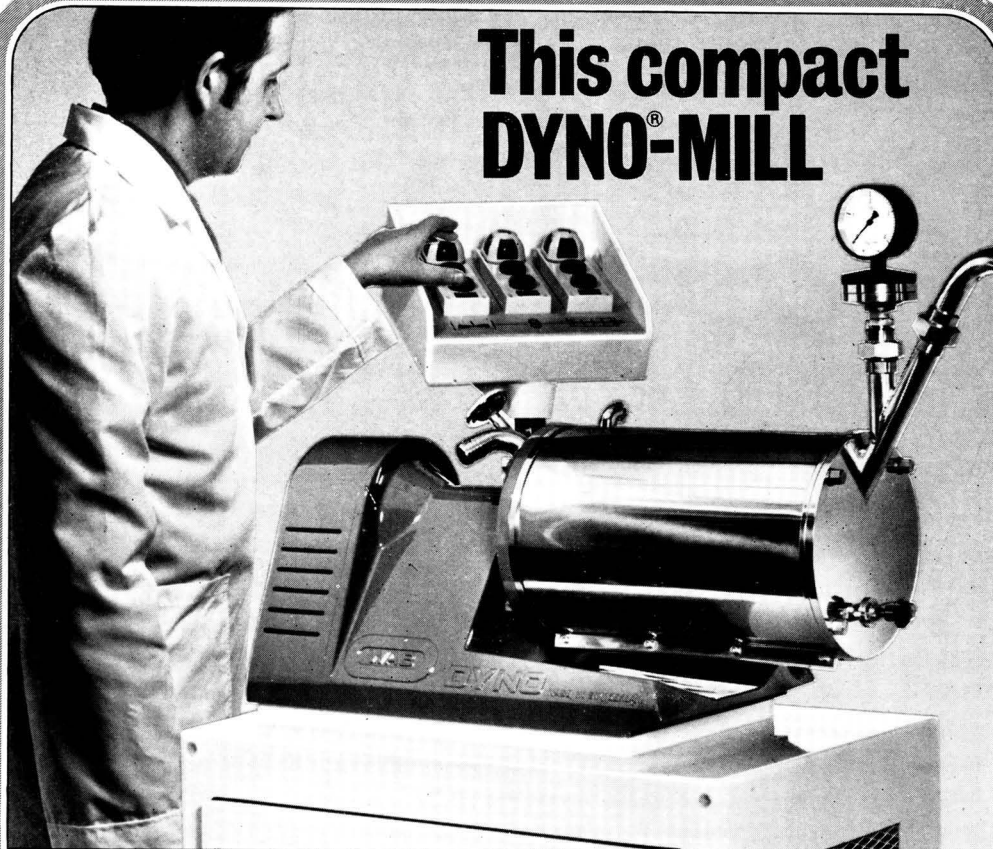
TODAY'S GIRL

**Polly Dean**  
is certainly today's girl.

And **POLIDENE**  
vinylidene chloride copolymer base  
for vinyl gloss paint is certainly today's  
material. A word of advice however.  
When you visit Scott Bader on Stand 56  
at the OCCA exhibition, ask for one of  
our technical staff, not Polly Dean.

**SCOTT BADER**  
MANUFACTURERS OF POLIDENE





## This compact DYNO<sup>®</sup>-MILL

**...grinds and disperses  
PAINTS, PRINTING INKS, PIGMENTS, ENAMELS  
at rates up to 750 litres per hour**

- \* Unmicronized powders milled to *finest* particles *at least twice as fast* as in conventional machines.
- \* Uniform particle size within close limits.
- \* Completely enclosed system excludes air, prevents evaporation of solvents, offers greater safety and cleaner working conditions.
- \* Extremely rapid cleaning with minimum use of solvent. No need to change containers for different products.
- \* Materials of construction available for all types of applications. All parts easily interchangeable.

- \* Free standing. Occupies much less floor space than equivalent size of vertical machines.
- \* DYNO - Mills available from 2 to 2000 litres per hour.

