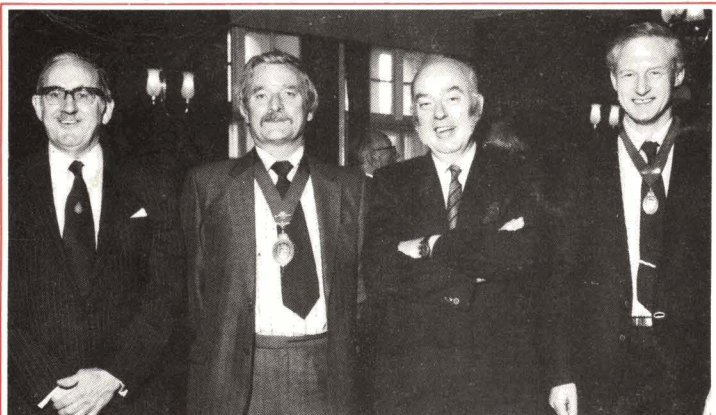




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*Parliamentary Under Secretary of State for Education addresses AGM Luncheon. See page 336*

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**SECTION  
 PROGRAMMES  
 FOR 1982-83  
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see page 345

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- |  |   |
|--|---|
| (I) Formulation including manufacturing etc.   | (II) The efficient use of coatings application            |
| (III) The use of computers in surface coatings | (IV) Maintenance of quality and prediction of performance |

Following the innovation at the 1981 Conference there will be a discourse session included in the fourth technical session.

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Vol. 65 No. 8 August 1982



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## Transactions and Communications

# Water-soluble epoxy vehicles

By N. Krishnamurti, M. M. Shirsalkar and M. A. Sivasamban

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### Summary

Water-soluble epoxy vehicles have been prepared which have produced paints with good gloss and anticorrosive properties. The paints can serve as economical single coat systems, having

the combined properties of primers as well as top coats. Application can be by brush, spray or dip coating methods without any resulting film defects.

### Keywords

*Raw materials for coatings  
binders (resins, etc.)*

epoxy resin  
methacrylate resin  
styrene resin

*plasticizers*

castor oil fatty acids

*raw materials used in manufacture or synthesis of  
ingredients for coatings*

acrylic acid  
castor oil dehydrated

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

accelerated corrosion test  
impact test

*Properties, characteristics and conditions primarily  
associated with*

*dried or cured films*

gloss  
hardness

### Milieux de suspension époxydes solubles à l'eau

#### Résumé

On a préparé des milieux de suspension époxydes, à partir desquels des peintures ayant de bonnes caractéristiques anticorrosives et de brillant peuvent être formulées et utilisées en tant que des systèmes monocouches économiques. Ces peintures

possèdent les caractéristiques d'une primaire en même temps d'une peinture de finition, elles peuvent être appliquées par brossage, pistelage ou trempage sans aucun défaut de film.

### Wasserlösliche Epoxidbinderlösungen

#### Zusammenfassung

Wasserlösliche Epoxidbinderlösungen wurden hergestellt, worauf Beschichtungen, die gute Glanz- und Korrosionsschutz-eigenschaften besitzen, formuliert werden können. Diese Beschichtungen lassen sich als preiswertige Einschichtsysteme

diene, die die Eigenschaften eines Grundanstrichstoffs sowie einer Schlussbeschichtung besitzen. Sie können, ohne jeden Filmfehler, durch Bürsten, Spritzen oder Tauchen angestrichen werden.

### Introduction

*Refs, 1-15*

The development of water-soluble media for the electrocoating of electroconductive substrates has gained an important position in industrial paints during the past two decades. The reason for this rapid development lies in the well-known advantages of the electrodeposition of paint compared with other coating procedures.

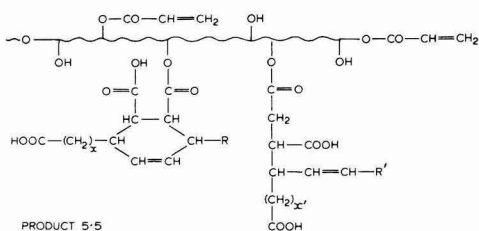
In recent years several workers have published articles<sup>1-6</sup> on water-soluble vehicles based on phenolics, alkyds, acrylics, polyesters etc. However, only a few articles have appeared on the preparation of water-soluble epoxy resins<sup>7-11</sup>, and most of the work is covered by patents<sup>12</sup>. The information available therein is insufficient to help in their preparation or in the designing of products for a particular end-use.

Air drying water-thinnable glossy paints based on vinyl

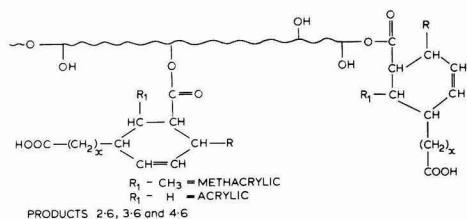


Epoxy resins were partially esterified with maleinised DCOFA and then further esterified with polyethylene glycols so as to increase the ether groups due to polyethylene glycols in the backbone of the polymer chain. The end product 4.5 had an acid value 100.3.

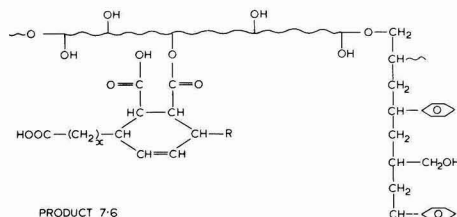
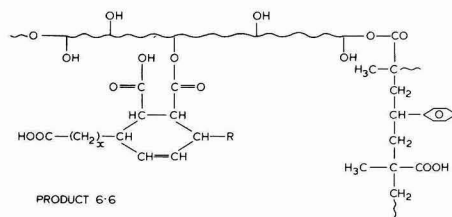
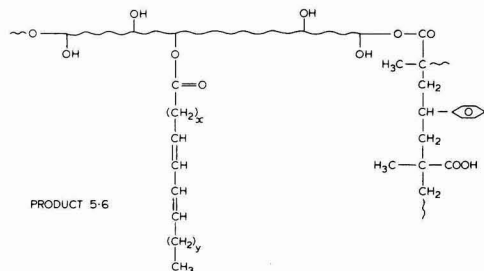
Epoxy resins could also be partially esterified with acrylic acid and then this partial ester alcohol further esterified with 8 per cent maleinised DCOFA to get resinous products with an acid value of 88 (product 5.5).



The Diels-Alder adducts derived from polyunsaturated fatty acids and dienophiles such as maleic anhydride, acrylic acid and methacrylic acid are known to be commercially important because of their polybasic nature. Such adducts were prepared from DCOFA in the presence of sulfur, an eladisation catalyst, by a process already developed in our laboratory<sup>17</sup>. These adducts were then reacted with epoxy resins. (Products 2.6, 3.6 and 4.6.)



Styrene-methacrylic acid (S-MA) and styrene allyl alcohol (S-AA) copolymers were also prepared and these were then partially etherified or esterified, as the case may be, with epoxy resin and DCOFA or maleinised DCOFA (products 5.6, 6.6 and 7.6). Maleinised fatty acids can be crosslinked with styrene and then reacted with epoxy resin (product 1.6).



All the products were first diluted to 70 per cent solids using butyl cellosolve as the solvent and then neutralised to 80-100 per cent of their carboxyl content with a tertiary alkanol amine base to get water-dilutable products. All the products gave clear solutions in water at infinite dilutions. The compositions and the acid values of the products are given in Table 1.

## Evaluation of the resins

Ref. 7

### 1. Hydrolytic stability

The hydrolytic stability of the aqueous systems was assessed by bottle storage tests on binder solutions at 25 per cent and 10 per cent solids concentration<sup>7</sup>. This test was of great importance as the water-soluble polyesters are hydrolytically unstable. This is due either to the hydrolysis of ester groups, catalysed by the neutralising amine in the presence of water, or aminolysis, both leading to a lowering of the molecular weight of the polymers, which can cause phase separation.

### 2. Storage stability

The storage stability of the products was assessed by taking out samples periodically, neutralising with tertiary alkanolamine and diluting with water. The product was considered unstable if it produced a turbid solution.

### 3. Evaluation of clear coatings

Clear coatings were obtained by neutralising the resin with a suitable base, adding the requisite quantity of suitable driers and diluting to 40-45 per cent solids content with deionised water. Coatings were applied on mild steel

Table 2  
Film properties of clear coatings

Film properties	Clear coatings from vehicles						
	1.5	3.5	5.5	1.6	2.6	3.6	6.6
Thickness (microns)	30	35	30	35	30	40	35
Scratch hardness (g)							
DEF - 1053 (14)	2100	2400	2400	2200	2100	2500	2800
Adhesion IS - 101 (1961)	NE	NE	NE	NE	NE	NE	NE
Flexibility (1/16 inch mandrel)	NE	NE	NE	NE	NE	NE	NE
Resistance to chemicals - time to wrinkle (hours)							
Sodium carbonate (5%)	96	96	96	96	96	96	96
Sodium hydroxide (1%)	2.5	10	2.5	2	10	86	96
Sodium hydroxide (5%)	(5 mins)		(5 mins)	(10 mins)	1.5	24	24

All the films were resistant to water, xylene, methyl ethyl ketone, butyl cellosolve and sulfuric acid (20%) for more than 96 hours. NE = no effect, DEF = defence specification, London.

panels (30 SWG 15 cm × 10 cm), tin coated panels (15 cm × 5 cm) and on test tubes; by brushing in the first two cases and by dipping in the third. The coated panels and test tubes were then baked at 110°C for 20 minutes and the films tested for adhesion, flexibility and resistance to impact, acids, alkalies and organic solvents commonly used in the surface coatings industry. The test results are given in Table 2.

#### 4. Evaluation of paint films

Paints were prepared using synthetic iron oxide, anatase titanium dioxide and lead chromate (individually) and subjected to various tests such as accelerated corrosion, gloss, adhesion, hardness, flexibility and impact resistance. The paints based on synthetic iron oxide at 10 per cent pigment volume concentration (PVC) gave matt finishes and hence were unsuitable as top coats. A few paints based on anatase titanium dioxide and lead chromate gave glossy finishes. As lead chromate is known for its anticorrosive properties, the paints based on this pigment only were studied extensively for their overall worthiness and acceptability as primers/top coats.

The lead chromate paints were applied on mild steel panels (30 SWG 15 cm × 10 cm) by means of spray coating and in some cases by brush. One set of panels was air dried and the other set was baked at 100°C for 30 minutes. The air drying characteristics of the paints are shown in Table 3. As none of the air dried films developed sufficient hardness even after 48 hours, these panels were not subjected to accelerated corrosion tests. The baked panels were subjected to accelerated corrosion tests, gloss, adhesion, flexibility, hardness and impact resistance tests. The results are given in Table 4.

Table 3  
Film properties of paints based on lead chromate

Film properties	Paints prepared from vehicles						
	1.5	3.5	5.5	1.6	2.6	3.6	6.6
PVC (%)	10	10	10	10	10	10	10
Solids (%)	50	50	45	45	50	50	50
Thickness (microns)	30	35	30	30	30	35	35
Touch dry (hours)	4	6	2	5	12	3	2.5
Hard dry (hours)	30	48	24	36	48	24	24
Scratch hardness (g)							
IS-101 (1961)	300	300	400	400	300	600	600

IS = Indian Standard specification

#### Conclusions

1. The hydrolytic stability of all the products at 25 per cent and 10 per cent dilutions lasted for longer than 14 months, except for product 2.5. As regards storage stability, products 4.5, 5.6 and 7.6 gave white emulsions when diluted with deionised water after six months of storage. No specific reason could be given for these failures. Other products were in a satisfactory condition for 14-16 months.

2. The clear coatings based on products 3.6 and 6.6 exhibited good overall properties, e.g. hardness, flexibility and resistance to alkali (1 per cent NaOH - 80-100 hours, 5 per cent NaOH - 24 hours), whereas the remaining products produced films which could not withstand a one per cent NaOH aqueous solution for even 10 hours (Table 2).

3. The paint films based on the vehicles 3.6 and 6.6 exhibited very good gloss and withstood the corrosion cabinet test for 1,500 hours and salt spray test for 750 hours. The creep of rust under the paint films during these tests was insignificant (Table 4). The films dried in 24 hours at 35°C and were moderately hard (scratch hardness - 600 g) Table 3.

Thus, water-soluble epoxy vehicles modified with (i) DCOFA and copolymers of styrene-methacrylic acid, or (ii) Diels-Alder adducts of DCOFA and methacrylic acid seem to be more suitable for preparing paints which can function as single-coat systems, i.e. both as primer as well as top coat.

These paints could be applied on mild steel surfaces by

Table 4  
Properties of stoved films of paints based on lead chromate

Film properties	Paints prepared from vehicles						
	1.5	3.5	5.5	1.6	2.6	3.6	6.6
(a) PVC (%)	10	10	10	10	10	10	10
(b) Thickness (microns)	35	40	40	30	45	40	40
(c) Scratch hardness (g) IS-101 (1961)	2300	2400	2500	2100	2200	2400	2800
(d) Reflectance, Gardner scale (%)							
20°	5	5	0	18	1	45	55
45°	35	40	6	80	11	100	100
60°	25	30	2	64	10	88	97
75°	60	60	9	95	33	98	98
85°	45	45	6	80	25	94	95
(e) Impact test 288 kg cm DEF 1053(17a)							
Direct	NE	NE	NE	NE	NE	NE	NE
Reverse	NE	NE	F	NE	F	NE	NE
(f) Corrosion Cabinet IS-101(1961) (hrs)							
250	B						
500	F						
750			NE				
1000		NE	B	NE	NE		
1500		NE		NE	NE	NE	NE
(g) Salt spray IS-104(1962) (hrs)							
250	NE			NE	NE		
500	B	NE	NE	B	B	NE	NE
750	F	NE	B	F	F	NE	B
(h) Corrosion Cabinet after X; rust creep (mm) (hrs)							
250	2						
500	F						
1000			1.0				
1500		1	3.0	0.5	0.5	0	1
(i) Salt spray ASTM 1654-78 rust creep (mm) (hrs)							
250							
500	1	3	3	3	3		0
750						1	3

IS = Indian Standard specification, DEF = defence specification London, ASTM = American Society for Testing Materials, NE = no effect, B = blistered, F = failed

conventional methods without any resulting film defects. The scaling upwards of the preparation of these vehicles is in progress.

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## References

- McLean, A., *Paint Manuf.*, 1968, **38**(8), 32; 1969, **39**(1), 37; 1969, **39**(5), 45; 1969, **39**(9), 59; 1972, **42**(2), 17; 1972, **42**(7), 23; 1972, **42**(11), 43; and 1973, **43**(2), 23.
- Brushwell, W., *Am. Paint J.*, 1972, **57**(11), 73.
- Albers, K. H., McCollum, A. W. and Blood, A. E., *J. Paint Technol.*, 1975, **47**(608), 71.
- Brett, R. A., *JOCCA*, 1964, **47**(10), 767.
- Jenkins, V. F., Mott, A. and Wicker, R. J., *JOCCA*, 1961, **44**, 42.
- Hunt, T., *JOCCA*, 1970, **53**, 380.
- van Westrenen, W. J. and Tysall, L. A., *JOCCA*, 1968, **51**, 108.
- van Westrenen, W. J., *J. Paint Technol.*, 1968, **32**(11), 27.
- Schenck, H. U. and Stoelting, J., *JOCCA*, 1980, **63**, 482.
- Schenck, H. U., Spoor, H. and Marx, M., *Prog. Org. Coat.*, 1979, **7**, 1.
- Ciba-Geigy, *Pig. Resin Technol.*, 1977, **6**(5), 10.
- Meltzer, Y. L., "Water soluble polymers. Recent developments", *Noyes Data Corporation, USA*, 1979 pp. 134-151.
- British Resin Products Ltd, Brit. Pats, 1, 134, 274; 1, 127, 985; 1,045, 715; 1,029, 544.
- Krishnamurti, N. Hanumanth Rao, G., Shirsalkar, M. M. and Sivasamban, M. A., *Paint Manuf.*, 1978, **48**(7), 37.
- Krishnamurti, N., Shirsalkar, M. M. and Sivasamban, M. A., *ibid*, 1979, **49**(6), 11.
- Vijayalakshmi, P., Chandrasekhara Rao, T., Sitarama Sastry, Y., Kale, V., Subba Rao, R. and Lakshminarayana, G., Proceedings of the 36th annual convention and symposium organised by OTAI, Hyderabad, India, 1981.
- Final Technical Report PL-480 Project: UR-A7-(40)-161 GN: FG-In-378 (1975).



# Accelerated corrosion tests in the motor industry\*

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## Keywords

### *Types and classes of coatings and allied products*

automotive finish  
corrosion resistant coating  
corrosion resistant primer

### *Properties, characteristics and conditions primarily associated with*

*structures or surfaces being coated*

corrosion

### *Miscellaneous terms*

rust

### *Processes and methods primarily associated with analysis, measurement or testing*

accelerated corrosion testing  
corrosion testing  
salt spray testing

### *application of coatings and allied products*

electrocoating  
service or utility  
galvanic corrosion

## Introduction

*Refs. 1, 2*

Many private motorists are concerned with the rapid deterioration of a motor vehicle body in the winter months, because the replacement in today's market costs him far more in real terms than the same replacement years ago. This results from the tax structure, which means that to have £1.00 to spend on a luxury, Mr P.A.Y. Earn must have earned £1.43. On the other hand, companies and fleet buyers only have to spend £0.50p for every £1.00 of motor car that they purchase, as the other £0.50p comes from the Inland Revenue at the end of the tax year. In this case it is a cash flow problem as the full initial price must be paid on purchase. Any improvement that the motor vehicle manufacturer makes to a new vehicle which may affect the second and third owners, adds a cash flow problem to the initial purchaser.

The company car syndrome that exists in Britain, and which is peculiar to this country, has an influence on what corrosion protection measures the manufacturer will employ, as each manufacturer must be no better nor no worse than any competitor, in order to remain competitive. About 80 per cent of the new cars manufactured in Britain are sold to companies or leasors where the first driver has no monetary stake in the vehicle. As the motor manufacturers are in the business of selling new cars, their products become more attractive as company cars if the internal specification is upgraded, rather than certain corrosion protection systems.

Corrosion protection, however, begins at the design stage, and there are plenty of examples<sup>1</sup> around our streets to show that fundamental anticorrosion design is lacking. Where these design faults give rise to cosmetic corrosion within the warranty period they are corrected by add-on items. Talbot and VW have both produced vehicles with



Figure 1. The outward flared rear wheel arch is protected by a plastic guard to reduce claims under the paint warranty. The plastic tube highlights the crevice produced between the plastic and the car body

outward flared rear wheel arches which would catch the front wheel spray leading to premature erosion of the painted surfaces. This design fault has been masked by the addition of a plastic guard as shown in Figure 1. If this erosion took slightly longer to show, it is more than probable that such a guard would not be fitted. Such an example exists on the Rover SD1 model towards the rear wheel and at the front of the vehicle. At the front, the Rover SD1 has a large area of painted steel which is at right angles to the direction of motion and so is abraded by the spray generated by the preceding vehicle. The erosion of this panel is not so rapid, as the distance between vehicles at high speed is some several orders of magnitude greater than the distance between front and rear wheels. However, this erosion of the front valance causes a lower trade-in value, but for company cars this matters little as a balancing charge will ensure that only

\*This paper results from a lecture given to the Institute of Petroleum Engineers (Protectives Panel) on 29 September 1981, in London.

£0.50p will be paid for every £1.00 of extra depreciation above that allowed to be written down against profits.

An analysis of the effect upon premature ageing and second hand values of poor anticorrosion design is given elsewhere<sup>2</sup>.

Undoubtedly, in most people's mind corrosion or "body rot" is the most severe parameter in the annual depreciation bill and far exceeds that of wear and tear.

Many manufacturers now court the motorist by offering a six year guarantee against corrosion provided certain conditions are fulfilled; and these are often periodic inspections at annual intervals (or thereabouts), together with a stipulation that the guarantee is confined to the first owner, or the second owner if the transfer or sale of the vehicle is within a two year or 30 month period.

In general, wax protective is the third defence mechanism against corrosion. The steel used in vehicle production is protected initially by a phosphate film, which has a dual role to play as it also provides a mechanical key for the subsequent painting process. Without the phosphate film the outer protective coatings would lose adhesion to the metal surface.

This paper will look at the accelerated tests used by the vehicle manufacturers and their suppliers of protective systems, in order to examine how closely they relate to the actual corrosion mechanism of steel in everyday "industrial atmospheres". Alternative tests will be offered to those which are considered too far removed from the actual corrosion mechanism, and their theoretical mechanisms proposed.

### Accelerated tests

Accelerated tests carried out by the manufacturers consist of driving the vehicle through saline fords at 20 mph (30 km/h) followed by incubation in humidity cabinets to allow the corrosive action of the salts to show up the corrosion prone areas.

Protective coatings used in most industries are subjected to salt spray tests, where well oxygenated saline water is made to produce a fog, which is allowed to settle upon the surface of the protective medium and cause corrosion. In this case the anodic areas are changing into cathodic areas as the salt condensate runs down the medium surface, thus polarising the differential aeration cell which causes the breakdown of the protective layer. The only places where anodic and cathodic areas are not changing positions are the corners and edges of the sample, where in general the coating will be thinner as a result of surface tension forces, which tend to round the corners of the evaporating volatile solvent coating. The final result is shown in Figure 2. This is often referred to as the edge effect and in many tests this is often ignored if the whole plain surface shows no corrosion.

How closely these forms of accelerated corrosion relate to the product in question will now be examined.

### The corrosion reaction

Ref. 2

The manufacturers blame the higher incidence of corrosion upon the increased usage of salt on roads during the

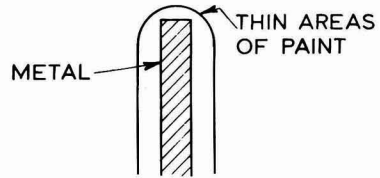


Figure 2. Surface tension forces pull the fluid paint medium away from the sharp edges to produce the minimum paint film thickness at sharp edges

winter. Salt accelerates the corrosion process and therefore only exposes bad design faults in the vehicle body. In order to understand this, some introduction to corrosion theory is necessary.

Corrosion is not an organic pest like dry rot which can be killed. Corrosion is an electrical phenomenon and produces a very small voltage in the same way as the "corrosion process" of the specially constructed torch battery produces voltage of 1.5 V from each cell. The outer case of the torch battery, denoted the positive electrode, is zinc, which corrodes to produce electrical energy. The central electrode is often denoted the negative electrode.

This *galvanic* corrosion mechanism in the case of motor vehicle corrosion is the differential aeration cell, which produces a very small emf as a result of the steel dissolving at the anode. This cell obtains its driving force because some areas of the steel body have a better access to oxygen than other areas. The areas which are oxygen denuded form the negative electrode (anode). This area dissolves at the expense of those areas which are plentifully supplied with oxygen. Hence, if we consider a small particle of insoluble road aggregate (dirt) in road deicing solution, we have the following situation in cross-section.