For further information, prices and *trial milling* contact the U.K. sole distributors and service organisation:



**GLEN CRESTON**

37 The Broadway, Stanmore, Middx HA7 4DL,  
England. Telephone: 01-954 4218.  
Telegrams: Glencrest Stanmore.

Enquiries outside the U.K. and Eire, please address direct to the manufacturers:

**WAB WILLY A. BACHOFEN**

Mfg. Engineers, Dept. of Application Technology, CH 4000  
Basle 5, Switzerland. Telephone: 061-33 55 55. Telex: 62564.

# SACRIFICE

**a second to hear about the  
sacrificial protection offered  
by ZINCOLI ZINC DUST...**

**The efficiency of zinc coating, the best and most reliable method of protecting steel, is based on this mechanism:- the zinc acts as an anodic metal to the steel which has become the cathode of galvanic cell. The zinc sacrifices itself for the protection of your steel.\***

Which is the more noble metal ?

## ZINCOLI ZINC DUST

GIVES STEEL REAL APPEAL — RUSTLESSLY

\* have you got your copy of the 'Zincoli zinc dusts' booklet?  
If not, ask:-

### MORRIS ASHBY LIMITED

10, Philpot Lane, London, E.C.3. Telephone: 01-626 8071.

**AD** AMALGAMATED OXIDES (1939) LIMITED.

Victoria Works, Dartford, Kent.

STOLBERGER ZINCOLI GmbH,

519 Stolberg/Rhld., Postfach 725, Cockerillstrasse, West Germany.



## A F SUTER & CO LTD

SWAN WHARF 60 DACE ROAD LONDON E3 2NQ  
Telephone 01-986 8218/9 Telegrams Suterresin London E3 2NQ

### SHELLACS

#### Swanlac Bleached (Whitelac)

Transparent (dewaxed) BS 1284:1960  
Waxy BS 1284:1960  
Modified  
Lac Esters  
Hydrolysed Shellacs

#### Shellacs, Machine and Native Made

Dewaxed and Decolourised  
Orange and Lemon  
Button  
Garnet  
Seed

### WATER GUMS

Acacia or Arabic  
Ghatti  
Guar  
Karaya  
Tragacanth

### WAXES

Bees  
Candelilla  
Carnauba  
Ceresine  
Earth  
Fibre  
Japan  
Montan  
Paraffin  
Shellac

### RESINS

Accroides or Yacca  
Spirit Manilla Copals  
Damars  
Kauri  
Mastic  
Rosin  
Sandarac  
Benzoin  
Elemi

Agents for ANGELO SHELLACS

## introduction to paint technology

The sales of this Association publication now exceed 16,000, and now includes an eleventh chapter entitled "Recent Development." The book contains 204 pages including 11 line diagrams, 8 photographs of common paint defects, and comprehensive index.

To keep the price of this book at its present low level, it is essential to reduce book keeping to a minimum. Copies of this book will only be supplied if remittance is sent with the order. Accredited Bookseller's discount: 25%

Copies are available, at £2.00 (post free in UK), from the Association's offices.

# PROGRESS IN ORGANIC COATINGS

AN INTERNATIONAL REVIEW JOURNAL

A new international journal summarizing and analysing significant developments in the field of organic coatings (paints, varnishes, inks, adhesives, etc.):

- Chemical, Physical, and Technological Properties
- Methods of Preparation, Manufacture, and Application
- Performance and Testing

Managing Editor:  
W. Funke

Consulting Editors:  
H. Burrell  
P. Fink-Jensen  
A. R. H. Tawn

Subscription price  
S Fr. 137.50  
4 issues per volume

For sample copies and further details please contact:

**ELSEVIER SEQUOIA S.A.**

P. O. Box 851

1001 Lausanne 1

Switzerland

# We can be very different.



When anyone says KRONOS, often he simply means titanium dioxide. He's right, and yet he's wrong.

You know us as suppliers of over 30 different titanium dioxides.

But do you know us as suppliers of over 15 different organic and inorganic titanium compounds, too? Of 13 different gelling agents for organic and aqueous systems? Of five different pigments for corrosion and flame protection?