The road deicing salt catalyses the corrosion reaction because:

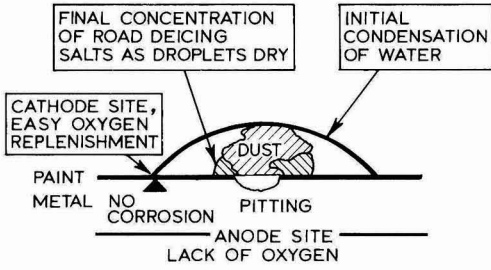
1. It accentuates pitting due to the chloride ion ( $\text{Cl}^-$ ) making the steel or ferrous ion more soluble.
2. It increases the electrical conductivity of the solution.
3. The salt concentrates in the areas which are the last to dry and which often suffer from oxygen deficiency e.g. interweld crevices (Figure 3). These are also areas of paint denudation. (The throw of the electrocoat paints is very poor in these locations<sup>2</sup>.)

### How do the bad designs arise?

Refs. 1, 2

The motor manufacturers test the prototype vehicle over paved roads, mud baths and by driving at 20 mph through salt fords (6 inch deep salt solution). The vehicle is then placed in a humidity chamber to show the designer where the weak points of design are situated.

This slow speed enables the tyre to bring up a large amount of water which washes away any deposited mud forming a "mud pocket". At higher speeds which characterise motorway driving or general consumer usage,



DIFFERENTIAL AERATION CELL

ANODE REACTION:

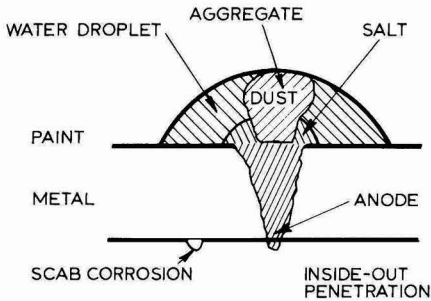


CATHODE REACTION:



ANODE AND CATHODE PRODUCTS REACT

$Fe^{2+} + OH^-$  PLUS MORE AIR GIVES RUST  $Fe_2O_3$  WITH AN INCREASE IN VOLUME



a smaller volume of water is taken up with the wheel. This smaller volume of water is usually associated with insoluble aggregates (road/tyre wear or mud) which get trapped on ledges over wheels. Because they are ejected at higher speeds, they become compacted and deposited over the headlight and/or side light mounting and at the A\* pillar wing interface, even without a ledge. In some cases, no amount of consumer washing will remove the road deposits<sup>1,2</sup>.

The vehicle in service obtains its microclimate by generating a spray of small droplets as a result of the change of kinetic energy to surface free energy. A detailed analysis is given in Figure 4.

If a car travels at 60 mph then the bottom of the tyre in contact with the road surface must be stationary at the instant of contact. i.e. its forward velocity is zero mph, and

SPRAY GENERATION

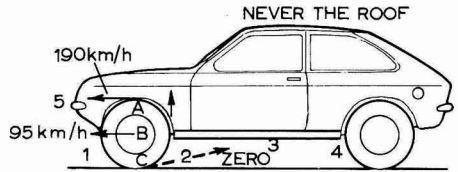


Figure 4. Origin of water spray

- (1) "Bow wave". The vehicle tyre pushes a finite volume of water ahead of the tyre. This is broken up into a spray by impact with the car
- (2) Tyre-road separation. Surface tension causes droplet formation from the water which is thrown out of the tyre tread. Over the whole circumference these droplets impact the car body at the vehicle speed
- (3) Droplet-body impact. The change of energy from kinetic energy to surface free energy of a larger number of microdroplets causes a very fine mist and obscurity of vision proportional to the vehicle speed to the third power. Each microdroplet has a small momentum and so is free to move to follow pressure eddies. This is discussed in greater detail in the text
- (4) Droplet-droplet impact with the spray from both front and rear wheels ahead of the rear wheel. Some spray is also caused by spray from the front wheel colliding with the rear wheel
- (5) Water spray is thrown ahead of the vehicle

the top of the tyre must be travelling at 120 mph. Therefore, any dirt/water thrown off at this point will hit the car body at a speed of 60 mph (120 mph minus the car speed of 60 mph).

Road dirt, ice, salt and stones coming off anywhere else around the circumference of the tyre will also sandblast the paintwork and compact the mud onto ledges underneath the wing with a velocity of 60 mph.

If water hits a plane surface at 60 mph then this kinetic energy must be dissipated and it is used in work done against the surface energy (surface tension) of water, by making much smaller water droplets (a mist). This mist usually leaves the point of impact at an angle of 10 to 15° with the impacting surface. As a result, dissolved salts and aggregates can be deposited in positions where road water directly from the wheel would not normally reach, i.e. those surfaces not washed by rain water. The faster the car travels, the smaller is the ratio of water/dirt and the larger is the kinetic energy of the ejected droplets, with the result that the microdroplets are smaller. Their momentum:  $M = mv$  (where  $M =$  momentum,  $m =$  mass and  $v =$  velocity) decreases, and therefore this mist may change direction as a result of very small pressure changes. Hence it is more easily drawn into the box members and cavities than large droplets. The smallest water droplets in the mist will nucleate on insoluble aggregates/particles (road dirt). The deposited road dirt, therefore, produces its own microclimate at deposition sites. The design of the motor car should therefore reflect the environment in which it works.

Passenger comfort, car heater

In the previous section it was stated that the water

\*The A and B pillars are, respectively, the pillars on which the front and rear doors are hung.

microdroplets could be introduced into the sills and box members by pressure eddies beneath the vehicle body. Another way is via the air extraction mechanism for stale passenger air. The designer should also consider the effects of having an efficient heater for the passenger compartment. In the majority of heating and ventilation systems, the air intake is by a ram effect. The major control of the quantity of air admitted to the passenger compartment is by a flap which controls the cross-sectional area of the heater opening. The "air extraction system" is not controlled and operates whenever the car is in motion. It becomes more efficient the faster the car travels. As passenger comfort and efficient winter heating and demisting are a modern requirement of "today's motor vehicle", the designer ought to consider what effect the extraction of air from the passenger compartment will have on the internal box members and sills when there is little or no fresh air being admitted to the passenger compartment. This arises because the extraction of stale air through ducts at the rear of the car can lead to the extraction of air from within the sills and box members, via the passenger compartment, due to the complex nature of the interconnecting box members as a result of the manufacturing process holes. An example of this interconnection is shown in Figure 5 where the hole shown is to let air out of the sill member as the vehicle is lowered into the electrocoating bath. All vehicles have these holes and because these processing holes effectively link the outside of the car (at the point where most of the spray is generated) to the internal sill cavity, water/salt ingress takes place. The sill cavity is linked via holes at the base of the A and B pillars and rear section to the passenger compartment, where the most efficient air extraction is achieved. This interconnection is shown up, externally, by the premature corrosion of the sills and an area around the rear wheel arch, where saline water may be taken in by capillary wicking. Corrosion results around the crevice formed by the inner wheel arch and the outer panel. And so a manufacturing requirement for wax injection should be the capillary creep of the wax into this crevice and subsequently the exclusion of water from the crevice by means of a high contact angle,  $\theta$ , between the wax substrate and water.

This proposed mechanism of inside-out corrosion, so called because corrosion is initiated on the internal surfaces of box members, is in total conflict with mechanisms put forward by other organisations<sup>3</sup>, who have extended the concept of mud poultices on ledges within the wing envelope, to mud poultices within sill and box members without producing the photographic evidence for its justification. The photographic evidence is that the internal microenvironment, producing the microclimate, is only a layer of salty dust, assumed to be worn road aggregate and road dirt, which traps the road deicing salts on vertical panels. This does not grow into a mud poultice until metal penetration has taken place which then alters the air flow mechanism to produce the mud poultices and rapid corrosion along the whole length of the sill box member.

Thus, the motor industries accelerated corrosion tests bear little or no relation to the service environment, as in one case only large droplets of saline water are produced as the car speeds through the saline ford at only 20 mph. In reality, the car is often driven at speeds in excess of 60 mph on motorways, where there is considerable turbulence as a result of the other traffic. Furthermore, the droplet size produced during high speed motoring is much smaller and therefore will enter the box members more

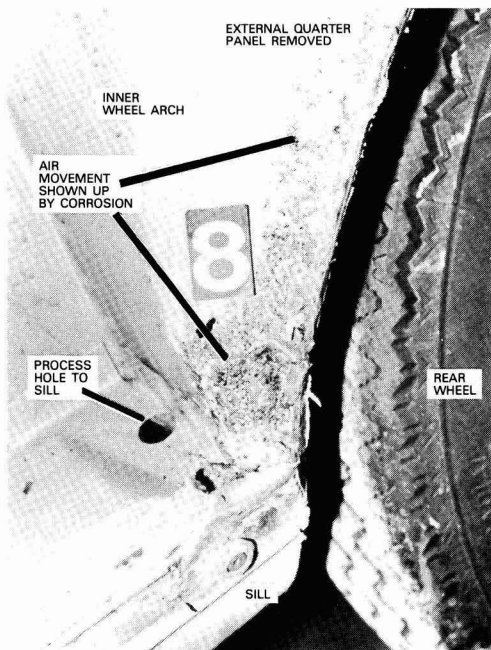


Figure 5. The rear wheel with the outer panel removed to expose the sill. The hole at the top of the sill connects the sill chamber to the passenger compartment. A saline moist air stream passes over the rear wheel arch to corrode the external panel from the inside. This airstream originates from front wheel spray and is picked up from the drainage holes in the base of the sill which are all situated over the front wheel track

readily as their momentum decreases. The motor industries accelerated corrosion procedure should involve high speed driving on a wet road, and yet all the test tracks so far commissioned do not incorporate this facility.

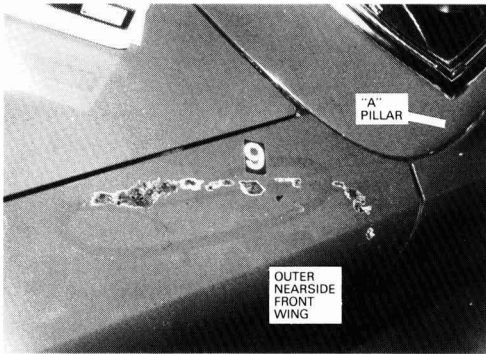
In order to understand the premature rusting of motor vehicle bodies, it is necessary to understand something about their building sequences and painting processes. The disadvantages and difficulties encountered in the body build processes give the underlying reason for the wax injection of motor vehicle bodies.

#### Vehicle manufacture and protection schemes

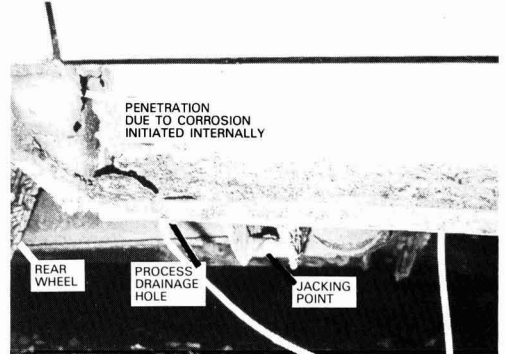
Refs. 2, 5

A motor vehicle body is made from preformed steel panels which are spot welded together to form a rigid unit termed "the body in white". These panels still have the slushing oils present on the surface and hence the interweld joint often consists of burnt grease/oil which prevents some of the subsequent operations from being effective. The body in white is transported (sometimes by a vehicle in the rain) to the paint shop, where the protective is removed by kerosine wipe and a subsequent alkali degreasing operation.

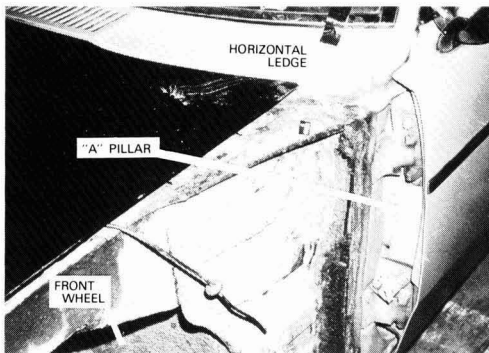
The body in white is then phosphated. The function of the phosphate is to provide a good chemical bond for the subsequent primer paint, as well as to contain the area of corrosion from stone chippings, i.e. preventing undercut-



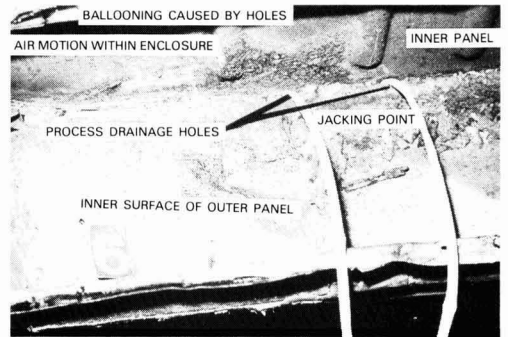
A row of paint blisters on the outer panel of a Cortina wing



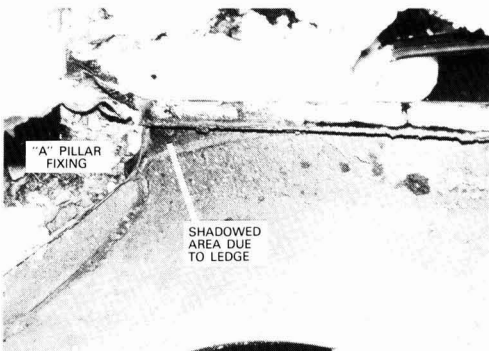
Corrosion initiated from the internal surface of this Volvo sill is caused by water ingress through the two drainage holes (marked by plastic tubes) and from the microclimate which builds up from having no screen or wire mesh over the heater scuttle (the sills are pressure vented from the scuttle via the A pillars), the microclimate is produced by moisture, leaves and other debris. The mudflaps prevent water ingress into the sills by the mechanism given in this paper



Removal of the Cortina wing shows the "A" pillar and the ledge forming a mud pocket beneath the wing. The usual manufacturer's accelerated tests, driving at 20 mph through a salt dip, will not show this ledge up, a ledge that harbours dirt. At higher speeds the amount of water taken up to "wash" the ledge is less

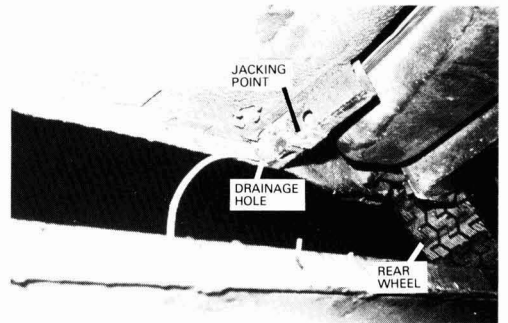


Marina jacking point seen from inside the sill, as the outer sill has been cut open from the top spot welds and pulled down. The tubes have been poked through the drainage holes on either side of the jacking point and the evidence for salt and water ingress is shown on the inside sill panel (6). There is also evidence of the injection of rustproofing waxes (top right-hand corner). Here only a small amount of fluid has been ejected from the gun due to the thixotropic nature of the fluid used



The ledge also prevents the application of thixotropic protective coatings as it acts as a shield to the inside surface of the outer wing

Figure 6.

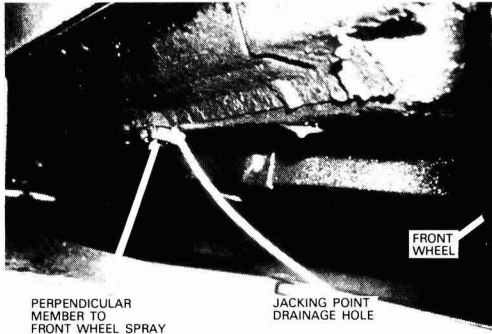


Drainage holes adjacent to jacking points which present horizontal members at right angles to high speed spray is bad design. This design fault is not detected by the motor industry's accelerated tests. Metro

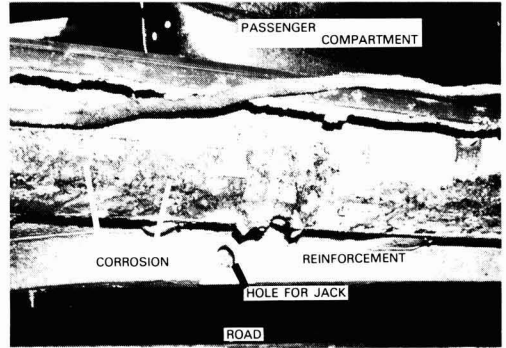
Figure 7.





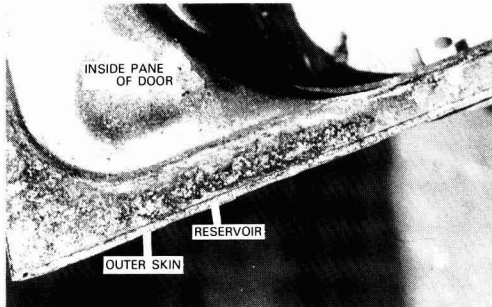


The juxtaposition of the process drainage holes and jacking point is bad design and is not detected at low speed driving through salt baths. At high speed the leading jacking point member acts to scoop up front wheel spray and deposit this on the internal surfaces (see photograph immediate right). Ford Escort Estate

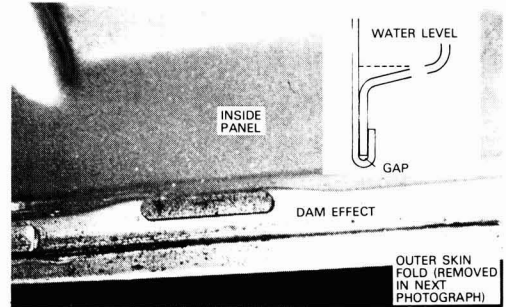


Ford Escort Estate. The external sill has now been removed to show the road deicing salts and corrosion around the jacking point reinforcement. Corrosion will cause the jacking point to collapse when loaded

Figure 12.

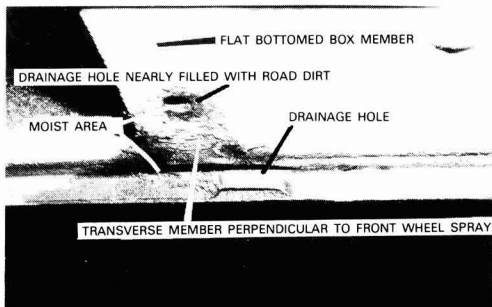


Lack of paint within the door hemming fold, and the false requirements for thick or thixotropic waxes means that crevice corrosion may take place with the cathodic stripping of the paint film. The photograph shows the hemming fold with part of the fold ground away to show the reservoir formed at the bottom of the fold. When this defect is combined with a high drainage hole lip, severe corrosion may result



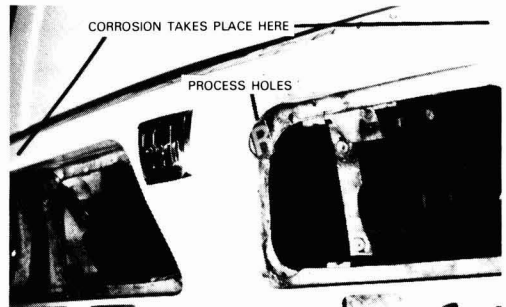
Process drainage holes often have a high internal lip which causes water to remain in the internal door crevice for long periods. A cross-section of this section is shown for clarity

Figure 13.



A close up of this photograph of the sill drainage hole in the interweld joint on a dry day would show that capillarity and water ingress into the sills keep them wet for longer periods: they take longer to dry out and concentrate the road salts at the regions which are last to dry. The flat bottomed box section of the sill is also a characteristic of bad design against corrosion

Figure 14.



An example of poor design can be seen in the Triumph Dolomite range front bonnet valence. Here the panels are arranged so that water spray from the previous car or rain will be channelled up into the "T" box member through the gap R by the forward motion of the vehicle. This causes corrosion at either ends of the valence where the box member has a constriction which forms a readily made crevice

Figure 15.

Subsequent paint processes – primer surfaces, PVC undercoating and final finishes – are not applied to the internal box members.

For added protection, the motor industry has started wax injection of the internal surfaces (0.0016 to 0.0020 in.).

Summarising the essential features of the paint protection process as it relates to corrosion:

1. Electrocoating deposits a paint coating only at those places where a current,  $i$ , may flow, and the thickness of paint film is proportional to the total quantity of coulombs,  $Q$ , that have passed:  $Q = i \times t$ , where  $t$  = time in the electrocoating bath.
2. Slipper dip processes, which rely on the evaporation of the solvent, produce a coating on all surfaces which are subjected to solvent wash. Thus slipper dip processes produce a thick coating of paint within the interwelds whilst electrocoating does not. This arises because the total electrical resistance ( $R_t$ ) from electrode to interweld deposition site is greater than the electrical resistance of the electrodeposited film on the outer surfaces of the car ( $R_c$ ).

$$R_c > R_t = R_{\text{bath}} + R_{\text{box member}} + R_{\text{phosphate}} + R_{\text{capillary interweld}}$$

The resistance offered to the interweld is given by the conventional formula:

$$R = \rho \frac{\ell}{A}$$

Where:  $R$  = resistance,  $\rho$  = resistivity =  $1/\text{conductivity}$

$\ell$  =  $\frac{1}{2}$  width of interweld and

$A$  = cross-sectional area which is some function of the interweld gap size

Basically, if the manufacturer increased the gap at the interweld joints there would be some electrocoating of the interfaces, but there would be an associated problem of water ingress during high speed driving in the wet. In this case the manufacturer takes the lesser of the two evils and designs for tight interweld joints, and uses cathodic electrocoating which has a better throwing power into the interwelds. However, the tighter the interweld joint the greater the capillary action. These interweld joints take a longer time to dry, and as a result there is a greater concentration of road salts in these joints. (The concentration of salts arises from the fact that dissolved species will not form a solid in a liquid environment until the liquid becomes supersaturated. Hence the last areas to dry will tend to possess higher concentrations of salt.)

Therefore, the construction of the car body produces a mosaic of capillaries which allows water and/or these concentrated salt solutions to be transferred from a wet region to dry region against gravity.

If the differential aeration cell theory is applied to the capillary interweld joint, then each spot weld will be an anode (dissolution area) and at the outer edge of the interweld interface where oxygen is plentiful will be the cathode. Hence corrosion takes place with the formation

of rust at the interface. The gap is enlarged as a result of the larger volume that the rust occupies. This is a slow process because the local anodes and cathodes are polarised in ordinary (uncontaminated) water. The process is, however, speeded up if the water contains the road deicing salts. These disadvantageous factors have therefore been the reason for the rapid acceptance of wax injection systems.

The penetration of the wax protective or grease paint into interwelds against gravity is a first requirement for a good protective coating. This is of paramount importance for two reasons:

1. Corrosion within a crevice produces an acidic environment which forms a more aggressive microclimate and accelerates the dissolution action.
2. The lack of paint within the interwelds. This arises because the deposition of the paint is a precipitation reaction caused by the dissociation of water.

If corrosion does take place within a crevice, the cathodic reaction will strip the phosphate conversion coating and/or the electrocoat, together with any other well applied coating with great ease however good an abrasion resistant final coating was applied.

In published tests<sup>2</sup>, it was reported that interweld gaps of 4 thou (0.01 mm) were the most critical size for corrosion. Interweld gaps of less than this size did not corrode as rapidly as gaps of 4 thou, and gaps of greater than 4 thou were coated with a thin film of electrocoat which had a beneficial effect upon corrosion resistance. It was further postulated that capillaries of 4 thou could trap some of the hygroscopic pretreatment phosphates, which would result in the accelerated corrosion of these gaps.

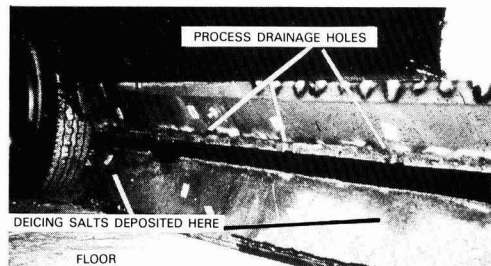
However, in none of the grease paint or temporary protecting specifications is there any form of test for capillary penetration, and yet this appears to be the main advantage of these materials. The science behind capillary penetration will therefore be examined.

The interaction of a liquid with a surface is a complex matter and is studied by measuring the surface tension of the liquid and the contact angle made with the surface. Both these factors are important because both the surface tension of the liquid and its contact angle with the surface dictate whether a fluid will penetrate small crevices (like water being soaked up by blotting paper) or be repelled like water on an oily or waxed surface.

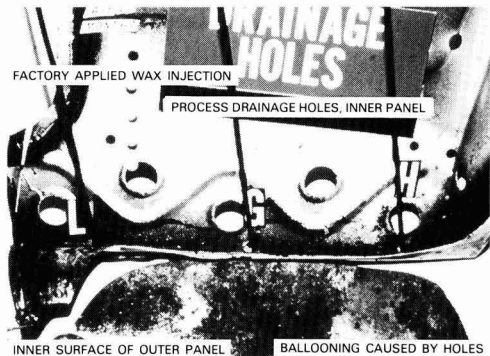
If the cross-section of a water droplet is examined on two surfaces A and B, Figure 16, it appears that there are two different angles of contact. This results from the forces of attraction between water-water species being less than the attractive forces between the water-substrate species A. As a result the water-substrate inter-species bond is higher than the water-water bond, the water will creep along the surface of substrate A to lower the centre of gravity of the water droplet. In the case of substrate B however, the bond between the water-water species is greater than the bond between the water-substrate species. If these two substrates now form two capillaries, there exists an essential difference.

The capillary formed from substrate A will result in a large rise of liquid, whilst the capillary formed from substrate B will be associated with a negative height, i.e. the

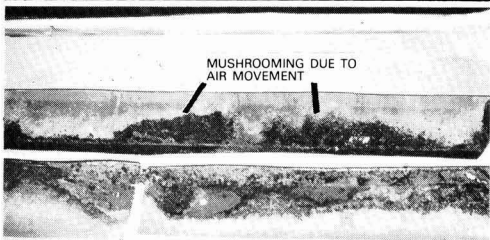
Figure 9.



If the outer sill is removed from a car, the deposited road dirt (and salts) can be seen localised around the drainage holes in the sill bottom. The Avenger shown above has had the outer panel of the sill laid below the car so that the deposited material corresponding to the process drainage holes can be seen

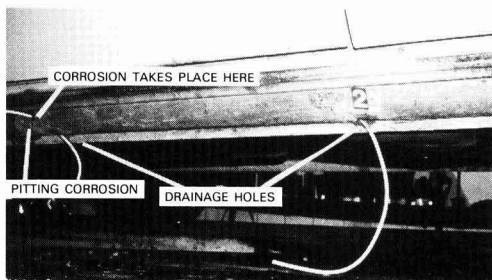


A 2-year old Chevette Hatchback rear quarter panel completely removed from the car, area L is the B pillar, H the rear of the car. The outer skin has been removed and is laid down in the lower half of the photograph. Tubes to L and H go through process drainage holes to the outside. Larger holes L, G and H connect the outside sill to the inside and it is through these holes that the mushrooming corrosion can be clearly seen on the inside face of the outer panel. These holes have constrained the flow of air within the sill to these areas. The brighter silver area is the factory-applied rustproofing material which performs a useless purpose on this upright panel. It has not reached the bottom of the sill, nor has it filled the interweld crevice. In practice the provision of the rustproofing material on this vertical surface will accentuate corrosion within the interweld when the saline liquid runs off this hydrophobic surface into the interwelds

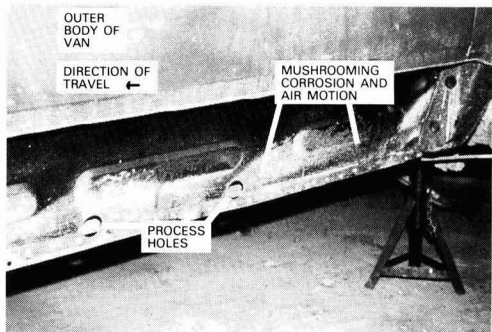


The internal surfaces of both nearside and offside sills of a Rolls Royce showing the road deicing salts deposited by the mechanism discussed in this paper. Each mushroom corresponds to a process drainage hole. Corrosion is no respecter of expense

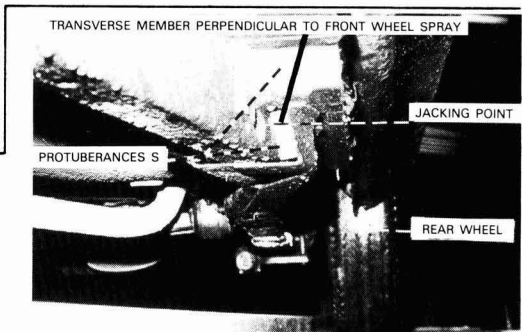
Figure 10.



The best protective coating for steel is useless and a waste of money if the design to resist corrosion is not right. Such is the case for drainage holes within sills. This localised corrosion is shown in the Datsun range where the deposited road dirt caused a small rust spot which was punctured with a screwdriver. A piece of tube shows the relation of this hole to the drainage hole. The figure 2 displayed on the sill shows another area which has corroded and its relationship to the drainage hole. Once holes are produced air and water ingress is accelerated and rapid deterioration results



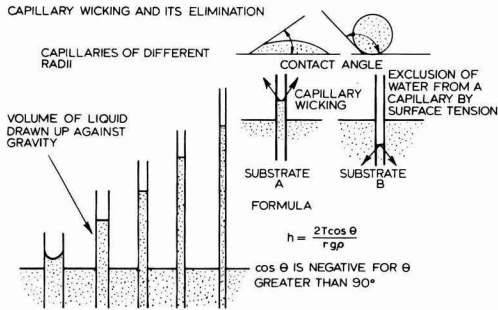
Removal of the outer panel of this Bedford Van shows the air movement within the double skin. The holes shown are the process drainage holes



Bad design which was not shown up by the motor manufacturers' accelerated test procedures. This is a view looking from the front wheel towards the rear wheel and shows the outward flared box member which runs across the front wheel spray. The member stops halfway along the car (adjacent to the B pillar) and forms the jacking point. Behind the jacking point hole there is a perpendicular member which acts as a spray generator. The circular jacking point (a hole for the lever arm jack) presents a certain cross-sectional area to the wheel spray.

This defect is not noticeable at the low speed of 20 mph

Figure 11.

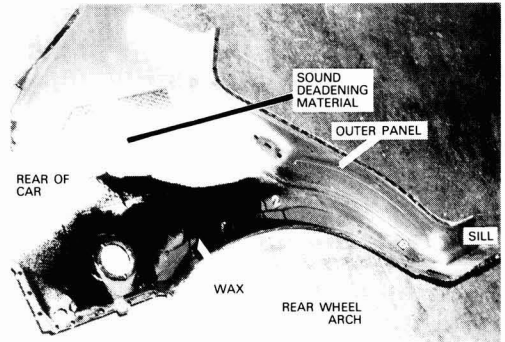


**Figure 16. Capillary rise is proportional to the reciprocal of the crevice gap or radius. However, negative heights can be obtained by using hydrophobic substances.  $h$  = height,  $r$  = radius of capillary,  $g$  = acceleration due to gravity,  $\rho$  = density of water,  $T$  = surface tension of water,  $\cos \theta$  = contact angle of water with respect to the substrate**

liquid will not want to rise up the capillary at any cost. This form of substrate is called hydrophobic (hates water), and is a property of most hydrocarbon waxes and oils. Hence, if the internal cavities are coated with an oil or wax it will stop the ingress of water. For this to be effective the wax or oil must be thin enough to penetrate these interweld joints. They must also have a low contact angle ( $\theta$ ) with their substrate (the electrocoat), in order that they penetrate the crevice, and provide a high contact angle ( $\theta$  greater than  $90^\circ$ ) with water as the medium and the wax as the substrate, so that the dissolved road deicing salts are excluded from the interweld. The waxes must be applied in a manner that will enable them to penetrate the crevices.

Many of the commercial waxes on the market are not designed to creep into these crevices. They are thixotropic liquids which are "thin" when being sheared (i.e. when stirred or sprayed), but thicken when the shearing forces are removed, i.e. they are specifically designed to thicken after spraying and so do not run into all the interweld joints. The only advantage with these liquids is that they do not run all over the operator and factory floor. They also give a visibly thick film. Figure 17 shows a visibly thick film applied to the inner rear quarter panel of a car whose manufacturer provides a six year guarantee. The wax is on the panel in those areas where corrosion is of little importance, as the saline microdroplets will run off these vertical surfaces under gravity and concentrate in the lower interweld joint. This incomplete coverage of internal panels is a characteristic of wax injection on the production line using thixotropic mediums. These mediums tend to block the orifices of the cavity probe, and due to the thixotropic nature of the mediums (becoming thinner with increase of shear), only a few spray holes need operate for the operator to believe that the spray equipment is spraying satisfactorily.

Most of these products on the market have their development in the field of metal protection, but metal protection in the otherwise unprotected state. This historical development means that the materials are tested for commercial use on plain carbon steel without the intervening phosphate or electrocoat layers. In this case use may be made of the physico-chemical attraction between certain radicals and the ferrous metal to form complex salts. In the case of the motor vehicle however, the ferrous surface is coated with a phosphate, to resist the



**Figure 17. A manufacturer offering a six year guarantee with this type of application will want a good lawyer, or will the exclusion clauses mean that it will be the plaintiff who will need the good lawyer. The photograph shows the inside surface of the outer panel taken from over the rear wheel arch where a moist salty airstream will pass during high speed driving in the wet**

lateral spread of corrosion, and an organic paint film. Therefore the physico-chemical attraction of these additives is superfluous in the case of motor vehicle protection as its protection is provided by more expensive means. (Paint films in combination with pretreatment phosphates is a much more expensive method of protection than the aforementioned "temporary" protectives or grease paints. ("Temporary" meaning that the medium may be removed with a hydrocarbon solvent, not the usual meaning of temporary, i.e. lasting only a short time.))

Therefore, in the salt spray tests using the medium on mild steel, some benefit can be derived using oxidised waxes which produces a wax with a higher acid number, which in turn will bond more firmly to the steel surface by producing a salt of that acid. In the case of the motor vehicle body, where the steel is coated by another organic coating, such a physico-chemical bond is absent and care must be invoked in the interpretation of the salt spray tests. This distortion of the accelerated tests would be pardonable if some measurement of the capillary penetration were taken into account. In some of the tests where this has been attempted<sup>5</sup>, capillary wicking has been aided by gravity, whereas Figure 6 shows how capillary penetration determinations should be tested, i.e. against gravity.

For a liquid to penetrate a capillary against gravity, it must pull a finite volume of liquid up with it, whilst if gravity aids the process, this finite volume of liquid aids capillary penetration. This would tend to make all fluids have the same wicking properties, provided that their viscosity allowed them to penetrate the crevice.

Crevices and interwelds corrode by the same mechanism as the corrosion beneath the captive dust particle. These crevices also become highly acidic and this condition promotes a localised form of corrosion which results in metal penetration. This being so, it is very important to keep water and saline microclimates out of crevices and joints. Hence, one parameter of a protective fluid must be its capability of being drawn into a crevice *against* gravity; another its ability to prevent water and salt solutions from entering the crevice and breaking down the coated surface, by its contact angle with water and not by its thickness. Therefore the liquid must



penetrate a crevice and stay there. It must also be hydrophobic so that water does not enter a crevice which has been coated, nor will a salt droplet stay on vertical or inclined panels. In other words the protective film must be self-cleaning, and this is a property one does not get with the "soft" or rough surfaces.

With these parameters as the basis for an accelerated test, the following tests are proposed as an alternative/replacement for the ASTM B117 salt spray. The differential aeration cell is retained together with the saline environment, but there is added to the corrosive medium a colour indicator for the ion of the metal substrate. For example, in the case of steel, potassium ferricyanide is added to the medium so that the onset of corrosion can be quickly detected. The whole corrosive mixture is made into a gel with agar-agar so that the medium is kept to one location and away from the edges. In this way, edge effects are completely eliminated. The gel is placed directly upon a coating of known thickness which is placed directly on the steel substrate. The test sample is placed in a constant temperature enclosure, with water at the bottom to ensure sufficient humidity for the salt gel to form the profile of the droplet depicted in Figure 1.

As the protective is in a humid environment, at an elevated temperature, the effects of the  $T_g$  (glass transition temperature) ought to be considered on the subsequent coherency of the film. The ambient test temperature may be very near to the  $T_g$ , and if this is the case, the absorption of water vapour over a long period of time may have the same result as a lowering of the coatings  $T_g$ . In such cases careful consideration should be given to the enclosure temperature. The full experimental details to make up the gel droplets are given in Appendix 1.

In order to measure the capillary rise, it is suggested that a glass surface approximates to the organic surface of the thin electrocoat paint film. Indeed, several test houses use glass plates and make a tapering gap and measure the wicking properties between the gap. However, it is very difficult to clean such large surfaces thoroughly and often irregular wavy lines appear for the wicked height. Such results are clearly due to insufficient cleaning.

Clean surfaces may, however, be obtained using freshly bought/made capillary tubes of standard radii. In order to measure the capillary wicking it is sufficient to stand a capillary in the medium and plot the rise of fluid with time, ensuring that the solids are being drawn up the capillary as well as the solvent.

## Conclusions

Vehicle manufacturers blame the incidence of corrosion on the fact there is a large amount of salt used for winter road deicing. Whilst this may be true to a certain extent, examination of accident damaged vehicles has shown that the manufacturers have only themselves to blame for the increased incidence of corrosion with increase of salt usage. The salt *accelerates* the corrosion reaction and quickly exposes the areas of the vehicle structure where the salt and road dirt are deposited. Hence the increase of salt usage *only exposes the areas of the vehicle where there is a design fault*. There is little evidence that there is a greater incidence of corrosion at those areas which are subjected to salt spray but well washed with (rain) water and/or devoid of mud traps, e.g. the roof, bonnet, A pillars, boot lid and the central area of the rear wheel arches. Therefore, it is not the increased use of salt *per se*,

but rather salt in combination with existing bad or ill-conceived designs which are tested in accelerated conditions which bear little or no relation to the operating environment that the vehicle finds on the roads. Furthermore, the accelerated corrosion tests used by the surface coating industry, who supply paints and other forms of corrosion protection coatings, do not relate to the breakdown mechanism.

In any accelerated testing procedure which involves higher temperatures in 100 per cent humidity in order to accelerate the testing, due cognisance should be taken of the glass transition temperature and its variation with water vapour uptake.

[Received 6 November 1981]

## References

1. McArthur, H., *Engineering*, 1979, Oct., 1308-15.
2. McArthur, H., *Inst. Mech. Eng. Conference*, "Impact of Design on Whole Life Costing", paper No. 359/80, London, 1980, Oct.
3. "Know about Corrosion", *AA*, second edition, 1974, p.16.
4. "Trans. electrodeposition of coatings 1971", A. G. S. Chicago, *Adv. Chem. Sc. Series 119 Conf. Proceedings*, published 1973.
5. *AA Report No. A 804*.

## Appendix

### Preparation of salt droplet gel

The gel is made up as follows: to 500 ml of boiling distilled water, add 10 g of agar-agar powder, 15 g of common salt, and 0.5 g of potassium ferricyanide (for the detection of the ferrous ion). 2 ml of 1 per cent phenolphthalein may be added as an indicator for the cathodic product (hydroxyl ions). Stir until the agar-agar powder is completely dissolved.

Cast the solution in a tray to produce a uniform film on solidification of 0.5 cm thick. Before solidification it is advisable to remove some of the undissolved agar-agar powder by drawing the edge of a clean piece of paper over the surface. When solidification is complete, slice the solid film into 1 cm squares with a stainless steel knife. Remove the squares from the casting tray and place on the protective to be tested.

The samples to be tested are suspended over a pool of distilled water, and the whole mounted in trays and kept in a humidity cabinet at a predetermined temperature. The test temperature of the ASTM B117 salt spray of 35°C was considered too high for most grease paints and so a lower temperature of 30°C was found to be satisfactory. Throughout the test procedure the samples should remain horizontal to prevent the condensing water vapour from touching the edges of the steel sample and producing "the edge effect".

The film is considered to have broken down when the blue colouration formed by ferrous ions with potassium ferricyanide appears. The test can be considered complete when some arbitrary number of samples shows breakdown. In our tests, the time taken for 60 per cent of the samples to show breakdown is taken as the measure of protection offered by a grease paint.

The lateral spread of corrosion can be determined by the spread of the blue colouration, but this is not considered advisable.

### Capillary penetration

Capillary tubing is inserted into small sample bottles in which an extra hole has been made to ensure that a temperature fluctuation will not alter the capillary rise.

# Studies in maleation and preparation of maleopimaric acid from gum rosin of *Pinus roxburghii*

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## Summary

The diene reaction of abietic type acids with maleic anhydride yields maleic adduct. A polybasic acid cis-6,14-dihydrolevopimaric acid-6,14-endo- $\alpha,\beta$ -succinic anhydride (maleopimaric acid) can be isolated in a pure form from maleic adduct. This acid can be utilised in various industrial products such as plastics, synthetic resins, fibres etc. where at present petrochemical-based polybasic acids are being used. A literature survey has revealed that very little work has been reported on

the maleation of the gum rosin of the Indian Chir Pine (*Pinus roxburghii*), and on the isolation of maleopimaric acid (MPA) from the adduct.

In the present work we have carried out some studies to determine the optimum reaction conditions for the maleation of this gum rosin; the isolation of pure MPA by simple methods is also reported.

## Keywords

*Processes and methods primarily associated with manufacturing or synthesis*

maleinization

*Raw materials for coatings*

binders (resins, etc.)

abietic resin  
gum rosin  
maleic resin  
rosin

*raw materials used in manufacture or synthesis of ingredients for coatings*

abietic acid  
dibasic acid  
maleic anhydride  
rosin

## Etudes sur la maléation et la préparation de l'acide maléopimarique à partir de la gomme-résine de *Pinus Roxburghii*

### Résumé

La réaction diénique des acides du type abietique avec l'anhydride maléique rend des adducts maléiques. Un acide polybasique, le cis-6,14-dihydrolevopimarique-6,14-endo- $\alpha,\beta$ -anhydride succinique (l'acide maléopimarique), peut être isolé à l'état pur à partir des adducts maléiques. Cet acide peut être utilisé en produits industriels tels que les matières plastiques, les résines et les fibres synthétiques, etc., où les acides polybasiques en provenance de la pétrochimie sont actuellement utilisés. Un

examen attentif de la littérature a révélé que très peu de recherches a été publié au sujet de la maléation de la gomme-résine de *Pinus Roxburghii* (Indian Chir Pine), et de l'isolation de l'acide maléopimarique (MPA), à partir de l'adduct. Au cours de cet exposé on rend compte des études destinées à déterminer, par les méthodes faciles, les conditions optimales de réaction pour la maléation de la gomme-résine et pour l'isolation du MPA pur.

## Versuche zu der Maleinierung und der Herstellung aus dem Gummiharz von *Pinus Roxburghii* der Maleopimärsäure

### Zusammenfassung

Die Dienreaktion des Abietinsäuretypes mit Maleinanhydrid liefert Maleinaddukte an. Eine mehrbasige Säure cis-6,14-Dihydro L-Pimärsäure-6,14-Endo- $\alpha,\beta$ -Sukzinanhydrid (Maleopimärsäure), lässt sich in reiner Form von den Maleinaddukten isolieren. In verschiedenen Produkten wie Kunststoffe, Kunstharze und Chemiefasern worin man gegenwärtig die auf Petrochemie gegründeten mehrbasigen Säure benützt, kann diese Säure angewandt werden. Eine

Überlick über die Literatur entdeckte dass sehr wenige Arbeit an der Maleinierung des Gummiharzes von *Pinus Roxburghii* (Indian Chir Pine), oder an der Isolierung der Maleopimärsäure (MPA), von dem Addukt berichtet wurde. In diesem Aufsatz sind die Untersuchungen die optimalen Reaktionsbedingungen zur Maleinierung des gummiharzes und die mittels leichter Methoden durchgeführte Isolierung der reinen MPA zu bestimmen mitgeteilt.

## Introduction

*Refs. 1-12*

One of the most interesting synthetic reactions of gum rosin (diene) is the formation of a Diels-Alder adduct with

maleic anhydride (dienophile) via the Diels-Alder reaction (diene synthesis). It is a 1:4 addition of a conjugated diene to a dienophile to form an adduct having a six membered unsaturated ring, a 4+2 cyclo-addition (Figure 1). Of all the rosin acids, levopimaric acid, with its homo-nuclear conjugated double bond, condenses at room temperature

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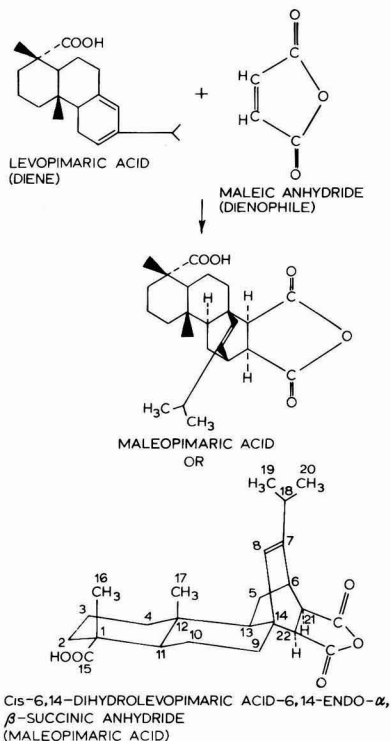


Figure 1. Diene reaction

with maleic anhydride to form the Diels-Alder addition compound<sup>1,2</sup>, cis-6,14-dihydro levopimaric acid-6,14-endo- $\alpha,\beta$ -succinic anhydride (maleopimaric acid). On the other hand abietic, neoabietic and palustric acid react with maleic anhydride under vigorous reaction conditions to form maleopimaric acid (MPA)<sup>3,4</sup>. To account for this abnormal Diels-Alder reaction of the abietic type acids it has been assumed that levopimaric acid is in equilibrium with abietic acid under the conditions<sup>5</sup> required for the reaction. Rosin-maleic anhydride adducts have important industrial applications<sup>6,7</sup>. Hovey and Hodgins<sup>8</sup> studied the reaction between rosin and maleic anhydride by noting the change in the melting point of the mixture and estimating its "free maleic anhydride" content.