Do you know us as suppliers of permanent white, iron sulfate, special titanates?

Get to know us even better. Write or phone.

KRONOS TITANIUM PIGMENTS LTD.  
St. Ann's House  
Wilmslow, Cheshire SK9 1HG, U.K.  
Tel.: Wilmslow 29511, Tx.: 669055

## KRONOS®



**Why  
the world's  
largest  
manufacturers  
of carbon black  
are also the  
most helpful**

Because we know that most carbon black problems need a TOTAL answer. Such as formulation and processing assistance, and test method development and control.

Also best methods of bulk handling, e.g. pellet breakdown assessment, minimising pollution risks, etc. Bucket elevator designs must be considered, and an appraisal of storage requirements.

And of course, technical reports and market intelligence. So that when CABOT sell you carbon black, you not only receive a better black through the results of our unique flame technology, but an exceptional before and after sales service.

We welcome your enquiries.

 **CABOT CARBON LIMITED**

**LEES LANE STANLOW ELLESMERE PORT CHESHIRE**

Tel: 051-355 3677 Telex: CABLAK, STANLOW No. 62261



# INDEX TO ADVERTISERS

<b>A</b>			
Anchor Chemical Co. Ltd.	.. .. .	Cover	
Ashby, Morris, Ltd.	.. .. .	xxiv	
<b>B</b>			
Banner, Samuel, & Co. Ltd.	.. .. .	xiv	
BASF Ltd.	.. .. .	xviii and inserts	
BIP Chemicals Ltd.	.. .. .	xii	
Berger Resinous Chemicals Division	.. .. .	xvi	
<b>C</b>			
Cabot Carbon Ltd.	.. .. .	xxvii	
Carless Solvents Ltd.	.. .. .	xvii	
Chemolimpex	.. .. .	xiii	
CIBA-GEIGY Pigments	.. .. .	xix	
Cory, Horace, & Co. Ltd.	.. .. .	x	
<b>E</b>			
Elsevier Sequoia SA	.. .. .	xxv	
<b>F</b>			
Färg och Lack	.. .. .	vi	
<b>G</b>			
Glen Creston Ltd.	.. .. .	xxiii	
<b>H</b>			
Hardman, E., Son & Co. Ltd.	.. .. .	xv	
<b>I</b>			
ICI Organics Division	.. .. .	iv	
<b>J</b>			
Jenag Equipment Ltd.	.. .. .	i	
<b>K</b>			
Kemira Oy	.. .. .	vii	
Kronos Titan GmbH	.. .. .	xxvi	
<b>M</b>			
Metchim & Son Ltd.	.. .. .	vi	
Microscal Ltd.	.. .. .	v	
Mitchell, W. A., & Smith Ltd.	.. .. .	Cover	
<b>O</b>			
OCCA—Australia	.. .. .	xiv	
<b>S</b>			
Scott Bader Co. Ltd.	.. .. .	xxii	
Sherwin Williams Chemicals	.. .. .	Cover	
Strazdins, A., Pty. Ltd.	.. .. .	lii	
Sub-Tropical Testing Service Inc.	.. .. .	xv	
Sun Chemical Corp.	.. .. .	ii	
Suter, A. F., & Co. Ltd.	.. .. .	xxv	
<b>T</b>			
Tioxide International Ltd.	.. .. .	viii	
<b>U</b>			
Urachem	.. .. .	xx, xxi	
<b>V</b>			
Veba Chemie AG	.. .. .	xi	

Classified Advertisements are charged at the rate of 75p per line. Advertisements for Situations Wanted are charged at 20p per line. A box number is charged at 20p. They should be sent to the Director & Secretary, Oil & Colour Chemists' Association, Priory House, 967 Harrow Road, Wembley, Middlesex HA0 2SF

## SITUATIONS VACANT

### THE HAWILUX PAINT COMPANY OF TEHERAN, IRAN

requires a

#### PAINT CHEMIST

for research and production work in their Industrial Finishes Laboratory and Production Department; and a

#### PAINT TECHNICIAN

for production and application work in their Household Paints Department (Synthetic Enamel and Emulsion Paints), and Wood Finishes Department (Polyester, Acid-cure, NC-Lacquers).