Generally, crude "maleated rosin" is used as it is or treated with other reagents and then used in inks, adhesives and coatings; maleopimaric acid is not separated. In the recent past it was realised that various useful products can be prepared from MPA, where a polybasic acid is required. The preparation of maleopimaric acid has been reported by several workers<sup>9-11</sup>, and a simple method of preparation of MPA from the gum rosin of the Indian Chir Pine (*Pinus roxburghii*) has already been reported by us<sup>12</sup>.

A literature survey has revealed that very little information is available on the various reaction parameters of the maleation of this gum rosin. As has already been reported<sup>12</sup>, the composition of the gum rosin of *P. roxburghii* is somewhat different from other species. Therefore, in the present work it has been our aim to

Table 1  
Rosin specifications

Acid value	170 mg KOH/g
mp (cap)	60-65°C
Softening point	75-77°C
Abietic acid	30-33%
Total acid content	90-92%
Abietic type acids	60-65%
Grade	WG
Ash content	0.05%
Unsaponifiable material	6%
Fe content <sup>13</sup>	0.02-0.05%
Saponification value	175
Material insoluble in toluene	0.05%

obtain the optimum reaction conditions for the maleation of this gum rosin with respect to: maleic anhydride content, time and reaction temperature. In addition to this, pure maleopimaric acid has been isolated using solvent extraction processes. Both methods are very simple and give good yields and pure products.

## Experimental

Refs, 1, 12-16

## Reagents

Gum rosin – WG grade supplied by ITR Co. Ltd (see Table 1 for specifications)

Maleic anhydride – LR grade (HPC)

Carbon tetrachloride – GR grade (SM Chemicals)

Glacial acetic acid – GR grade (SM Chemicals)

Petroleum spirit – (40°-60°C) – LR grade (SM Chemicals)

Diethyl ether purissa p.a. (Fluka AG)

Toluene – LR grade (BDH Chemicals)

Aviation turbine fuel (ATF) – commercial (distilled)

## Procedure

### 1. Maleation of gum rosin

The reaction products of rosin and maleic anhydride were prepared by heating them together in a nitrogen atmosphere with continuous stirring. The proportion of rosin to maleic anhydride, the temperature and the duration of the reaction were varied. Samples were taken out at fixed intervals.

The reaction products obtained were analysed in each case and free rosin (unreacted rosin), free maleic anhydride, the acid value and softening point (ring and ball method) were determined.

A probable mechanism for the Diels-Alder reaction of gum rosin and maleic anhydride is shown in Figure 2. The results of the above reactions are given in Table 2.

### 2. Preparation of cis-6,14-dihydro levopimaric acid-6,14-endo- $\alpha,\beta$ -succinic anhydride (maleopimaric acid)

The rosin-maleic adduct obtained contained some non-reactive rosin acids and unsaponifiable material besides

Table 2  
Effect of temperature and proportions of maleic anhydride used on the maleation of gum rosin

Sample No.	Proportion of gum rosin to maleic anhydride (g/mole)	30 minutes				60 minutes				90 minutes				120 minutes				180 minutes				
		FR (%)	FMA (%)	AV	SP (°C)	FR (%)	FMA (%)	AV	SP (°C)	FR (%)	FMA (%)	AV	SP (°C)	FR (%)	FMA (%)	AV	SP (°C)	FR (%)	FMA (%)	AV	SP (°C)	
1.	160	1:1 mol 100:33 g	27.12	5.71	352	108	26.09	5.65	354	109	26.1	5.61	357	110	26.06	4.5	361	111	25.8	4.3	360	112
2.	160	1:0.9 mol 100:30 g	29.4	3.4	341	105	29.1	3.3	343	106	28.7	3.2	348	108	28.5	2.4	352	109	28.1	1.9	350	111
3.	190	1:1 mol 100:33 g	23.8	4.8	365	109	22.2	3.8	367	110	21.9	3.5	369	112	21.3	3.2	372	112	20.7	2.4	370	113-114
4.	190	1:0.9 mol 100:30 g	25.8	2.8	358	108	24.6	2.0	362	109	24.4	1.9	367	111	24.2	1.7	372	112	23.4	1.5	369	113
5.	190	1:0.8 mol 100:27 g	28.5	1.6	349	107	27.3	0.6	353	108	26.8	0.6	358	109	26.5	0.5	364	110	25.8	0.4	361	111
6.	190	1:0.7 mol 100:24 g	34.2	1.0	340	106	32.0	0.3	347	106-107	31.4	0.28	350	107	30.9	0.27	358	108	29.7	0.22	356	110
7.	200	1:1 mol 100:33 g	22.2	3.7	365	109-110	20.4	2.4	369	110	19.7	1.4	370	112	18.2	0.8	371	112	17.6	0.24	370	114
8.	200	1:0.9 mol 100:30 g	23.5	2.7	359	108	22.3	2.2	361	109	21.0	0.8	365	110	19.6	0.6	370	110	18.1	0.22	367	113

Notation: FR = free rosin; FMA = free maleic anhydride; AV = acid value in mg KOH/g; SP = softening point (ring and ball); and MA = maleic anhydride

maleopimaric acid (MPA). The tricarboxylic acid, MPA, can be isolated by extracting the maleated rosin with different solvent mixtures. In our earlier work we reported the preparation of MPA from the gum rosin of *P. roxburghii* using a modified version of the Lawrence and Eckhardt process<sup>12</sup>. In the present paper we have used two solvent mixtures, i.e. ether/petroleum ether and ATF/toluene, for the isolation of the pure polybasic acid. We found that the yield is good and the product is comparable.

**2.1 Ether-petroleum ether extraction method** – For the separation of MPA, sample No. 4 (100:30, gum rosin/maleic anhydride), prepared by the maleation of rosin, was used.

200 g of maleic adduct was crushed to a fine powder. To this, 240 ml of a mixture of ether/petroleum ether (40-60°C) in a 1:5 ratio was added with vigorous stirring while the MPA separated. Another 240 ml of the solvent mixture was added and stirring continued for some time. Crude MPA was obtained by using vacuum filtration; the solid was washed several times with the solvent mixture (5 × 30 ml).

The properties of the crude MPA obtained were: – mp (cap) 215°C, acid value 380 (acetone/water),  $(\alpha)_D^{25}$  (CHCl<sub>3</sub>) – 29.2°, yield – 49.5 per cent, IR values –  $\bar{\nu}_{\text{Max}}^{\text{KBr}}$  1845, 1780, 1710 cm<sup>-1</sup>.

The crude MPA was washed with ice-cold glacial acetic acid and dried under vacuum at 110-130°C for 4 hours. The resulting product was a very pure white crystalline solid.

The properties of the purified MPA obtained were: mp (cap) 225-226°C, acid value – 398 (acetone/water),  $(\alpha)_D^{25}$  (CHCl<sub>3</sub>) – 28.9°, yield – 48 per cent.

**2.1.1 Residual material** – The filtrate contained a substantial amount of rosin which was unreacted. It was

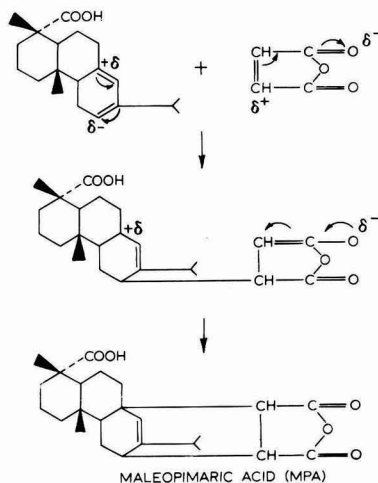


Figure 2. Mechanism of maleation of gum rosin

therefore of interest to evaluate the residual material. It could have easily been assumed to be a mixture of unreacted rosin (free rosin), non-crystallisable adduct and free maleic anhydride.

The liquid obtained by the above method was evaporated to obtain 75 g of product. This product differed very little from the unmodified rosin, and it can easily be utilised as such. In addition, the colour of this product was superior to the rosin used for making the maleic adduct. The colour values of the residual material are given in Table 3.

The residual material was esterified with glycerol and pentaerythritol to produce esters which were compared to

Table 3

	Residual material	Gum rosin
Colour (USDA)	WW	WG
Gardner value	7	8
Acid value (mg KOH/g)	196	170
Melting point (°C) (cap.)	60	60
Free maleic anhydride (%)	0.018	

Table 4

	Residual material		Gum rosin	
	Glycerol ester	Penta ester	Glycerol ester	Penta ester
Acid value (mg KOH/g)	8	40	7.8	21
Melting point (°C) (cap.)	106	140	83	100
Melting point (°C) (ring and ball)	117	151	92	110
Reaction time (hours)	3	3	3	3
Polyol used (%)	13	12	13	12

the esters prepared from unmodified rosin. The results are shown in Table 4.

It has been reported by G. Weissmann<sup>14</sup> that due to the presence of a dibasic acid (mercusic acid) in Indonesian gum rosin, the melting points of the glycerol and penta esters are higher than the corresponding esters prepared from Portuguese rosin, which does not contain mercusic acid. Similarly, it has been observed here that the presence of a small amount of dibasic acid, i.e. maleic anhydride, greatly increases the melting points of the esters due to the formation of higher molecular weight esters<sup>1</sup>.

**2.2 Aviation turbine fuel (ATF)/toluene extraction method** – The maleic adduct obtained with sample No. 4 (100:30, gum rosin/maleic anhydride) was used for the extraction of MPA. Adduct (200 g) was extracted with a solvent mixture comprising ATF/toluene in the ratio 10:2 over a period of seven to eight hours. The extract was then concentrated and allowed to stand overnight during which time crystals of crude MPA were deposited. The crude product was then recrystallised to produce pure product. The yield was 40 per cent, acid value – 398 (acetone/water), mp (cap)-225°C, ( $\alpha$ )<sub>D</sub><sup>25</sup> (CHCl<sub>3</sub>) – 29.3°.

Other solvent such as cyclohexane, heptane etc. were also tried but the results were not satisfactory.

**2.3 Instrumental analysis of MPA** – The MPA samples prepared by the above methods were examined using the following techniques.

**2.3.1 Infrared spectroscopy** – IR values:  $\text{P}_{\text{Max}}^{\text{IR}}$  3400-2500 cm<sup>-1</sup> (–OH stretching in free carboxylic group),

1840-1845 cm<sup>-1</sup>, 900-940 cm<sup>-1</sup>

(characteristic of  $\begin{array}{c} \text{O} & & \text{O} \\ || & & || \\ \text{--- C --- O --- C ---} \end{array}$ ),

1780 cm<sup>-1</sup>, 1710 cm<sup>-1</sup> (C=O stretching in free carboxylic group),

1980 cm<sup>-1</sup> (cyclic olefin in the molecule),

1450 cm<sup>-1</sup> (carboxylate ion). Infrared spectra are given in the literature<sup>12</sup>.

**2.3.2 Nuclear magnetic resonance analysis<sup>15</sup>** – The NMR spectrum was characteristic of pure MPA in giving signals at:

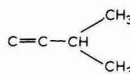
$\delta$  0.63

ANGULAR CH<sub>3</sub> (C-12)

$\delta$  0.9

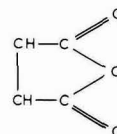


$\delta$  1.01 to 1.18

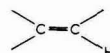


(Doublet, two equivalent methyls of the isopropyl group)

$\delta$  3.0



$\delta$  5.6



(Vinyl proton singlet)

The C-12 methyl group's resonance lies in an abnormally high part of the field,  $\delta$  0.63, indicating that this group is magnetically shielded to an unusual degree (Figure 3).

**2.3.4 Mass spectroscopy<sup>16</sup>** – Mass spectra of MPA confirmed that the substance prepared was pure MPA. The main molecular ion ( $M^+$ ) had a mass of 401 m/e (theoretical value: 400). The base peak was at 302 m/e, i.e. maleopimarate, C<sub>20</sub>H<sub>30</sub>O<sub>2</sub>, (Figure 4).

## Results and discussion

*Refs. 18-21*

The major constituent present in gum oleoresin, levopimaric acid, isomerises to abietic acid, neoabietic acid and palustric acid on distillation. Abietic type acids react with maleic anhydride under extreme conditions to form adducts. Adduct formation, therefore, raises the acid number and softening point of the product.

A dicarboxylic acid anhydride titrates as a monobasic acid in an alcoholic solution<sup>17</sup>. The hydrolysed product from the adduct does not behave as a free tricarboxylic acid but as a mono-hydrate anhydride, titrating by the reaction of only two of its carboxyl groups in an alcoholic solution<sup>18,19</sup>. The acid value of the pure adduct on this basis is about 280 and the observed value is around 276-278. Its acid value in our experiment was determined by using an acetone/water (70:30) solution, and titrating it with a 0.1N aqueous solution of KOH. The value obtained was about 398 whereas the theoretical value is 399-420.

All data regarding the maleation of gum rosin are given

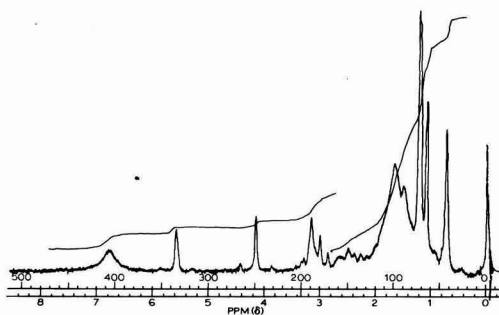


Figure 3.

in Table 2. We have studied the effects of various parameters of the maleation of Indian Chir Pine rosin, viz. time, temperature and the percentage of maleic anhydride used. We have observed that at 200°C and above, decomposition of rosin, evaporation of maleic anhydride, decarboxylation and darkening of the product occurs. The optimum value for the reaction time is two hours, for reaction temperature, 190°C, and for maleic anhydride percentage, 30. Using a lower percentage of maleic anhydride, maleation of the gum rosin is not completed as is evident from the low acid value and softening point. In varnish formulations, only the percentage of maleic anhydride actually consumed in the reaction with rosin has so far been considered important<sup>20</sup>. Rosin-maleic adduct, besides maleopimaric acid, contains some unsaponifiable material, non-reactive rosin acids and non-crystallisable adduct. In order to obtain pure MPA these impurities must be removed. We have used two solvent mixtures for the extraction viz.: (i) Ether and petroleum ether (40-60°C) (ratio 5:1), (ii) Aviation turbine fuel (ATF) and toluene (ratio 10:2).

The product MPA was obtained in good yields and was quite pure. The methods discussed are quite simple and industrially feasible. Thus, this polybasic acid can be manufactured in sufficient quantities to replace petrochemical-based polybasic acids in surface coatings, plastics, printing inks, fibres, synthetic resins etc<sup>21</sup>.

#### Acknowledgement

The authors express their gratitude to the managing director of ITR Co. Ltd for his continuous interest in our work and for permission to publish this paper. We are indebted to Ray V. Lawrence, Florida, USA, and Dr D. F. Zinkel, research chemist, USDA, Madison, Wisconsin, USA, for their valuable suggestions.

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#### References

1. Bacon, R. G. R. and Ruzicka, L., *Chem. Ind.*, 1936, 546.
2. Wieubans, H. and Sandermann, W., *Ber.*, 1936, 60, 2202.

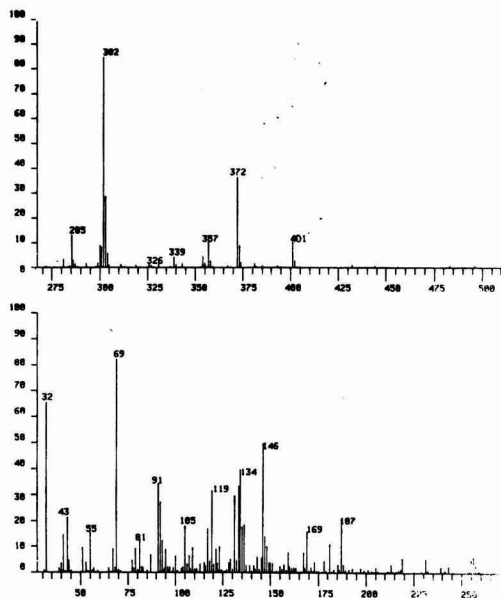


Figure 4.

3. Loeblich, V. M., Baldwin, D. E. and Lawrence, R. V., *J. Amer. Chem. Soc.*, 1955, 77, 2823.
4. Arbutov, B., *J. Gen. Chem.*, USSR, 1932, 2806; *CA*, 27, 2088, 1933.
5. Fieser, L. F. and Campbell, W. P., *J. Amer. Chem. Soc.*, 1938, 60, 159.
6. Alder, K., "Newer methods of preparative organic chemistry", *Interscience Publishers*, NY, 1948, 473.
7. McKennon, F. L., Johnson, A. J., Field, E. T. and Lawrence, R. V., *Ind. Eng. Chem.*, 1949, 41, 1296; *CA*, 52, 6994, 7918 (1958); *CA*, 53, 17737 (1959).
8. Hovey, A. G. and Hodgins, T. S., *Ind. Eng. Chem.*, 1940, 32, 272-279.
9. Lawrence, R. V. and Eckhardt, O. S., US Pat. 2, 628, 226 (1953); *CA*, 48, 728 (1954).
10. Gonis, G. and Slezak, F. B., US Pat. 3, 658, 538 (1972).
11. Wieger, P. K., South African Pat. 68-04, 538 (1968).
12. Saksena, S. C., Panda, H., Ahisanuddin and Rakhshinda, *JOCCA*, 1981, 64(8), 299.
13. Kapoor, B. M. and Saksena, S. C., *J. Col. Soc.*, 1980, 19(4), 215-218.
14. Weismann, G., *Naval Stores Review*, 1977 Sept.-Oct., pp. 6-8.
15. Meyer, W. L. and Huffman, R. W., *Tetrahedron Letters*, 1962, 16, pp. 691-695.
16. Genga, C. A., *Anal. Chem.*, 1959, 31(11), 1750.
17. Siegal, E. F. and Moran, M. K., *J. Amer. Chem. Soc.*, 1947, 69, 1457.
18. Mashihoro, Abo., *Bull. Chem. Soc.*, Japan, 1960, 33, 798.
19. Sanderson, T. F., private communications.
20. Matin, S. R. W., *Paint Technology Manual*, Part Two, *Chapman and Hall Ltd*, London, 1961, 72.
21. Singh, A. P. and Mehra, S. N., "Rosin and its derivatives, their chemistry and potential for industrial utilisation", presented at Symfor, *R.R.L. Jammu*, India, 1979, March.

## Short Communication

# Corrosion inhibitors – an alternative to active anticorrosive pigments?\*

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As is generally known, the real or presumed hazards involved in using active anticorrosive pigments are assessed differently. In any case, legal injunctions make it increasingly difficult to use such pigments and comprehensive efforts are being made to find alternative solutions to protect metals, especially iron and steel. One of the possibilities discussed is to substitute anticorrosive pigments by corrosion inhibitors.

The application of corrosion inhibitors in corrosion protective coatings has long been discussed and investigated. However, up to now these inhibitors have not been used much. How can this be explained and what is the prospect, according to the present state of the knowledge, of substituting anticorrosive pigments such as red lead or zinc chromate with corrosion inhibitors?

Basically, one may distinguish between corrosion inhibitors of acid corrosion, which evolves hydrogen, the so called pickling inhibitors, and corrosion inhibitors of normal atmospheric corrosion in weakly acid or alkaline media, which consumes oxygen. In organic coatings the last group is of prominent interest. Apart from special cases three types of corrosion inhibitors<sup>1</sup> are known:

1. Basic compounds such as inorganic bases or amines
2. Organic acids as salts, such as sodium benzoate
3. Oxidising inorganic or organic compounds such as sodium nitrite, dicyclohexyl ammonium nitrite or chromates.

Whereas pickling inhibitors mainly act by adsorption at the local corrosion elements, inhibitors of corrosion in the neutral to weakly alkaline region support the formation and repair of the natural oxide layers directly at the electrodes of the local corrosion elements. In the case of inorganic corrosion inhibitors, other oxides, such as those of chromium, are also found in the oxide layer besides the oxides of iron.

What are the requirements for corrosion inhibitors to be effective?

Corrosion inhibitors must be sufficiently soluble, because their action is bound to the dissolved fraction. Moreover they must be present at the film/metal interface or must be able to diffuse easily to it. For this, the binder must be sufficiently hydrophilic or permeable to water and inhibitors must be dissolved in it, a condition, incidentally, which must also be met by anticorrosive pigments. That means, conditions must exist which oppose optimal protection of the metal substrate from penetrating corrosive agents such as water, oxygen or sulfur dioxide. If the inhibitor is too soluble, osmotic blistering may occur, especially if it is locally enriched in the form of small pigment-like particles.

The choice of hydrophilic or permeable binders, however, is normally disadvantageous with regard to the adhesion of coatings at high humidity or in the presence of liquid water. Because inhibitors, like anticorrosive pigments, will work only in the dissolved state and in direct contact with the metal surface, the loss of adhesion (i.e. a paint defect) is a prerequisite for their anticorrosive action. Therefore the question arises whether improving adhesion and reducing the permeability of coatings is preferable to the substitution of anticorrosive pigments with corrosion inhibitors. One may object that the use of anticorrosive pigments together with binders, which admittedly have poor barrier properties, has been quite successful over many years. However, this argument disregards that, contrary to corrosion inhibitors, these pigments are used in high concentrations and provide additional protection mechanisms, e.g. as a metallic soap in the case of red lead. Corrosion inhibitors cannot be used in such high concentrations without detrimental effects on other important coating properties. Moreover, many inhibitors may cause specific defects, such as the formation of carbonates, discolouration or inhibition of film formation.

Attaching inhibitors chemically to binder molecules or modifying them with inhibiting groups is not practicable because the protective action is completely lost if the active group or compound is not freely mobile and diffusible. Accordingly, it can be shown that the salts of polymers with carbonic acid groups, as used in electrodeposition, are excellent corrosion inhibitors in aqueous solutions, however, they lose this capability after film formation<sup>2</sup>.

Finally, it should not be forgotten that in using corrosion inhibitors in organic coatings, the same limitations regarding toxicity and environmental effects apply as with anticorrosive pigments. Therefore a great number of especially effective inhibitors, such as organic amine nitrites or nitro derivatives, are ruled out from the beginning.

The large number of known – or still unknown – corrosion inhibitors makes it somewhat difficult to present a general judgement on the usefulness of corrosion inhibitors as alternatives to the classical anticorrosive pigments which have been and still are used in corrosion protective paints. Considering the principal difficulties mentioned above, there is little hope that the problem of corrosion protection by organic coatings may be satisfactorily solved by corrosion inhibitors.

[Received 12 October 1981]

## References

1. Funke, W. and Hamann, K., *Werkstoff und Korrosion*, 1958, 4, 202.
2. Funke, W., *Farbe und Lack*, 1969, 75, 844.

\*Originally published in *Farbe und Lack*, 1981, 87, 787.

# Oil and Colour Chemists' Association

## ANNUAL REPORT OF THE COUNCIL FOR 1981

Adopted at the Twentieth Annual General Meeting of the Incorporated Association, held on Wednesday 16 June 1982 at the Piccadilly Hotel, London W.1, England at 3.00 p.m.

### General

The year under review during a period of recession, has been a difficult year for the Association but various steps have been taken to plan for future developments, particularly in respect of the Sections overseas. In the Annual Report for 1980 it was mentioned that Council were considering a new concept for OCCA International and at the December Council meeting a Working Group was appointed. During August, the President (Mr D. J. Morris) accompanied by Mrs Morris visited South Africa and addressed meetings of members and discussed Association matters with them.

The Thirty-third Technical Exhibition took place at the Cunard International Hotel, Hammersmith, London from 28-30 April and attracted visitors from 37 countries and exhibitors from 10 overseas countries were represented at this Exhibition. A report appears later under the heading "Exhibition Committee" and a review appeared in the July issue of the *Journal*.

In June, the Reader Enquiry Service in the *Journal* was extended to cover advertisements.

A welcome addition in August was the introduction of the OCCA Bulletin containing information on forthcoming Section activities etc. to replace individual Section Circulars for the United Kingdom and Irish Sections. This has proved to be popular as further details of activities organised by each of the Sections is given wider publicity than by the Section Circulars.

At the end of September the *Journal* despatchers went into liquidation which delayed the circulation of the October issue as it was necessary to transfer the stock of carriers and labels to new despatchers.

The Council Reunion Dinner, which had been scheduled to take place following the Council meeting on 21 October, was postponed to 2 December owing to a threatened rail strike in October. At the Reunion Dinner a presentation was made to Mr C. N. Finlay to mark his six years' service as Honorary Research & Development Officer.

The Nineteenth Annual General Meeting of the Incorporated Association took place at the Beaufort Hotel, Bath on 19 June 1981. Mr D. J. Morris was elected President and the following Vice-Presidents were elected:

Mr R. A. Eglington  
Mr R. A. Bettison  
Mr D. A. Bayliss

Mr P. Birrell  
Mr J. E. Mitchell  
Mr J. R. Taylor  
Mr C. N. Finlay

The Honorary Officers were elected as follows:

Honorary Secretary . . . . . Mr J. R. Bourne  
Honorary Treasurer . . . . . Dr H. R. Hamburg  
Honorary Editor . . . . . Mr D. S. Newton  
Honorary Research and  
Development Officer . . . . . Mr J. R. Taylor  
Honorary Technical Education  
Officer . . . . . Mr A. T. S. Rudram

As only three nominations had been received for the three elective places, it was announced that the following members had been elected to the Council for the years 1981-1983:

Mr F. D. H. Sharp  
Mr F. B. Windsor  
Mr H. C. Worsdall

Votes of thanks to the retiring President and Council members, to the Honorary Officers and to the Director & Secretary were carried with acclamation.

The Annual General Meeting took place at the end of the final session of the Association's Biennial Conference at Bath on "Alternative technologies in coatings".

Bath was a new venue for an OCCA Conference and proved to be very popular with delegates, particularly those from overseas. Twelve full papers were presented and as an innovation a discourse session was introduced; the sessions took place in the mornings and afternoons of Thursday and Friday.

A varied social programme was arranged for delegates and their ladies and these were all well supported during the Conference, but in accordance with requests for a coach tour and a works visit on the Wednesday afternoon, arrangements were made but these did not attract the support expected.

On Thursday 18 June, a meeting was held of the International Liaison Committee which was attended by delegates for FATIPEC (Prof A. Toussaint and Mr J. Roire, a Past President), for the SLF (Mr G. K. Thomsen, President), for the JSCM (Dr K. Meguro, Vice-President), for FSCT (Mr W. H. Ellis, President) and for OCCA



(President, President Designate and the Director & Secretary).

The Association's Dinner Dance was held on Friday 19 June. At the Dinner Dance, in addition to members of the International Liaison Committee, the Association's guests included the Mayor and Mayoress of Bath (Councillor and Mrs L. Ridd) who received the delegates at the Reception with Dr and Mrs Smith prior to the Dinner and the President of the Paintmakers Association (Mr D. Johnson) and Mrs Johnson and the President of the Society of Dyers & Colourists (Dr J. Butcher) and Mrs Butcher.

The Conference was reported on fully in the August issue of the *Journal*.

During the year, Council conferred Commendation Awards upon Mr E. Armstrong (Chairman on two occasions of the Hull Section), Mr N. Cochrane (a former Chairman of the West Riding Section) and Mr C. Barker (a former Manchester Section Representative on Council and Elective Member) for their work in promoting the Association's activities, particularly at Section level.

In the course of the year, Divisions and Sections of the Association have organised Symposia as follows:

The London Section held a joint symposium with the Society of Dyers & Colourists on 18 March entitled "Applications of Colour".

The Thames Valley Section held a Seminar on 22 October entitled "Automotive Refinishing".

The Midlands Section held a Seminar on 18 November entitled "Low Energy Coatings" at the National Exhibition Centre, Birmingham.

The London Section held a Seminar also on 18 November entitled "Printing and Printing Inks" at the Thames Polytechnic, Woolwich.

The Auckland Section of the New Zealand Division held a 1-day Symposium on 17 November entitled "Coil Coating".

In the course of the year the Director & Secretary was pleased to welcome, amongst other visitors from overseas, Mr David Morris (Nigeria and formerly Chairman of the West Riding Section) and Mr O. C. Vorster (Transvaal).

Council learnt with regret of the death of the following distinguished Members or former Members of the Association:

Dr S. H. Bell, OBE (Past President)

Mr J. Ebdon (Chairman, Zimbabwe Branch, General Overseas Section)

Mr. J. Smethurst (Elective Council Member and former Chairman of Manchester Section)

Obituary notices appeared in the *Journal*.

The autumn meeting of the Finance Committee recorded a tribute to the work of the Director & Secretary in maintaining the standard of the organisation of the Association during such a difficult period and the Council, in receiving the report of the Finance Committee at its December meeting, endorsed the views expressed by the Finance Committee.

## Membership of the Association

Council reports that, in a year which has seen a general decrease in employment, the total membership has only slightly decreased (2.5%) during the year and the figures given below at 31 December 1981 relate only to those members whose 1981 subscriptions have been received; the names of those in arrears with subscriptions have been removed.

Section	Ordinary	Associate	Honorary	Reg. Student	Total
Bristol	63	12	—	—	75
Hull	45	2	—	1	48
Irish	33	8	—	—	41
London	449	40	4	10	503
Manchester	324	39	1	14	378
Midlands (including					
Trent Valley Branch)	159	19	—	9	187
Newcastle	102	5	—	2	109
Scottish (including					
Eastern Branch)	96	13	—	4	113
Thames Valley	90	15	—	—	105
West Riding	75	14	1	9	99
General Overseas	314	20	1	—	335
Zimbabwe Branch	24	9	—	—	33
Nigerian Branch	20	6	—	—	26
Ontario	76	15	—	—	91
New Zealand Division					
Auckland	127	50	—	2	179
Wellington	50	31	—	—	81
South African Division					
Cape	35	14	—	—	49
Natal	89	28	1	1	119
Transvaal	105	25	2	—	132
Total 1981 —	2276	365	10	52	2703
Total 1980 —	2344	367	8	55	2774
Net increase/decrease during 1981 —	-68	-2	+2	-3	-71

## The Council

During the calendar year the Council has met four times, attendance being 24. All meetings were held in London.

## Committees of the Council

The Committees of Council met as set forth below:

Exhibition Committee	1
Finance Committee	3
Liaison Committee	—
President's Advisory Committee	4
Professional Grade Committee	4
Technical Committee	1
Jordan Award Committee	1
Technical Education Committee	1
Publications Committee	—
Forward Thinking Group	—
Working Group on Exhibition	1
Working Group in Technical Education	2
Working Group on OCCA International	—
	(instituted December 1981)

## Exhibition Committee

Chairman: The Honorary Treasurer, Dr H. R. Hamburg

The Thirty-third Annual Exhibition was held at the Cunard International Hotel, Hammersmith, London W.6 and a full report of the Exhibition including a review of the stands appeared in the July issue of the *Journal*; the Exhibition Committee recorded its thanks to Mr D. S. Newton the Honorary Editor, who prepared the review.



This was the second occasion on which the Exhibition had been held in a hotel venue and the Exhibition was arranged on two floors – the New Exhibition Hall and syndicate rooms on the third floor.

Admission to the Exhibition was once again free to visitors, but they were asked to complete registration forms, since as members of the Association of Exhibition Organisers, the Association has to complete the Exhibition Data Form, which is duly certified by the Association's auditors and the Audit Bureau of Circulations. The information contained in the Registration cards showed that the Exhibition had once again attracted visitors from a large number of overseas countries and the high quality of the exhibitors was manifestly evident in days of recession.

#### *Finance Committee:*

Chairman: The Honorary Treasurer, Dr H. R. Hamburg

As stated in the last Annual Report, the Finance Committee considered that members would prefer the membership subscription to be reviewed annually so that smaller increases could be arranged when necessary rather than a larger increase at wider intervals. Accordingly it was agreed at the Annual General Meeting that a small increase should be made on the subscription rates for 1982 and that the retired membership subscription, which had remained unchanged for many years, should be increased; no increase was made on the rates charged to registered students which had remained the same for a number of years in order to encourage younger personnel in the industry to identify themselves with the Association.

The Committee noted with satisfaction that in times of recession, the loss of membership in 1981 was limited to just over 2%.

Although the receipts from the Exhibition in 1981 were less than in 1980, it is pleasing to record that both sales of the *Journal* and advertising in the *Journal* showed an increase during the year.

During the year, certain adjustments were made to the Association's equity holdings on the advice of the Director & Secretary and at the end of the year the market value of the investments held showed that the equities stood at £1569 above their purchase price but that the market value of the British Government Securities was £1565 below their purchase price.

#### *Jordan Award Committee*

Chairman: The Honorary Research & Development Officer, Mr C. N. Finlay until June then Mr J. R. Taylor

The Committee met in February and decided to make the Jordan Award to Mr M. W. Leonard for his paper on "A study of the effects of increasing crystallinity in polyvinylidene chloride coated polypropylene (Prop C) and cellulose (mxxT/s)". This paper which was published in the December 1979 issue of the *Journal* had originally formed the basis of Mr Leonard's successful dissertation for the Licentiate ship. The Certificate and cheque for £100 was presented to Mr Leonard at the first meeting of the London Section on 24 September 1981 by the Chairman of the London Section, Mr B. F. Gilliam in the presence of the Director & Secretary.

#### *Liaison Committee*

Chairman: The President

A meeting of the International Co-ordinating Committee took place during the Bath Conference which was on 17-20 June 1981 and which was attended by the President of the Association, Dr F. M. Smith, who took the chair, the Director & Secretary and the President Designate. Various suggestions were made for future co-operative work between the constituent bodies of the International Co-ordinating Committee which will next meet to report progress at the FATIPEC Congress in May 1982.

Also present as the Association's guests at the Bath Conference and attending the Liaison Committee were the President of FSCT Mr W. Ellis, the President of the SLF Mr G. K. Thomsen and the Vice-President of JSCM Dr K. Meguro; the Honorary Secretary of the Association (Mr J. R. Bourne) was able to renew acquaintance with Dr Meguro during his visit to Japan in the autumn.

The Association was pleased to present a paper at the FSCT Convention in Detroit 28-30 October 1981. The paper, by Dr L. A. Simpson of BTP Tiioxide Ltd, entitled "Factors Affecting Metal Marking" had the distinction of being awarded the only "Roon Award" of 1981. The President of the Association Mr D. J. Morris attended the Convention.

#### *President's Advisory Committee*

Chairman: The President

For the 1981/1982 Session, Mr D. J. Morris invited the Chairmen of the Midlands Section, Mr R. L. Devenish, the Thames Valley Section, Mr V. A. Moore and the Scottish Section, Mr T. L. M. Humphrey, all of whom were in their second year of office, to serve on the Committee, together with the Honorary Officers of the Association.

#### *Professional Grade Committee*

Chairman: The President

The Professional Grade Committee met, as usual, on four occasions during the year, but the usual October meeting had to be re-scheduled to December, owing to a threatened rail strike and these names could not be included in the customary list which is printed in the December issue of the *Journal*. Thus, the details of the members admitted to the various grades in the table shown below does not take into consideration those admitted or transferred between grades at the December meeting.

In the last Annual Report it was stated that new regulations for admission to the Professional Grade would be presented to the Council early in 1981 and these regulations came into operation in September 1981, the 10th anniversary of the introduction of the professional grade. The details were published in the *Journal* and reprints of the regulations are available from the Association's offices.

Discussions have taken place with representatives from technical institutions to encourage them to prepare students in their final year of studies for the licentiate ship, since both the Professional Grade Committee and the Technical Education Committee are convinced that students are reluctant to return for a further period of

	Applications received	Applications transferred between grades	Successful	Awaiting fulfilment of regulations	Not accepted	Resignations and deaths	Upgradings	As shown in December 1981 Journal*
Fellowship	266	Less 48 Add 12	216	10	4	34	—	182
Associateship	377	Less 24 Add 60	354	39	20	59	17	278
Licentiatehip	50	Less 12 Add 12	21	18	11	2	10	9
	693	—	591	67	35	95	27	469

\*Notes: 1. Members admitted or transferred between grades at the meeting held on 2 December 1981 were not included in the December 1981 issue of the *Journal*. Details of these were recorded in the January 1982 issue of the *Journal*.  
 2. Including the United Kingdom and Ireland, 35 countries are represented in the list of successful candidates published in the December 1981 issue of the *Journal*.

study for the licentiatehip, but little success has been achieved in this field.

**Technical Committee**

Chairman: The Honorary Research & Development Officer, Mr C. N. Finlay until June, then Mr J. R. Taylor

The Technical Committee met, under the Chairmanship of Mr J. R. Taylor, in November to discuss the format and subject for the 1983 Conference and preliminary details will be announced in the *Journal* in 1982.

**Technical Education Committee**

Chairman: The Honorary Technical Education Officer, Mr A. T. S. Rudram

During the year a Working Group was set up by the Honorary Technical Education Officer, comprising two members from the Paintmakers Association (Mr D. H. Clement and Mr L. Bilefield), two members from the Society of British Printing Ink Manufacturers (Mr H. C. Worsdall and Mr L. Randall) and three members from this Association (Mr A. T. S. Rudram, Mr K. Arbuckle and the Director & Secretary).

The Working Group met on two occasions to try to clarify how best the Association could assist students in the new educational pattern and in particular, as recorded in the report of the Professional Grade Committee, it endeavoured to discuss with representatives from technical institutes the desirability of encouraging students to prepare for the licentiatehip during their studies, rather than at the completion of their studies.

The Association continues to be represented on the Paintmakers Association Training Board by the Honorary Secretary and the Director & Secretary.

**Publications Committee**

Chairman: The Honorary Editor, Mr D. S. Newton

This year has been one of some difficulty, entirely due to circumstances beyond the Association's control. The despatchers failed to send out copies of the *Journal* on time on a number of occasions, due to financial difficulties with the Post Office, and finally, without the Association's knowledge went into receivership. This necessitated the Director & Secretary having to make emergency arrangements to distribute the *Journal* and at short notice negotiate a contract with a new despatching company. Delays were also experienced due to one paper being extensively rewritten at the galley stage, resulting in it

finally having to be omitted from that particular *Journal* and printed in a later issue.

This year's Volume consisted of 538 text pages, a slight increase on the previous year, and contained 46 papers, including 3 Short Communications. These Short Communications are of considerable value to the *Journal* and could be profitably used by authors to give preliminary information on longer term work. An analysis of these papers by source and subject is given at the end of the report. It will be noted that the number of papers originating from the UK has increased compared with last year, owing to the Conference papers.

The OCCA Bulletin which is now included in the *Journal* has proved popular, but some changes in the layout will be made in the light of experience. The Reader

**Papers by Geographical Origin**

United Kingdom	19
Argentina	2
Australia	1
Belgium	3
Canada	1
Denmark	1
India	5
Italy	1
Netherlands	4
South Africa	1
West Germany	3
United States	2
Short Communications	3
	46

**Papers by Subject**

Accelerated Weathering	1
Additives	1
Analysis	5
Applications	2
Film properties	6
Inks	2
Paints (Solvent Based)	6
Paints (Water Reducible)	2
Pigments	6
Powder Coatings	2
Pretreatment (Metals)	2
Resins	3
Rheology	4
Surveys	3
Toxicity	1
	46

Enquiry Service continues to be well-used throughout the year.

The number of papers in hand is more than satisfactory for the immediate future, but this does pose problems since an excessive delay in publication results in a lack of immediacy when the papers are finally published.

The Honorary Editor thanks both the Director & Secretary for his efforts in ensuring the minimum delay in the despatch of the *Journal*, and to the Assistant Editor, D. N. Buddles, for his willing efforts during the year.

#### Representation on other organisations

The Association was represented on other organisations as follows:

The Parliamentary and Scientific Committee: The President and the Director & Secretary.

The British National Committee for Chemistry: Dr F. M. Smith

The City and Guilds Advisory Committee for the Chemical Technicians Certificate: Dr J. G. Gillan.

East Ham Technical College Consultative Committee for the Science Department: Mr R. M. W. W. Wilson.

Association of Exhibition Organisers: The Director & Secretary.

Programme Liaison Committee: The Honorary Programmes Officer of the London Section and the Director & Secretary.

Training Committee of the Paintmakers Association: The Director & Secretary with the Honorary Secretary.

The Paintmakers Association Hazardous Substances Advisory Panel and Technical Committee: Mr A. J. Ford.

The Society of Dyers & Colourists Terms and Definitions Committee: Mr J. T. Tooke-Kirby and Mr D. M. Varley.

The Society of Dyers & Colourists "Review of Coloration Progress" Committee: Mr J. T. Tooke-Kirby.

The Colour Group (Great Britain): Mr K. Lord.

Institution of Corrosion Science and Technology Education Committee: Mr D. S. Newton.

Institute of Metal Finishing Technical Education Committee: Mr A. R. H. Tawn to August 1981, Mr D. H. Clement from October 1981.

British Standards Institution:

PVC Pigments, Paints & Varnishes Industry Committee: Mr R. G. J. Toms

PVC/1 Pigments: Mr E. A. Peters and Mr S. A. Ray

PVC/1/6 White Pigments: Mr S. A. Ray

PVC/1/8 Chrome Pigments, Prussian Blue and Zinc Phosphate: Mr D. S. Newton to Feb. 81 then Mr M. Dickinson

PVC/1/9 Black Pigments: (from April 1981) Mr P. Gallagher

PVC/1/10 Miscellaneous Pigments: Mr D. S. Newton

PVC/1/13 Methods of Test for Pigments: to be appointed

PVC/1/18 Zinc Dust Pigments: Mr C. N. Finlay

PVC/3 Paints Media and Related Products: Mr G. H. Hutchinson

PVC/4 Lac: Dr B. S. Gidvani

PVC/10 Test Methods for Paints: Mr A. N. McKelvie

PVC/11 Glossary of Paint Terms: Mr G. V. G. Hill

PVC/14 Colour Schedules: Mrs E. Stretton

PVC/16 Priming Paints for Wood: Mr W. Phillips

PVC/21 Surface Preparation of Steel: Mr A. N. McKelvie

PVC/27 Paint Systems for Metallic Substrates: Mr R. Lang, Mr M. Pettit and Mr P. Munn

PVC/28 Paint Systems for Non-Metallic Substrates: Mr W. O. Nutt and Mr W. Phillips

LGL/9 Artificial Daylight for Colour Matching: Mr K. Lord

C/17 Viscosity: Mr A. N. McKelvie

C/17/2 Revision of BS188 (Drafting): Mr A. N. McKelvie

CPE/10/1 Test Sieves: to be appointed

CPE/10/2 Test Sieving and other Sizing Methods: to be appointed

CIC/4 Solvents and Allied Products: Mr A. R. H. Tawn

CIC/6 Glycerol: Mr W. A. Ledger

GEL/16/3 Varnishes: Mr N. H. Seymour

ACE/44 Aircraft Finishes: Mr R. G. Booth

BDB/7 Building Protection and Maintenance: Mr J. E. Mitchell

BDB/25 Road Marking Compounds: Mr T. R. Bullett

DOS/3/10 Chemistry and Chemical Technology (UDD54 & 66): to be appointed

PHS/14 Viewing Conditions: (from April 1981) Mrs E. Stretton

The Association was also represented on overseas organisations as follows:

#### New Zealand

Surface Coatings Committee of the Standards Association of New Zealand: Mr T. Slinn.

#### South Africa

Natal College for Advanced Technical Education, Science and Education Advisory Committee:

Council of the Natal Section Association of Scientific and Technical Societies: Mr P. Draper

## Appendix

### Report of the Council in accordance with the Companies Act 1967

1. The Council presents herewith the audited accounts of the Association for the year ended 31 December 1981.

#### 2. Results

The results for the year and the appropriation thereof are set out in the Income and Expenditure Account on page 10.

#### 3. Principal activities of the Association

The Association has continued in its work of furthering the development of the science and technology of the oil and colour industries.

4. *Change in fixed assets*

The movement in fixed assets during the year is set out in the Table on page 11.