Applicants should have appropriate qualifications and ability to achieve RESULTS. Previous experience in the paint industry of at least 6 to 8 years is required.

Applications should be made in writing, giving full personal details and experience, together with salary conditions, and should be addressed to:

**HAWILUX CO. LTD. (Private),**  
Personnel Manager,  
PO Box 14/1618,  
Teheran, Iran.

**TiO<sub>2</sub> consultant** with plant experience wanted by organization free of international tie ups to aid development of pigment which will produce nib free finish (haze free gloss). Please send résumé of recent background to

CMP, 174 Bd Haussmann, 75008 Paris, France who will forward.

**Ink maker** with complete knowledge of chemistry of printing inks, vehicles, resins, characteristics of pigments and all phases of sheet and web offset lithography to work under present technical director until his retirement. Subsequently assume technical directorship of ink manufacturing company in Chicago USA. Submit complete resume stating age, experience, background, etc. to:

President, Handschy Chemical Company, 2525 N. Elston Avenue, Chicago, Illinois 60647 USA.

## MISCELLANEOUS

### COLOUR COMPARATOR

Reflectance colorimeter for textile, paper, paint, leather and other colour industries. Enables sensitive comparison of test and standard surfaces even for dark materials. Has XYZ tristimulus filters. Read-out with test expressed as percentage of standard, or direct reading of XYZ tristimulus values. Can test for metamerism.

Price £350, plus VAT

W. Harrison, 74 Liverpool Old Road, Much Hoole, Preston PR4 4QA. Tel: (0772) 612462.

**Single or triple roll laboratory mill wanted**  
Enquiries to:

Mr M. Povah (Painting Section)  
Salford College of Technology,  
Frederick Road, Salford 6, Lancs.



**He may be joking, but we are not!**

## In fact.

We are a major producer of general chemical additives. And the U.K.'s biggest name in curing agents for epoxide resins.

But that doesn't rule out personal service. If you come to us with a problem, you'll not only be given technical literature. You'll also be given the answer.

Anchor produce aromatic amines, phenolic and accelerated amines, adducts, polyamides and BF<sub>3</sub> complexes for use in epoxy coatings, encapsulations, laminates, floorings and filament winding. And many more. All in a wide variety of grades for widely varying applications. If you'd like to see an Anchor Technical Representative, send the coupon. We promise, he'll never laugh at your problems.

**We make the difference**

Anchor Chemical Co. Ltd., Clayton,  
Manchester, M11 4SR. Tel: 061-223 2461.



**See us on Stand No. 28 at OCCA  
Exhibition, Olympia 23-26 April**

To: Anchor Chemical  
Co. Ltd., Clayton,  
Manchester.

- Please send me your Technical Data Sheets.
- Please arrange for a Technical Representative to call.

Please tick applicable box.

Name

Position

Company

Address

Tel. No.

CLIPPING  
AGENTS  
FOR  
EPOXIDE  
RESINS  
ANCHOR  
CHEMICAL  
LIMITED



SHERWIN WILLIAMS CHEMICALS

# PRESENTS

SEE



**MOLY-WHITE® 101 and 212**

Unique zinc molybdate  
paint compounds... non-toxic...  
inhibit corrosion

SEE



**REFLEX BLUE**

The amazing compound  
that makes black printing inks  
look blacker

SEE



**COBRATEC®**

An aromatic triazole  
that inhibits corrosive attacks  
on copper and its alloys



See them all at  
**the Kingsley & Keith**  
**Stand No. 52 during**  
**the OCCA Exhibition**

If you can't see them at the Exhibition, contact the  
Sherwin Williams Chemicals representative located nearest you  
or write Sherwin Williams Chemicals, International Sales Division,  
260 Madison Avenue, New York, New York 10016.  
Phone (212) 532-5806.



Cable: "SHERWIN" NEW YORK. InteleX: "SHERWIN" 420303