5. *The Council*

The following were members of Council at 31 December 1981:

F. M. Smith, BSc, PhD, CChem, FRSC, CCol, FSDC, MIOP, FTSC  
 R. C. Somerville  
 D. J. Morris  
 H. R. Hamburg, PhD, FTSC  
 C. N. Finlay, ATSC  
 A. T. S. Rudram, FTSC  
 B. F. Gilliam, ATSC  
 J. R. Taylor, BSc, CChem, FRSC, FTSC  
 T. Entwistle, FTSC  
 P. W. Munn, BSc, CChem, MRSC, AMBIM  
 T. A. Banfield, PhD, DIC, ARCS, FICorrT, FTSC  
 F. Redman, ATSC  
 R. L. Devenish  
 J. Clark, BSc  
 H. C. Worsdall, FTSC  
 T. L. M. Humphrey, ATSC  
 V. A. Moore, AIMF  
 R. A. C. Chappell, MRSC  
 J. E. Mitchell, BSc, FRSC, FTSC  
 C. Butler, LRSC, FTSC  
 L. P. G. Goodale  
 R. A. Eglington, BSc, FTSC  
 D. A. Bayliss, FTSC  
 P. Birrell, FTSC  
 D. S. Newton, AMCT, CGIA, FICorrT, FIMF, FTSC  
 J. R. Bourne, FTSC  
 G. W. Fowkes  
 L. J. Brooke, ATSC  
 J. L. Taylor  
 D. F. Smith  
 R. E. Rouse  
 E. A. Watson, BSc, MICorrT  
 J. Toovey, BSc, FTSC  
 R. Bettison (elected 19 June 1981)  
 F. D. H. Sharp (elected 19 June 1981)  
 F. B. Windsor, ATSC (elected 19 June 1981)  
 K. E. Figgott, BSc, FTSC (elected 14 April 1981)  
 A. G. Stubbs (elected 20 February 1981)

D. D. Kimber, BSc, ARIC (elected 25 April 1981)  
 G. R. Robson, BSc, ARIC (elected 10 April 1981)  
 D. Pountain (elected 31 August 1981)  
 R. A. White, MSc, FTSC (elected 17 March 1981)  
 R. H. Wright (elected 9 April 1981)  
 J. T. Tooke-Kirby, ERD, JP, FInstPet, AAIME, FTSC (elected 14 July 1981)  
 C. D. Laming (elected 22 April 1981)  
 H. Young, ATSC (elected 7 April 1981)

In addition the following were members of Council at 1 January 1981 and served during the year; the date shown after each name denotes when during 1981 service on Council terminated:

L. H. Silver (2 December 1981)  
 C. Gooch, FTSC (19 June 1981)  
 S. R. Finn, BSc, FRSC, FTSC (19 June 1981)  
 C. Barker, MSc (19 June 1981)  
 W. G. Paul (17 March 1981)  
 A. J. Newbould, BSc, MRSC (23 April 1981)  
 A. C. Jolly, BSc, FTSC (10 April 1981)  
 J. A. Burns (25 April 1981)  
 D. E. A. Williams-Wynn, MSc, PhD, CChem, FRSC (14 April 1981)  
 S. Patel, BSc, ATSC (22 April 1981)  
 G. V. G. Hill, BSc, AMICorrT, LRPS, FTSC (9 April 1981)  
 G. L. Willis, BAgSc (20 February 1981)  
 G. Willison, MRSC (2 December 1981)  
 M. G. Bentley, ATSC (7 April 1981)  
 J. Smethurst, AMCT, FTSC (Deceased 29 April 1981)  
 R. N. Rea (31 August 1981)

6. *Auditors*

In accordance with Section 14(1) of the Companies Act 1976, a resolution will be proposed at the general meeting to reappoint the auditors, Coopers & Lybrand.

By Order of the Council

ROBERT HAMBLIN  
 Director & Secretary

2 January 1982

**OIL AND COLOUR CHEMISTS' ASSOCIATION**

## STATEMENT OF SOURCE AND APPLICATION OF FUNDS FOR THE YEAR ENDED 31 DECEMBER 1981

	Year ended 31.12.81 £	Year ended 31.12.80 £
<b>SOURCE OF FUNDS</b>		
Unappropriated surplus/(deficit) for year .....	(15,561)	25,956
Deduct profit on sale of investments and fixed assets .....	( 5,167)	( 274)
Adjustment for item not involving the movement of funds:		
Depreciation and amortisation .....	3,259	1,186
<b>TOTAL GENERATED FROM OPERATIONS .....</b>	<b>£(17,469)</b>	<b>£26,868</b>
<b>FUNDS FROM OTHER SOURCES</b>		
Proceeds from the sale of fixed assets .....	600	-
Proceeds from the sale of investments .....	7,506	5,176
	£(9,363)	£32,044
<b>APPLICATION OF FUNDS</b>		
Purchase of fixed assets .....	(8,496)	(1,044)
Purchase of investments .....	(1,354)	-
<b>INCREASE/(DECREASE) IN WORKING CAPITAL .....</b>	<b>£(19,213)</b>	<b>£31,000</b>
<b>INCREASE/(DECREASE) IN WORKING CAPITAL comprises-</b>		
Increase/(Decrease) in stocks .....	1,839	(502)
Increase/(Decrease) in debtors and payments in advance .....	739	724
Increase/(Decrease) in current liabilities .....	2,460	29,790
Movement in net liquid funds:		
Increase/(Decrease) in balance at bankers and cash .....	(24,251)	988
	£(19,213)	£31,000





## OIL AND COLOUR CHEMISTS' ASSOCIATION

## INCOME &amp; EXPENDITURE ACCOUNT FOR THE YEAR ENDED 31 DECEMBER 1981

£	1980 £	£	INCOME	£	1981 £	£
			<b>MEMBERSHIP AND GENERAL INCOME—</b>			
	40,107		Subscriptions .....	42,475		
	270		Professional Grade Certification fees .....	153		
	765		Entrance Fees .....	751		
	1,602		Publications .....	2,107		
	676		Sundry income .....	920		
	274		Profit on sale of investments and fixed assets .....	5,167		
	2,158		Section Surplus (Note 5) .....	1,976		
	—		Conference Surplus .....	2,917		
	15,331		Investment Income .....	8,806		
	<u>61,183</u>				<u>65,272</u>	
			<b>JOURNAL RECEIPTS—</b>			
	21,749		Advertising .....	23,099		
	41,997		Sales .....	46,712		
	2,754		OCCA Australia .....	3,020		
	1,513		Reprints .....	3,544		
	<u>68,013</u>				<u>76,375</u>	
	<u>127,922</u>		<b>EXHIBITION RECEIPTS</b>		<u>47,958</u>	189,605
257,118						
			<b>EXPENDITURE</b>			
			<b>MEMBERSHIP AND GENERAL EXPENSES—</b>			
	21,381		Administration expenses (Note 4) .....	24,548		
	24,289		Journal .....	26,724		
	15,904		Postage, printing and stationery .....	17,419		
	164		Notices .....	168		
	6,604		General expenses, including accountancy .....	5,464		
	<u>68,342</u>				<u>74,323</u>	
			<b>JOURNAL EXPENSES—</b>			
	21,380		Administration expenses (Note 4) .....	24,548		
	29,686		Printing and publication .....	32,664		
	1,639		Reprints .....	2,854		
	6,214		Postage and stationery .....	6,725		
	2,403		General expenses .....	2,131		
	<u>61,322</u>				<u>68,922</u>	
			<b>EXHIBITION EXPENSES—</b>			
	77,715		Direct expenses .....	35,243		
	21,380		Administration expenses (Note 4) .....	24,548		
	2,403		General expenses .....	2,130		
	<u>101,498</u>				<u>61,921</u>	
<u>231,162</u>						<u>205,166</u>
<u>£25,956</u>			Surplus (deficit) for the year .....			<u>£(15,561)</u>

## STATEMENT OF RETAINED RESERVES

1980 £	1981 £
25,956	(15,561)
109,866	135,822
<u>£135,822</u>	<u>£120,261</u>

**OIL AND COLOUR CHEMISTS' ASSOCIATION**

**NOTES ON THE ACCOUNTS as at 31 December 1981**

**1. Fixed Assets**

	<i>Furniture, Fittings, Office Machines and Motor Car</i>		<i>Freehold Property</i>	
	£	£	£	£
<i>Cost</i>				
At 1 January 1981	13,160		73,631	
Additions	8,496		-	
Disposals	(3,180)		-	
		18,476		73,631
<i>Depreciation</i>				
At 1 January 1981	11,518		2,900	
Disposals	(3,180)		-	
Charged to Income and Expenditure Account in 1981	2,459		800	
		(10,797)		(3,700)
<b>Net Book Value at 31 December 1980</b>		<b>£7,679</b>		<b>£69,931</b>

Depreciation of fixed assets is calculated so as to write off the assets over their expected useful lives. The principal rates used for this purpose, which are consistent with those of the previous years are: Freehold Buildings 2%; Furniture, Fittings, Office Machines and Motor Car 10% or 25%.

**2. Foreign Currencies**

Overseas Section income, expenditure, assets and liabilities have been converted to Sterling at the following rates ruling at 31 December 1981:

	1980	1981
New Zealand	\$2.4850	\$2.3175
South Africa	R1.781	R1.8285
Canada	\$2.8545	\$2.2660
Zimbabwe	Z\$1.4975	Z\$1.3850

**3. The Ethel Behrens Fund and the Jordan Award Fund**

The Ethel Behrens Fund and the Jordan Award Fund have not been incorporated in the Association's Income & Expenditure Account and Balance Sheet, but have been shown as separate accounts.

**4. Administration Expenses**

Administration expenses have been equally apportioned between the three main headings of expenditure in the Income & Expenditure Account. These expenses are:

1980		1981
£		£
48,688	Salaries including pensions	48,848
7,697	Agency Staff	12,292
590	Welfare	562
4,975	Rates, lighting and telephone	7,046
960	Audit Fee	1,637
1,186	Depreciation of fixed assets	3,259
45	Credit Notes issued	-
<b>£64,141</b>		<b>£73,644</b>

The charge to each heading is therefore:

21,381	Membership	24,548
21,380	Journal	24,548
21,380	Exhibition	24,548
<b>£64,141</b>		<b>£73,644</b>

**5. Section Surplus (1980 and 1981)**

1980		1981
£		£
34	Bristol	(60)
53	Hull	(98)
48	(a) Irish	106
(710)	London	(102)
6	Manchester	(160)
(220)	(a) Midlands	(86)
(165)	(a) Trent Valley Branch	85
296	Newcastle	(461)
117	(a) Scottish	47
(293)	Thames Valley	366
488	West Riding	544
352	(a) Auckland	1,326
(257)	Wellington	500
3,121	(a) Natal	181
(141)	(a) Cape	(199)
823	(a) Transvaal	(464)
(189)	(a) Ontario	111
441	(a) Zimbabwe Branch	340
<b>£2,158</b>		<b>£1,976</b>

**NOTES:**

- (1) (a) unaudited returns incorporated in the accounts 1.3.82
- (2) Net surpluses are shown without brackets.  
Net deficits are shown inside brackets.
- (3) The figures reflect the net increase/(decrease) in assets, including cash, held by the Sections during the year.

**6. Limited by Guarantee**

The liability of the members of the Association is limited by guarantee.

**7. Stocks**

The value is determined on the basis of the lower of cost and net realisable value. Cost is determined on a first-in, first-out basis.

**8. Cash at bank comprises**

1980		1981
£		£
98,522	Amounts on deposit	72,992
525	Savings Certificates	662
13,474	Current Accounts and Cash in Hand	14,616
<b>£112,521</b>		<b>£88,270</b>

Auditors' Report - Page 9

**OIL AND COLOUR CHEMISTS' ASSOCIATION**

**ETHEL BEHRENS FUND**

INCOME & EXPENDITURE ACCOUNT for the year ended 31 December 1981

1980 £	<i>Expenditure</i>	1981 £	1980 £	<i>Income</i>	1981 £
49	Corporation Tax on Investment				
	Interest .....	138	123	Interest on Investments (Gross) .....	345
537	President's Expenses .....	144	140	Surplus on redemption of investment .....	-
-	Surplus .....	63	323	Deficit 1980 .....	-
<u>£586</u>		<u>£345</u>	<u>£586</u>		<u>£345</u>

BALANCE SHEET as at 31 December 1981

1980 £	<i>Liabilities</i>	1981 £	1980 £	<i>Assets</i>	1981 £
2,920	Accumulated Fund Balance at 1 January 1981	2,597	2,582	British Government Securities at cost .....	2,582
-	Surplus .....	63		(Market Value £2,187)	
(323)	Less Deficit (1980) .....	-		(1980 £2,480)	
			15	Balance at Bank .....	78
<u>£2,597</u>		<u>£2,660</u>	<u>£2,597</u>		<u>£2,660</u>

**JORDAN AWARD FUND**

INCOME & EXPENDITURE ACCOUNT for the year ended 31 December 1981

1980 £	<i>Expenditure</i>	1981 £	1980 £	<i>Income</i>	1981 £
-	Award .....	100	138	Interest on Investments (Gross) .....	138
-	Certificate .....	5			
138	Surplus .....	33			
<u>£138</u>		<u>£138</u>	<u>£138</u>		<u>£138</u>

BALANCE SHEET as at 31 December 1981

1980 £	<i>Liabilities</i>	1981 £	1980 £	<i>Assets</i>	1981 £
1,424	Accumulated Fund Balance at 1 January 1981	1,562	1,007	British Government Securities at cost .....	1,007
138	Surplus .....	33		(Market Value £1,000)	
			555	(1980 £1,130)	
				Balance at Bank .....	588
<u>£1,562</u>		<u>£1,595</u>	<u>£1,562</u>		<u>£1,595</u>

# Proceedings of the Annual General Meeting

The twentieth Annual General Meeting of the Incorporated Association was held on 16 June 1982 at 3.00 p.m. at the Piccadilly Hotel, London, W.1 with the President (Mr D. J. Morris) in the chair.

There were 27 members present. The notice convening the meeting was read.

## Apologies

Apologies for absence were received from Mr L. J. Brooke, Mr D. J. Silsby, Mr D. H. Vettewinkel, Mr F. Sowerbutts, Mr F. D. H. Sharp, Mr D. Kimber, Mr R. Saunders, Mr F. B. Windsor, Mr J. E. Mitchell, Mr S. R. Finn, Mr M. H. M. Arnold, Mr L. P. G. Goodale, Mr D. Pountain, Dr T. A. Banfield and Mr D. A. Bayliss.

## Minutes

The President asked the meeting to take as read the minutes of the nineteenth Annual General Meeting held on 19 June 1981, as printed and circulated in *JOCCA*, pp. 319-321 inclusive, August 1981.

There being no comments, the adoption of the minutes was put to the meeting and carried unanimously.

## Report of the auditors to the members

The report of the auditors to the members was read.

## Annual report of the Council for 1981

Mr J. R. Bourne (Honorary Secretary) moved the adoption of the annual report of the Council and statement of accounts for 1981. He drew attention to a printing error under that section of the annual report headed Technical Education Committee when inadvertently Mr K. Arbuckle had been shown as representing the Paintmakers Association on the Working Group whereas he was one of three Association representatives; Mr D. H. Clement should have been shown as representing the Paintmakers Association instead of Mr K. Arbuckle. Mr Bourne pointed out that the Association, like most organisations, had encountered difficulties in the present economic climate and that a decrease of only 2.5 per cent in membership was better than many other bodies. In 1981, the monthly *bulletin*, issued with the *Journal*, had replaced the notices sent individually to members and not only had this resulted in a saving in postage and stationery but it had also meant that all members resident in the United Kingdom and Ireland received notices about activities in other sections; the *bulletin* had been welcomed by members. Dr H. R. Hamburg (Honorary Treasurer) seconded the adoption.

The President asked for comments. Mr A. R. H. Tawn referring to the statistics on the Professional Grade in the annual report recalled that at its inception in 1971 one of the major concerns had been to offer the younger members an opportunity to identify with the industries and the Association. However, out of 600 successful candidates for the whole Professional Grade only 21 had been accepted for the Licentiate and he wondered if consideration had been given to making the direct route to the Associateship on experience after 30 years of age more

difficult to achieve, as he felt that many young people might have simply ignored the Licentiate and waited until they could apply for Associateship. The Director & Secretary agreed with Mr Tawn that the number of applications for the Licentiate had been disappointing and he suggested that there were two factors which might have been of influence. First, many entrants into the industries were of graduate or equivalent status, reflecting the educational pattern of the country. Secondly, many young people had other commitments and were not willing to spend a further year preparing a dissertation after they had passed the necessary qualifying certificate. Consequently, it had been suggested to polytechnics and technical colleges that students should be encouraged to prepare their dissertations in the last year of study. Although this had proved difficult to arrange, some progress was being made. Dr F. M. Smith commented that another suggestion had been to arrange a technician certificate at a lower level and he drew attention to a recent announcement concerning a technician qualification being offered by one polytechnic for the Society of Dyers and Colourists. Mr A. T. S. Rudram (Honorary Technical Education Officer) said that the Committee wished to use the polytechnic system not only in one area but wherever a need existed.

There being no further comments on the annual report of the Council for 1981 and statement of accounts, these were formally adopted by the meeting.

## Appointment of President Designate

The President stated that, as indicated on the agenda, Mr C. N. Finlay (currently a Vice-President and a former Honorary Research & Development Officer) had been appointed President Designate of the Association by the Council. The Annual General Meeting welcomed this appointment in the traditional manner by applause.

## Election of Vice-Presidents of the Association

The President read the nominations of the Council as printed on the agenda and asked the meeting to accept them *en bloc*. This was agreed. He pointed out that, of the seven Vice-Presidents, Mr R. Bettison (New Zealand) and Mr C. N. Finlay were completing their second year of service and the other five were commencing their two-year period of service. Of these, Mr R. E. Rouse was from the South African Division, Mr V. H. Furuhejelm (a former President of the Scandinavian Federation for Paint Technologists) was attached to the General Overseas Section, Dr T. A. Banfield was a former Chairman of the London Section, Dr H. R. Hamburg had just completed six years as Honorary Treasurer and Mr C. Butler was a former Chairman of the West Riding Section. The following were then elected as Vice-Presidents:

- (i) Mr R. E. Rouse
- (ii) Mr R. Bettison
- (iii) Mr C. N. Finlay
- (iv) Mr C. Butler
- (v) Dr T. A. Banfield
- (vi) Dr H. R. Hamburg
- (vii) Mr V. H. Furuhejelm



applicable to membership subscriptions paid by members resident in the United Kingdom.

#### **Reappointment of auditors and fixing the remuneration thereof**

It was proposed by Mr L. H. Silver that Coopers & Lybrand (chartered accountants) be reappointed auditors of the Association and that their fee for 1982 be £975.00. This was seconded by Mr J. T. Tooke-Kirby and carried unanimously.

#### **Vote of thanks to retiring Council members**

Mr A. T. S. Rudram moved a vote of thanks to all members retiring from Council for their work on behalf of the Association and this was carried with acclamation.

#### **Vote of thanks to Honorary Officers of the Association**

Mr A. R. H. Tawn in moving a vote of thanks to the

Honorary Officers of the Association paid particular attention to the work of the retiring Honorary Treasurer, Dr H. R. Hamburg. He asked the meeting to show their appreciation of the work of the Honorary Officers and this was carried with acclamation.

#### **Vote of thanks to the Chairman of the meeting**

The Director & Secretary called upon Dr F. M. Smith to propose a vote of thanks to the President for taking the chair at the Annual General Meeting. In doing so, Dr Smith extended his best wishes to the President for his second year of office and asked the meeting to show their appreciation in the usual way. This was carried with acclamation.

There being no other competent business, the President declared the meeting closed at 3.30 p.m.

## **Association Annual General Meeting Luncheon and Lecture**

Prior to the Annual General Meeting (the proceedings of which appear above) the following events took place at the same venue, the Margaret and Edward Suites of the Piccadilly Hotel, London W.1.

In the late morning a meeting of Past Presidents with the Honorary Officers and the Director & Secretary took place. Items of general interest concerning the future of the Association in relation to its present activities were discussed and the views expressed by the Past Presidents were of considerable interest.

At 12.30 p.m. a reception took place at which members were able to meet the Guest of Honour, Dr Rhodes Boyson, MA, MP, Parliamentary Under Secretary of State for Education. The Luncheon, which took place at 1 p.m., was also on this occasion the Annual Reunion of the Council with Past Presidents, Past Honorary Officers and Honorary Members.

After the Loyal Toast, the President (Mr D. J. Morris) welcomed the following Past Presidents:

Dr H. W. Keenan (1944-47)

Mr H. Gosling (1953-55)

Mr N. A. Bennett (1957-59)

Mr L. H. Silver (1973-75)

Mr A. T. S. Rudram (1975-77)

Dr F. M. Smith (1979-81)

It was a particular pleasure to announce to the meeting that a Past President, Mr L. H. Silver, had received an OBE in the Queen's Birthday Honours List for services to export.

The following Past Honorary Officers present were also welcomed:

Mr D. S. Newton (*Hon. Secretary* 1969-74, *Hon. Editor* 1962-66 and currently *Hon. Editor*)

Mr A. R. H. Tawn (*Hon. Research & Development Officer* 1970-75, *Hon. Editor* 1966-69)



Shown from left to right are: Mr Robert Hamblin (Director & Secretary), Mr Don Morris (President), Dr Rhodes Boyson (Guest of Honour) and Mr Brian Gilliam (Chairman, London Section)

Dr H. R. Hamburg (*Hon. Treasurer* 1976-82)

Mr. C. N. Finlay (*Hon. Research & Development Officer* 1975-81, currently a *Vice-President* and to be appointed *President Designate* at the AGM)

Finally he welcomed the Association's Guest of Honour, Dr Rhodes Boyson, and asked all the company to join in a toast in his honour.

Dr Boyson then spoke in an invigorating, entertaining and informative manner on education and its relationship with industry, the speech being all the more remarkable in that it was delivered following an all-night sitting of the House of Commons. The members present much appreciated Dr Boyson's kindness in attending the Luncheon as his engagements for the day were particularly heavy.

At the conclusion of Dr Boyson's talk a vote of thanks was proposed by Mr B. F. Gilliam (Chairman, London Section) and carried with acclamation.



## Next month's issue

The Honorary Editor has accepted the following papers for publication. They are expected to appear in the September issue:

**Drier compositions for air drying coatings** by *D. Agrawal and A. K. Vasishtha*

**The automotive refinish paint market in the UK and continental Europe** by *G. Collingham*

**Living with lead legislation** by *A. C. D. Cowley*

**Radiation polymerisation as a tool for the surface coatings industry** by *J. L. Garnett*

Further information on any of the publications reviewed may be obtained by circling the appropriate *Reader Enquiry Service* number on the form at the back of the *Journal*. Enquiries will be forwarded to the publisher.

## reviews

### Handbook of paint raw materials

**E. W. Flick**

**Noyes Publications, Park Ridge, New Jersey 07656, USA**

**March 1982**

**pp. 340 Price \$45**

This book is a compendium of the latest data on raw materials for the coatings industry. It is divided into 37 sections, which of course cannot be detailed in this review. Like all books of this type, it depends upon the willingness (or ability) of raw materials manufacturers to provide the data, and omissions cannot be blamed on the author. Under US law it is necessary to describe the chemical nature of all manufactured products, and in this respect the book is most useful since these are included.

A useful reference book for the paint chemist.

*Reader Enquiry Service No. 21*

*D. S. Newton*

### Managing your companies finances

**R. L. Hargreaves and R. H. Smith**

**William Heinemann Ltd,**

**pp. 181 + index and preface ISBN 434.90686.7 Price £8.95**

This is a book for the small businessman. It is written in

the belief that prevention is better than cure, and gives practical guidance on how to manage resources in such a way that external finance does not arise except as part of a planned extension of a business. It is intended to be read by managers or owners of companies who do not have professional accounting and financial support, and clearly describes the various techniques of planning, budgeting, accounting and control, including examples of balance sheets and the various financial ratios which can prove so helpful. Every other type of financial activity is covered in sufficient detail to let the reader understand not only how they are arrived at, but equally importantly why they are necessary.

Methods of access to finance are clearly described, a glossary of key terms is given, and a number of case studies are included.

In total a very useful and readable book, the latter being somewhat of a rarity in this particular field of activity!

*Reader Enquiry Service No. 22*

*D. S. Newton*

For information on membership of OCCA, enquiries should be sent to the Association's offices, see front cover for address.

## occa meetings

### Bristol

#### Natural pigments from flowers to red wine

Mr C. F. Timberlake, scientific liaison officer of the Long Ashton Research Centre, Department of Agriculture and Horticulture, Bristol University, gave a talk on "Natural pigments from flowers to red wine" to members of the Bristol Section and their ladies, with Mr Fowkes (Chairman, Bristol Section) in the chair on Friday 27 November.

The talk was held at the George and Dragon, High Street, Winterbourne, near Bristol.

The lecturer gave a short history of the Long Ashton Research Centre and outlined its activities in food, beer, wines, horticulture and agriculture, and its work on plant

# JOCCA meetings

sprays and hormones. The work was undertaken to benefit the customer in many aspects: to better the quality of apples to watercress. The natural colouring pigments in food including porphorins and chlorophyll were illustrated by comparing them with the colours in the animal kingdom, i.e. the colours of birds, fish and insects, which need to eat plants having these coloured complexes, e.g. the red colour of carrots due to carotene and the yellow colours due to saffron. Red colouring matter is also obtained from insects e.g. cochineal from the Cochineal beetle often used in the colouring of Campari and yoghurts.

The red-blue pigments of the B cyanine group found in beetroot, for example, are water-soluble and not heat stable. Stabilisation against oxidation can be obtained by the use of vitamin C and the pigments are used in dairy products. The yellow pigments based on the riboflavins (vitamin B<sub>2</sub>) which occur in milk and yeast are used to colour cereals and dairy products. Brown pigment present in caramel by the heat treatment of sugar with caustic soda, ammonia or ammonium sulfide is used in the colouration of beers and soft drinks. The consumption of the caramel pigments by beer drinkers consuming six litres a day would possibly be six grams.

The coloration of both white and red wines was also discussed and an interesting comparison was carried out at the Research Station when a white wine which had not been allowed to oxidise was given higher marks by wine experts for taste but lower marks for colour. Therefore, there has to be a compromise between colour and taste. Red wines contain anthocyanine, the colouring found in black grapes; the pigment is also found in bluebells.

Mr Timberlake also entertained his audience to some practical chemical experiments when he showed the effect of pH on the colour of grape extract by the addition of sodium bicarbonate. The use of Camden Tablets in wine making was fully explained.

The application of modern analytical techniques to investigate the chemistry of wine, together with recent work of a fundamental nature carried out at the Research Centre was explained.

There were many questions from the audience which were fully answered by the lecturer. The vote of thanks was well received by those present.

## Solvent selection by computer techniques

A joint lecture with the Birmingham Paint, Varnish and Lacquer Club, was held on 3 December 1981 at the County Suite, Edgbaston, Birmingham. Mr H. Blum of Shell Chemicals UK Ltd gave a lecture entitled "Solvent selection by computer techniques" to a large audience. He dealt with the concept of resin and solvent parameters and the value of computer programs, especially with regard to subjects such as the reduction of formulation costs of

solvent blends for exempt solvents (environmental problems) and performance.

The speaker discussed the background of the theory of solvent and resin parameters with respect to viscosity, polymer interaction and the solubility properties of solvent blends. The older methods of defining solvent power, KB value, aniline point and dilution ratios were considered. The points covered by the lecturer contributed to an active question time and highlighted the need for computer based programs for the formulation of solvent mixtures in modern paint and for the formulation of thinners.

## Pigments and protection

Mr D. Bishop of the British Railway Technical Centre, Derby presented a lecture in Cardiff at the Post House Hotel on 26 February 1982. Mr K. A. Chippington deputised for Mr Fowkes who was away on business. The speaker introduced his lecture on "Pigments and protection" by giving a short history of the growth of the laboratories within the railways. He pointed out that the early railway companies soon realised the importance of chemists in the smooth running of the trains, and laboratories were organised between the 1860s and 1890s. The London and North Western Railway was the first company to establish a chemical laboratory in 1864 at Crewe and the other companies soon followed. The surface coatings and corrosion unit had its origins at Wolverton in 1921 and was responsible for the quality control of paints for the London and North Western Railway's rolling stock. Following the grouping of the railways in 1923, the laboratory became part of the London, Midland and Scottish Railway Research Department, and on nationalisation in 1948 became responsible for the painting and allied problems for the whole of the railway network. Several of the activities that are under current investigation were discussed and will be the subject of further papers in this *Journal*.

Micaceous iron oxide has been extensively used as the major pigment in undercoats and finishes for the protection of civil engineering structures. Although micaceous iron oxides have been found in various parts of the world, only two pigments have been approved for use in British Railways protective systems, namely those from Devon, England (from 1900-1964) and Waldenstein, Austria (from 1964 onwards). In the latter years several alternatives have become commercially available with obvious differences in their physical properties. Extensive research has shown that of the pigments currently available, only the Austrian one can be classified as micaceous iron oxide; other pigments do not possess the lamellar structure of mica, have Fe<sub>2</sub>O<sub>3</sub> contents below the accepted minimum of 85 per cent (w/w), and have inferior corrosion protection to the lamellar pigments.

Over the last few years there have been indications that the protection given by zinc phosphate pigments has deteriorated appreciably since its introduction on to the railways in the 60s. Corrosion tests on pigments from various manufacturers have shown large variations in the levels of protection (or corrosion acceleration!). An extensive programme of work has been carried out to physically and chemically characterise zinc phosphate pigments by wet and instrumental techniques, including a sample of an original zinc phosphate pigment (pre-1970 origin). Work is in hand to assess the effect of the pigment properties on corrosion.

The evaluation of paints for the outside of rolling stock has been assessed by attaching painted Mylar sheets to the

bodysides, thus subjecting the various paints to the mechanical and chemical conditions associated with a railway environment. The value of this technique is that the sheets can be removed to the laboratory and the paint performance assessed by optical and analytical techniques. Over 40 different types of paint are being assessed and there are strong indications of the type of air drying system most suitable to meet the requirements of railways. There is also a major project on finding suitable decorative fire-retardant paints to increase the protection of wooden materials inside rolling stock. Over 200 paints from all over the world have been evaluated, and suitable paints have been subjected to the various British Standards tests, followed by large scale fire tests simulating the conditions inside a burning coach compartment. On the basis of these tests, recommendations have been made to minimise the fire risk.

Further information on any items mentioned below may be obtained by circling the appropriate Reader Enquiry Service number on the form at the back of the Journal. Enquiries will be forwarded to the organisation concerned.

### Gema acquired by Ransburg

Gema AG of St Gallen, Switzerland is now part of the Ransburg Corporation. In a series of moves the Indianapolis based corporation acquired the total electrostatic powder interests of Gema. Ransburg's worldwide subsidiaries will now cover both liquid and powder paint application projects.

This acquisition has been widely rumoured in the industry for some months. Ransburg, who is said to have innovated the electrostatic painting process in the late 1940s, is primarily known for its high efficiency guns, bells and discs for wet painting.

Reader Enquiry Service No. 31

### Advisory service

A new company known as Genways has been formed to give specialist advice on the selection of paints, lacquers, powder coatings and adhesives and the appropriate application equipment.

Reader Enquiry Service No. 32

### Anglo-Swiss agreement for specs and standards

London Information, the Ascot-based technical documentation specialists, have signed an agreement with Infonorme of Zurich, Switzerland. The agreement means that the whole available range of European specs, standards and technical documentation can be obtained in the UK by a telephone call to London Information.

Reader Enquiry Service No. 33

## new products

### Portable holiday detector

Sheen has announced a new portable holiday detector range. The new range is described as having a number of features as standard which enable the detectors to be used in virtually any environment or in awkward recesses or corners. The

features include a rolling spring electrode, band brush electrode, conductive rubber electrode, together with circular brushes for internal pipe testing, and needle probes for the awkward recesses and corners.

The common problem when using a holiday detector of finding a proper earth has been overcome by supplying a small magnet fitted with a contact which attaches easily to the earth probe.

Reader Enquiry Service No. 34

### Detection of phenols in water

Anachem has announced the availability of a complete HPLC system for the analysis of priority phenols in water. Phenols are used extensively in manufacturing, and their presence as by-products and degradation species has led to regulation of their concentration in waste water.

Anachem states that although a colorimetric method has been widely used, it lacks specificity. HPLC with electrochemical detection offers significant advantages over this and many other methods due to its high selectivity and sensitivity. Phenols are easily oxidised at a glassy carbon working electrode and thus may be detected to low picogram levels in aqueous samples.

Reader Enquiry Service No. 35

### Can lid clips

An extensive range of colour coded lever can lid clips is now available from TRW Carr Supplies.

The clips, which simply and effectively prevent spills and wastage from cans in transit and in storage, are intended for use on containers for chemicals, paint, powder, varnish, adhesives, etc.

Each size of clip is colour coded for easy identification. The new range of lever can lid clips suits British Paint Manufacturers' Association recommended cushion lid cans.

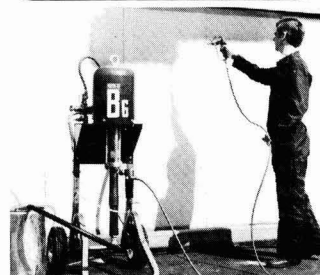
Reader Enquiry Service No. 36

## OCCA meetings

The lecture was well received and many questions were raised by those present. The vote of thanks was carried with acclamation.

J. R. Taylor

## news



New high volume airless spray which can operate in the temperature range  $-40$  to  $+120^{\circ}\text{C}$

### High volume airless spraying

A new high volume airless spraying system intended for use in shipyards, heavy construction and on oil exploration and production rigs has been made available by Binks-Bullows Ltd. It features a new type of pump and fluid control system which, it is claimed, radically reduces maintenance requirements. The pump, it is said, will perform under the most arduous working conditions at temperatures of between  $-40^{\circ}\text{C}$  and  $+120^{\circ}\text{C}$ .

All types of paints, sealants, waxes and mastics can be handled by the new system. It will also handle aggressive liquids and deicing fluids. The wide range of systems available can be used for applications as diverse as maintenance of North Sea oil production platforms and insecticide sprays for live animals.

The B series systems operate at high pressures usually feeding two or three sprayguns, with outputs of between 1 and 6.7 gallons per minute. Versions are available to apply hot spray materials.

Reader Enquiry Service No. 37

## High pressure spray nozzle

A new high pressure threadless spray nozzle from Clayton-Heyes Engineering Co. Ltd is claimed to conserve media and energy during spray applications whilst promoting faster operations. The new spray nozzle is described as a new high pressure, easy to maintain, threadless spray for applications ranging from industrial steam cleaning and vehicle washing equipment, through to paint, chemicals and crop spraying systems.

Nozzle replacement is said to take seconds to perform using a simple hand tool, whilst high pressure jets reduce the risk of blockages.

The spray has options for solid or hollow cone jets and is designed to operate at pressures up to 2,000 psi.  
*Reader Enquiry Service No. 38*



Clayton-Heyes' high pressure threadless spray nozzle

## Light fastness tester

Microscal has developed a new model, Mark V, light fastness tester. It is designed to replace Mark II in the model range I-IV and to "...fulfil a more 'up-market' need..."

According to Microscal the Mark V is "preferred" where the aesthetics of textiles being tested has commercial significance. The facilities of the standard and rapid fade lamps and control gear have for the first time been brought together into a single compact unit. To this have been added pre-settable and re-settable timers for recording and pre-determining the duration of fading tests, when required.

*Reader Enquiry Service No. 39*

## New defoamer and new catalyst

Byk-Mallinckrodt has announced a new defoamer based on an organically modified polysiloxane, Byk<sup>®</sup>-80. It has been developed for two-pack polyurethane paints (conventional and high solids) and VC-copolymers as existing defoamers were not considered effective enough by Byk-Mallinckrodt.

The new defoamer is claimed not to cause hazing because of the small amounts that are added (0.05 - 0.5 per cent), which is especially important in clear finishes. In flat varnishes Byk<sup>®</sup>-080 promotes the orientation of the flattening agents thereby preventing streaks. Byk-Mallinckrodt also says that the defoamer can be successfully used in chlorinated rubber and acrylate paints as well as in amine neutralised systems.

Also new from Byk-Mallinckrodt is an acid catalyst for aqueous- and solvent-based stoving enamels, Byk<sup>®</sup>-Catalyst 450. It is a stable blocked p-toluenesulfonic acid solution.

The catalyst it is claimed, allows, a 10-20°C lowering of stoving temperature compared to similar compounds.

*Reader Enquiry Service No. 40*

## Proportioning and mixing equipment

Kremlin Spray Painting Equipment Ltd has announced the development of a new range of equipment for proportioning, mixing and applying two- and multi-component materials, including adhesives, sealants, surface coatings etc.

*Reader Enquiry Service No. 41*

## Overrun pump protection

Graco has introduced a new pump runaway valve. It is designed to prevent the damage and possible fire risk, due to sparking, that occurs when an air-operated pump overruns because the material being pumped has run out.

Fitted to an air motor, the Graco Pump Runaway Valve immediately cuts off the air supply when a runaway condition is detected. It is said to be ideal for all air-operated pumps, but particularly so in those situations where the pump is located remotely, as in paint mixing rooms and below scaffolding.

*Reader Enquiry Service No. 42*

## literature

### Painting of buildings, BSI

"BS 6150:1982 Code of practice for painting of buildings" has been made available by the British Standards Institution.

*Reader Enquiry Service No. 43*

## Corrosion protection

Crown Protective Coatings recently produced "The corrosion file" containing information to help combat corrosion: "... around 4 per cent of our gross national product is literally rusting away".

It is aimed particularly at anyone responsible for maintaining buildings, structures or plant. Data sheets are included showing the advantages of the company's protective coatings, including a one-pack polyurethane developed with Bayer designed for application to North Sea oil rigs that can be applied to damp metal.

Also included are details of a free technical advisory service. For a free copy fill in the reader enquiry service form at the back of the *Journal*.

*Reader Enquiry Service No. 44*

## Steel structures painting manual

The Steel Structures Painting Manual, (volumes 1 and 2) published by the US Steel Structures Painting Council has been completely revised and updated. For the last 30 years the manual has been considered the definitive publication in its field. These volumes are available at £82.47 per set or £54.18 each plus postage and handling.

*Reader Enquiry Service No. 45*

## Organic compounds

Chapman and Hall has announced the publication of "Dictionary of organic compounds". The cost of this five volume title is £125.

*Reader Enquiry Service No. 46*

## meetings, etc.

### American Paint Show

Cray Valley Products Ltd is arranging a trip to the American Paint Show which this year is to be held in Washington on 3, 4 and 5 November.

The theme of this year's show is "Quality designed/confidence renewed" and in addition to the Paint Show exhibition, there are symposia planned under the following titles:

"Ensuring quality management and technology through computer utilization"

"Designing quality through the use of scientific instrumentation"

The flight will leave Heathrow on Monday 1 November at approximately 11.30 a.m. arriving in Washington at 14.45 local time. Accommodation has been arranged at the Sheraton Hotel where the Paint Show is taking place.

Tuesday will be a free day and the Show opens the following day.

On the morning of Saturday 6 November the participants will fly to Florida for a long weekend, where they will stay at the Sheraton Sandcastle Hotel, Tampa situated on the beach at Clearwater Bay overlooking the Gulf of Mexico. The group will return to Heathrow via Miami on the morning of Tuesday 9 November.

Longer trips are also being arranged, full details of which can be obtained from Cray Valley Products Ltd, Farnborough, Kent BR6 7EA, Tel: 0689 53311.

### Call for papers

The "Ninth international conference on organic coatings science and technology" will be held on 11-15 July 1983 in Athens. Anyone interested in submitting a paper should contact: Professor Angelos V. Patsis, director, Materials Research Laboratory, CSB 209, State University of New York, New Paltz, New York 12561, USA.

## people

**Mr J. P. Merrill** has been appointed to the board of International Paint plc, the

parent company of the International Paint Group. John Merrill, 38, is responsible for International Paint operations in the USA and Mexico and he will continue in that role. He joined the group in 1979, became executive vice-president of International Paint Company Inc., and has since guided the expansion programme in the USA.

**Roger Regan**, 39, has been appointed managing director of Manders Paints Ltd. He was previously a director of Tetrosyl Ltd and has also worked with Fads and Crown Paints. Manders Paints Ltd is the decorative paints subsidiary of Manders (Holdings) Ltd.

### Ciba-Geigy marketing changes

The Pigments Division of Ciba-Geigy Plastics and Additives Company has announced the following changes in the organisation of its Marketing Department in the United Kingdom.

**Mr B. W. Sharp**, marketing manager, Paint Industry Products, retired on 31 March after 15 years with the division, and is succeeded by **Mr A. Morris** who was formerly marketing executive, plastics industry. **Mr N. H. Hammersley**, representative, south west region, retired on 30 April after 46 years with the company and **Mr P. Henman**, product officer and representative, Ten Horn Products, retired on 30 May after 18 years with Ciba-Geigy and the Hercules

## news

Company. **Mr S. Newton**, field sales executive, north west region, retired on 15 July after 47 years with the company.

The following appointments have been made within the department:

**Mr G. A. Fielding** has become paint industry sales executive;  
**Mr E. J. Hurst**, field sales executive for all user industries in the Midlands and south west region;  
**Mr J. T. Hurst**, representative, paint industry south east region;  
**Mr J. E. Todd**, representative, plastics industry south east region;  
**Mr R. N. R. Watson**, plastics and fibres industry sales executive;  
**Dr J. F. Weston**, representative to all user industries in the northern region, Scotland, and also the Republic of Ireland;  
**Dr D. T. Pechey**, currently within the division's Research and Development Department, became representative to all industries, north west region, on 1 June 1982.

## OCCA news

For information on membership of OCCA, enquiries should be sent to the Association's offices, see front cover for address.

### David Wilcox

Mr David Wilcox has joined Marlow Chemical Company Ltd with effect from 1 May. He will be based in the north and will be handling a range of products for the surface coatings and chemical industries, including titanium dioxide, paint additives, PVC resins, and stabilisers.

Mr Wilcox was previously with Manchem where he held several positions in sales and marketing, and is well known in the Manchester Section of OCCA.

## Obituary

### Mr Roland Atha

We record with regret the death on Saturday 26 June of Mr Roland Atha who was Cornelius Chemicals' northern area manager.

Roland had, in June, completed 25 years with Cornelius Chemical Co. Ltd and he will be sadly missed by all his colleagues in the company and also by the many friends and customers with

whom he had established an extremely good working relationship over so many years.

## Jordan Award

The Jordan Award Committee now invites applications for the seventh award of £100. The rules of the Award are:

1. The Award will be made for the best contribution to the science or technology of surface coatings by a member of the Association of any nationality working in either the academic or industrial field who is under the age of 35 at the date of application.

2. The final date for submission of applications will on this occasion be 31 December 1982 and it is hoped to present the award at the Association's Conference in the following year.

3. The selection of the recipient of the Award will be made by the Jordan Award Committee under the chairmanship of the Association's Hon. Research and Development Officer.

4. There will be two methods of application. First, by the submission of a paper describing original work by the candidate which is offered for publication in the *Journal* or has been so published during application. The alternative method will be by recommendation by a superior for work which for reasons of commercial secrecy cannot be published; in this case the candidate will be expected to submit a dissertation on a topic relating to his work and demonstrating his superior knowledge of the principles thereof. The Award is for individual merit and clear evidence of the candidate's own contribution will be required if a paper is offered under joint authorship.

5. Applications should be addressed to the Director & Secretary at the Association's offices.



## Manchester Section

### Fifty eighth annual general meeting

Friday 2 April 1982 at 6.30 p.m. in the Members' Bar and Ballroom of the Lancashire County Cricket Club, Old Trafford, was the date and venue for the Manchester Section's fifty eighth annual general meeting. Sixty members were present under the chairmanship of Frank Redman to witness the following procedures:

1. Acceptance of apologies.
2. Acceptance of the AGM minutes.
3. Matters arising.
4. Annual report of the Section Committee.
5. Presentation of the financial report.
6. Re-election of the existing Committee by nomination of the Committee. The new Honorary Officers elected were: Stuart Heyes of BTP Tioxide who has succeeded Alan Peters of ICI as Honorary Secretary, and Alan Whaley who has replaced F. Arnold as Honorary Student Activities Secretary.
7. Three nominations had been received for the two vacancies on Committee: Ken Wright and Ray Stott were elected by majority votes. David Tench was co-opted to serve on the Discourse Committee.

During the discussion period that followed the formal proceedings, many subjects were raised including some very pertinent points on the present and future policies of the Association and including, specifically, the OCCA Exhibition. The main contribution on this subject was by a past President of OCCA and Chairman of Manchester Section, Francis Smith, whose consistent opinions are highly respected in OCCA and especially in the Manchester Section.

Following the completion of any other business and the vote of thanks to retiring Committee Members and Officers, the AGM proceedings were officially terminated.

After the adjournment to the bar, an excellent meal followed before glasses were recharged prior to the involvement of the guest speaker who had joined the proceedings at the end of the AGM.

This year we were pleased to welcome Dr Ivan McIntyre, a doctor of medicine, presently employed by Ciba-Geigy who, notably, was previously transfer listed from Manchester United FC where he was "the doctor" (not the Doc!).

Ivan's speech was diverse to say the least, with humour symptomatic of a medical career, interspersed with anecdotes of varying geographical sources including those of his Scottish homeland.

Frank Redman (Chairman, Manchester Section) proffered the thanks on behalf of the audience, which included past chairmen Sam Duckworth and Tony Jolly, before informality took over with liar dice playing, the order of the evening.  
*F.B.W.*

## London Section

### Annual general meeting

The 44th annual general meeting of the London Section was held on Thursday 22 April at the Gt. Eastern Hotel, Liverpool Street, London EC2 under the chairmanship of Mr B. F. Gilliam.

The annual report was presented by the Honorary Secretary, Mr A. J. Newbould. He commented that the year had been a difficult one with evening meetings being poorly attended.

The January meeting had marked an all-time low and there was some doubt over the value of holding evening meetings. Two functions had been cancelled due to poor response and this had placed a financial burden on the Section. On the brighter side, the symposia held at Woolwich in November had proved successful as had the golf tournament at Cannons Brook, Harlow.

Ladies' night was held at the Gt. Eastern Hotel for the first time. The numbers attending showed an increase over previous years. Everyone attending had enjoyed the evening. The banqueting facilities at the Gt. Eastern are being closed and a new venue will be required for 1982. Once again the Honorary Secretary appealed for members to let the Committee know why they do not attend evening meetings and which topics would interest them enough to come. The report was accepted unopposed.

Mr D. B. Bannington, Honorary Treasurer, presented the financial report. The rising costs of evening meetings continued to cause concern. The cancellation of two functions had placed a strain on funds. It was hoped to recoup some of the funds in the ensuing year. The report was accepted unopposed.

The election of the Honorary Officers of the Section was proposed from the chair and adopted.

Only three nominations were received for the three Elective Committee Members, as a result no ballot was required.

Mr B. F. Gilliam's position as Chairman for his second year was confirmed by the meeting.

The retiring Committee Members and Honorary Officers were thanked for their services on Committee and to the Section.

Under any other business there was a lengthy discussion over the choice of venue for evening meetings. The committee were considering a return to East London.

The venue for ladies' night was also discussed. The sudden closure of the Gt. Eastern facilities had resulted in the Committee having to find a new venue at short notice. The Royal Chase Hotel in Enfield had offered the most favourable terms and was accessible from most points in and around London. Methods of attracting more members to meetings were also raised. The meeting closed with an invitation to attend the first meeting to be held in the 1982-83 session.

### Restoration of pictures

Following the AGM of the London Section at the Gt. Eastern Hotel, Dr A. Roy, Scientific Department, National Gallery, presented a lecture on the subject of "Technical examination of pictures in the National Gallery".

Dr Roy explained that the Gallery's collection spans the years 1300 to 1900. Brief mention was made on the construction of paintings, the use of canvas or board panels.

The examination and conservation of the collection was detailed. The various techniques were illustrated by two sets of slides shown side by side.

Examination takes the form of non-destructive and destructive tests. Non-destructive tests include infrared photography and radiography. Until recently, UV photography was also used but this has been dropped because of damage caused by the radiation.

Destructive methods include paint cross-sections examined under incident and transmitted light microscopes.

Dr Roy then showed several paintings and the restoration and conservation work carried out. One painting had several earlier drafts under the final and it was possible to see how the paintings had evolved. The earlier paintings were only visible under X-ray examinations. The construction of fine detail in several paintings was also discussed. After an interesting question period a vote of thanks was proposed by Dr Ellinger to which the audience responded in the usual manner.

*B.A.C.*

The publications listed below and their prices are obtainable from: BSI Sales Counter, 195 Pentonville Road, London N1 9ND (personal callers). BSI Sales Department, 101 Pentonville Road, London N1 9ND (orders by post). Telephone: 01-837 8801. Telex 23218.

**bsi**  
**news**

## British Standards

5466: SRC/15  
Methods for corrosion testing of metallic coatings

5466: part 7: 1982 Guidance on stationary outdoor exposure corrosion tests (ISO 4542) 8 page A4 size Gr 6

Applicable to corrosion in natural conditions of protective metallic, conversion and other non-organic coatings. Results may have to be supplemented with mobile tests not covered in this standard. No current standard is superseded (ISBN 0 580 12627 7)

5775: OC/127  
Specification for quantities, units and symbols  
5775: Part 0: 1982 General principles (=ISO 31/0) 12 page A4 size Gr 7

General information on the principles concerning physical quantities, equations, quantity and unit symbols, and coherent unit systems, especially SI. These principles are intended for general use within the various fields of science and technology, and as an introduction to the other Parts of BS 5775. No current standard is superseded (ISBN 0 580 12642 0)

4748: 1982 DOS/7  
Specification for format for bibliographic information interchange on magnetic tape (=ISO 2709) 4 page A4 size Gr 3.

A generalised exchange format, designed specifically for communication between systems, which will hold records describing all forms of material capable of bibliographic description as well as related records such as authority records. Although designed for magnetic tape, the structure may be used for other data carriers. Supersedes BS 4748: 1971 (ISBN 0 580 12727 3).

6150: 1982 BDB/7  
Code of practice for painting of buildings 80 page A4 size Gr 9.

Recommendations for good practice in the initial and maintenance painting of buildings to facilitate achievement of standards of finish likely to be acceptable, provided that the work of other trades has been completed to a satisfactory standard. Supersedes CP 231: 1966 (ISBN 0 580 12670 6).

## New ISO Standards

ISO 276: 1981  
Linseed stand oil for paints and varnishes - Specifications and methods of test 3 page C  
To be implemented as a revision of BS 4725:1971

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ISO 662: 1980  
Animal and vegetable fats and oils - Determination of moisture and volatile matter content  
Erratum

ISO 756:  
Propan-2-ol for industrial use - Methods of test ISO 756/2: 1981 Determination of acidity - Titrimetric method 2 page B ± BS 1595: 1965

ISO 787:  
General methods of test for pigments and extenders  
ISO 787/10: 1981 Determination of density - Pycnometer method 5 page D  
To be implemented as a revision of BS 3483: Part B8: 1974

ISO 1388:  
Ethanol for industrial use - Methods of test  
ISO 1388/3: 1981 Estimation of content of carbonyl compounds present in small amounts - Photometric method 3 page C  
To be implemented in revising BS 507 1388/9: 1981 Determination of esters content - Titrimetric method after saponification 3 page C  
To be implemented in revising BS 507

ISO 2431: 1980  
Paints and varnishes - Determination of flow time by use of flow cups  
Erratum

ISO 3905:  
Paints and varnishes - Determination of contrast ratio (opacity) of light coloured paints at a fixed spreading rate (using black and white charts)  
ISO 3905: Amendment 1: 1981 1 page B

ISO 3906:  
Paints and varnishes - Determination of contrast ratio (opacity) of light coloured paints at a fixed spreading rate (using polyester film)  
ISO 3906: Amendment 1: 1981 1 page B

ISO 4652: 1981  
Rubber compounding ingredients - Carbon black - Determination of specific surface area - Nitrogen adsorption methods 15 page J

ISO 4849: 1981  
Personal eye-protectors - Specifications 8 page E

ISO 5277: 1981  
Aromatic hydrocarbons - Determination of residue on evaporation of products having boiling points up to 150°C 2 page B  
No equiv BS

ISO 5279: 1980  
Toluene - Determination of hydrocarbon impurities - Gas chromatographic method  
Erratum

ISO 5282: 1982  
Aromatic hydrocarbons - Determination of sulphur content - Pitt-Ruprecht reduction and spectrophotometric method 6 page D  
± BS 135, 458, 805: 1977

## Reprints

### General series

3900:  
Methods of test for paints  
3900: Part E7: 1974 Resistance to impact (falling ball test)

### Draft standards for public comment

81/31328 DC Specification for electrostatic hand held spraying equipment (for spraying flammable substances) (CLC/SC 3-8 (Sec) 09 and 09a) GEL/114

82/60357 DC Packaging. Specification for pictorial markings for handling of goods (Revision of ISO/R 780)  
PKM/504

82/50780 DC. Revision of BS 3900 - Methods of test for paints, Part A4 - Notes for guidance on application of liquid paint for laboratory testing.

## Amendments

4652: 1971 PVC/27  
Specification for metallic zinc-rich priming paint (organic media)  
Amendment No. 1 Gr 0 AMD 3901

3900: PVC/10  
Methods of test for paints  
3900: Part E6: Cross-cut test  
Amendment No. 1 Gr 0 AMD 3893

6044: 1981 PVC/26  
Specification for pavement marking paints  
Amendment No. 1 GR 0 AMD 3921

2521 & 2523: 1966 PVC/16  
Lead-based priming paints  
Amendment No. 2 Gr 0 AMD 3941

5044: 1973 MEE/169  
Contrast aid paints used in magnetic particle flaw detection.

## Proposed for withdrawal

3900: PVC/10  
Methods of test for paints  
3900: Part D2: 1967 Gloss specular reflection  
Superseded by BS 3900: Part D5: 1980



# professional grade

At the meeting of the Professional Grade Committee held on 14 July 1982 the Committee authorised the following:

## Admitted as Associates:

Berberi, Anwar Edmond (*General Overseas - Lebanon*)

McKay, John (*Manchester*)

Notley, Malcolm Anthony Leslie (*London*)

Tooke-Kirby, David Henry (*London*)

Walters, Peter (*Auckland*)

Whaley, Alan Roy (*Manchester*)

Wilkinson, Roy Rowley (*Manchester*)

Wright, Graham Leslie (*Auckland*)

## Future of surface coatings courses

With very few recruits being employed by the industry at present, some of the colleges are not receiving sufficient numbers to run their now well established coatings courses. Since coatings units were introduced into TEC programmes in 1978, over 200 students have completed at least Level I. Yet for the academic year just finished only four colleges ran the subject and in some cases these were for special full-time students.

The full list of colleges with experience

in surface coatings, and those willing to help Registered Students and Ordinary Members of the Association to prepare dissertations in respect of LTSC, is given below. Full details to meet students' needs should be obtained from these colleges.

**Bradford College, School of Technology & Design**, Gt. Horton Road, Bradford BD1 1AY.

**College of Arts & Technology**, Maple Terrace, Newcastle upon Tyne NE4 7SA. Mr P. Maycock, Head of Department of Science.

**Coventry Technical College**, Butts, Coventry CV1 3GD. Mr B. Bell, Head of Department of Science.

**East Ham College of Technology**, High Road South, London E6 4ER. Mr G. Wood, Department of Science.

**Hull College of Further Education**, Queens Gardens, Hull HU1 3DE.

**London College of Printing**, Elephant and Castle, London SE16. Mr K. Bradshaw, Science and Printing Department.

**Manchester Polytechnic**, All Saints, Manchester M15 6BR. Mr G. Higginbotham, Department of Polymer Technology.

**Manchester Polytechnic**, Chester Street, Manchester M1 5GD. Mr R. Stott, Department of Polymer Technology.

**Matthew Boulton Technical College**, Sherlock Street, Birmingham 5. Mr C. J. Thompson.

**Polytechnic of the South Bank**, Borough Road, London SE1 0AA. Mr P. Barnes, Department of Chemistry and Polymer Technology.

**Stow College - Glasgow**, 43 Shamrock Street, Glasgow G4 9LD. Mr D. C. Dunn, Head of Department of Management Services.

**The Polytechnic**, Wolverhampton WV1 1LY. Dr B. W. Rockett.

**Warley College of Technology**, Crocketts Lane, Smethwick, Warley B66 3BU. Dr R. A. W. Longden, Head of Department of Chemistry, Computing and Applied Sciences.

**Watford College**, Hempstead Road, Watford, Herts WD1 3EZ. Mr L. Young, Head of Department of Printing and Packaging.

# new members

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

## Ordinary members

BRYANT, DAVID PHILIP, BSc, PhD, MRSC, 13 Cheriton Road, Howick, New Zealand (*Auckland*)

BURY, JAMES ANDREW, GRSC, Crown Decorative Products (Dec Research Laboratory), Hollins Road, Darwen, Lancashire (*Manchester*)

CASTOR JR, WILLIAM STUART, BSc, PhD, 1 Highland Avenue, Bethlehem, Pennsylvania 18017, USA (*General Overseas*)

CHIN, ANTHONY PAUL, BSc, 3 Kerryman Place, Northcote, Auckland, New Zealand (*Auckland*)

EMSLIE, NEVILLE JOHN, 137 Diana Drive, Glenfield, Auckland 10, New Zealand (*Auckland*)

GORE, DAVID NEVILLE, FRSC, FPS, "Poynings", Pilgrims Close, Westhumble, Surrey RH5 6AR (*London*)

HARRIS, EDWARD MURRAY, BSc, MRSC, Nether Kinknockie, Ardallie, Peterhead, Aberdeenshire AB4 8AT (*Scottish*)

HEBDEN, ANDREW ERSKINE, BSc, 10 Park Rise, Campbells Bay, Auckland, New Zealand (*Auckland*)

HOLMES, BRUCE GRAHAM, BSc, 45 Fox Street, Ngaio, Wellington, New Zealand (*Wellington*)

IKEDA, SATORU, BSc, Japan Synthetic Rubber Co. Ltd, Grove House, 551 London Road, Isleworth, Middlesex (*London*)

MCGOWAN, JOHN MICHAEL, BSc, Brown & Dureau, PO Box 2192, Auckland, New Zealand (*Auckland*)

SEN GUPTA, KAMAL KUMAR, BSc, Post Box 24337, Safat, Kuwait (*General Overseas*)

TAYLOR, ALAN JOHN, Trimite Truecoat Ltd, Industrial Estate, Naas, County Kildare (*Irish*)

TROWER, KEITH, 1 The Drive, Boden Park, Scholarstown Road, Rathearnam, Dublin 14  
*(Irish)*

WALLINGTON, JOHN EDWARD, LRSC, 169 Main Road, Gidea Park, Romford, Essex RM2 6LT  
*(London)*

ZIMMERMAN, PAUL MICHAEL, BSc, Ohauti Road, RD3, Tauranga, New Zealand  
*(Auckland)*

#### Associate Members

BROOKS, CHRISTOPHER JOHN, WR Grace (NZ) Ltd, PO Box 17-177, Greenlane, Auckland, New Zealand  
*(Auckland)*

GOULDEN, BRUCE, Shell Chemicals, PO Box 1084, Nr Wyndham & Albert Street, Auckland 1, New Zealand  
*(Auckland)*

KHAN, NIZAMOODEEN SHOKUTH, PO Box 23039, Isipingo Rail, Natal 4110, Republic of South Africa  
*(Natal)*

MCGRATH, AUSTIN, Trimate Truecoat Ltd, Industrial Estate, Naas, County Kildare  
*(Irish)*

**new  
members**

SMITH, FRANCIS ALFRED, 40 Burn Street, Levin, New Zealand  
*(Wellington)*

YOUSSEF, YOUSSEF FAHMY, 32 Lemomba Street, Alexandria, Egypt  
*(General Overseas)*

#### Registered Student

BREED, JOHN EDWARD, Marrable & Co. Ltd, Delamare Road, Cheshunt, Hertfordshire  
*(London)*

## Section Organisations for the 1982-83 session

### Association events

#### 1983

##### Wednesday 15-Saturday 18 June

Association Biennial Conference to be held at the Viking Hotel, York.

##### Friday 17 June

Annual General Meeting to be held at the Viking Hotel, York.

### Bristol

Unless otherwise stated, all meetings will be held at the George and Dragon Inn, Winterbourne, Nr Bristol, commencing 7.15 p.m.

#### 1982

##### Tuesday 28 September

"Chain stopped alkyds" by J. Wilson, Soab Ltd, to be held at the Post House, Cardiff.

##### Tuesday 26 October

Ladies' evening, "The Brunel Society" by K. Hickman, Assistant Secretary.

##### Tuesday 30 November

"Solvent-soluble dyes for inks and paints" by P. Eckert, Ciba-Geigy Ltd.

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#### 1983

##### Tuesday 25 January

"Painting and printing on plastics" by D. J. L. Lewis, Sonneborn & Rieck Ltd.

##### Tuesday 22 February

"Flushed pigments" by a speaker from BASF Ltd.

##### Tuesday 15 March

"Microcomputers in the laboratory" by B. J. Millard of Lombardy Scientific Ltd.

##### Friday 25 March

Dinner dance to be held at the Unicorn Hotel, Bristol.

##### Tuesday 26 April

Annual general meeting.

*Hon. Secretary:* Mr K. A. Chippington ATSC, 37 Sheppard Way, Minchin-hampton, Stroud, Gloucestershire GL6 9BZ. Tel: 0453 883164 (Business).

### General Overseas

### Nigerian Branch

Unless otherwise stated all meetings will be held at the Berger Training Centre, commencing 5 p.m.

#### 1982

##### Tuesday 28 September

Technical meeting, paint lecture.

##### Tuesday 26 October

Technical meeting. Any R.M. Supplier.

##### Tuesday 30 November

Executive to review plans for 1983.

##### Tuesday 14 December

End of year dinner with guest speaker.

*Hon. Secretary:* N. K. Apatira, LRSC, Portland Products, Ewekoro Works, PMB 21011, Ikeja, Lagos State. Tel: 01-961-272 (Business).

### Irish

Unless otherwise stated, all meetings will be held at the Clarence Hotel, Wellington Quay, Dublin 2, commencing 8.00 p.m.

#### 1982

##### Friday 17 September

"Containers for paint" by W. S. Hill, director, Light Pressings (Ireland) Ltd.

##### Friday 15 October

"Alternative methods of pigmentation" by a speaker from Sachtleben.

##### Friday 5 November

Annual dinner dance.

# OCCA news

## Friday 3 December

"Financial controls in business" by P. J. Gunn, Director/Management Services, Berger Paints.

## 1983

### Friday 21 January

"Printing inks."

### Friday 25 February

Ladies' evening.

### Friday 25 March

"Pigment dispersion techniques." (*To be confirmed.*)

*Hon. Secretary:* P. N. Holmes, BSc, 19 Thormanby Lawns, Howth, County Dublin.

## London

Unless otherwise stated all evening meetings will commence 6.30 p.m. Refreshments will be available from 6.00 p.m.

## 1982

### Thursday 23 September

"New market opportunities for performance acrylics" by D. Kerrison of Rohm and Haas, to be held at the Princess Alice, Romford Road, Forest Gate E7.

### Thursday 21 October

"Wood preservation" by E. Pearce of Protim Ltd, to be held at the Princess Alice, Romford Road, Forest Gate E7.

### Wednesday 17 November

One day symposium on "Industrial finishes", to be held at the Thames Polytechnic SE18. *Details to be announced.*

### Friday 3 December

Ladies' night, to be held at the Royal Chace Hotel, The Ridgeway, Enfield. *Details to be announced.*

## 1983

### Thursday 13 January

"History of the titanium dioxide industry" by G. E. Watts of Tiioxide

International, to be held at the Princess Alice, Romford Road, Forest Gate E7.

### Thursday 17 February

"Colour measurement by colorimeters" by D. A. Plant, consultant, to be held at the Princess Alice, Romford Road, Forest Gate E7.

### Wednesday 16 March

One day symposium on "Inks" to be held at the Thames Polytechnic, SE18. *Details to be announced.*

### Thursday 21 April

AGM followed by "Colour in heraldry" by J. J. Froggatt, to be held at the Rubens Hotel, SW1.

*Hon. Secretary:* A. J. Newbould, BSc, CChem, MRSC, 30 Windsor Park, Worcester Park, Surrey KT4 8EW. Tel: 01-590 6030 (Business), 01-337 3553 (Home).

## Manchester

## 1982

### Thursday 2 September

Golf tournament, to be held at Stockport Golf Club.

### Friday 24 September

A discourse in surface coating, "DISC", at the University of Lancaster, commencing 9.00 a.m.

### Friday 8 October

"Pigments for ink makers" by J. D. Sanders of Ciba-Geigy plc, to be held at the Crest Motel, Bolton, commencing 6.30 p.m.

### Friday 15 October

Annual dinner dance, to be held at the Piccadilly Hotel, Manchester.

### Monday 8 November

"The preservation of paint systems" by F. Hauxwell of ICI Organics Division, to be held at Manchester Polytechnic, All Saints, commencing 6.30 p.m.

### Wednesday 17 November

"Coatings for plastics", a student lecture by T. Vincent of Bee Chemical Co. (UK) Ltd, to be held at Manchester Polytechnic, All Saints, commencing 4.30 p.m.

### Monday 6 December

"Colour perception and measurement" by M. P. Pointer of Kodak, to be held at Bolton Wanderers Executive Club, Burnden Park, commencing 6.30 p.m.

## 1983

### Monday 10 January

"Carbon black" by Herr Albrechter of

Degussa, to be held at Manchester Polytechnic, All Saints, commencing 6.30 p.m.

### Wednesday 19 January

"Chlorinated rubber - the versatile paint resin", a student lecture by R. G. Humphries of ICI plc, to be held at Manchester Polytechnic, All Saints, commencing 4.30 p.m.

### Friday 11 February

"The use of the electron microscope in technical service" by H. H. McEwan of BTP Tiioxide plc, to be held at the Crest Motel, Bolton, commencing 6.30 p.m.

### Wednesday 23 February

"Paint under railway conditions", a student lecture by D. M. Bishop of BR Research RTC, to be held at Manchester Polytechnic, All Saints, commencing 4.30 p.m.

### Monday 14 March

"Recent developments in colour-difference equations" by K. Maclaren of Instrumental Colour Systems Ltd, to be held at Manchester Polytechnic, All Saints, commencing 6.30 p.m.

### Friday 18 March

Informal buffet dance, to be held at the RAFA Club, Sale.

### Early April

Annual general meeting, to be held at Old Trafford Cricket Club. *Details to be announced.*

*Hon. Secretary:* S. G. Heyes, c/o Mrs Linda Jenkins, BTP Tiioxide plc, Didsbury House, 748/754 Wilmslow Road, Didsbury, Manchester M20 0DW. Tel: 061 434 4511 (Business).

## Midlands

Unless otherwise stated, all meetings will be held at The Clarendon Suite, Stirling Road, Edgbaston B16 9SB, commencing 6.30 p.m.

## 1982

### Thursday 16 September

"Memoirs of a Birmingham paint man" by R. L. Staples, managing director of Midland Speciality Powders Ltd.

Mr Staples will take a humorous look back over the interesting people he has met and events which have occurred during his long career in the Midlands Paint Industry.

### Friday 24 September

Annual ladies evening at the Botanical Gardens, Garborne Road, Edgbaston, Birmingham, commencing 7.00 p.m. for 7.30 p.m.

#### Thursday 21 October

"Coatings for plastics" by D. Lewis, technical development manager, Sonneborn and Rieck Ltd.

Mr Lewis will talk about the general types of plastics which can be coated, together with application methods and typical systems used. A review of possible future trends in this field will also be made.

#### Thursday 18 November

Annual student lecture. "Synthetic resins" by J. S. Bridle of Cray Valley Products Ltd.

Mr Bridle will give a general review of resins used in the paint industry, which will be of particular interest to students.

#### 1983

#### Thursday 20 January

Annual dinner lecture. "Midland paint scene" by P. A. J. Sturge, managing director of Holden Surface Coatings Ltd, to be held at The Clarendon Suite, as above, commencing 7.30 p.m.

A look at the history of the Birmingham paint industry and its corporate development over the years, and a prediction about its possible future progress.

#### Thursday 17 February

Lecture on organic pigments by BASF. Details to be announced.

#### Thursday 24 March

J. Newton Friend lecture. "Rocks, minerals, fossils and gemstones" by B. W. Gamston of the West Midlands Mineral and Mining Society, to be held at The Clarendon Suite, as above, commencing 7.30 p.m.

Mr Gamston will talk on how rocks, fossils and gemstones are formed, and how the latter are used to make jewellery. There will be many specimens available for examination.

#### Thursday 21 April

AGM to be held at the Aston Edwardians Clubhouse, Sunnysbank Avenue, Birmingham 44, commencing 6.30 p.m.

The AGM will be followed by a games evening to be held in conjunction with the Birmingham Paint, Varnish and Lacquer Club.

*Hon. Secretary:* B. A. Fowler, 12 Broadoaks, Moss Pit, Stafford ST17 9DW. Tel: 0785 59121 (Business).

## Trent Valley Branch

#### 1982

#### Thursday 28 October

"An update on the performance of paints incorporating zinc phosphate" by D.

1982(8)

Bishop of British Rail, to be held at the BR School of Engineering, London Road, Derby, commencing 7.00 p.m.

#### Friday 29 October

Hallowe'en disco/buffet, to be held at Wollaton Park Golf Club, Nottingham, tickets £4.50. Details to be announced.

#### Thursday 25 November

"Packaging and labelling - how to stick with it" by Mrs D. Cornelius of Cray Valley Products, to be held at the BR School of Engineering, London Road, Derby, commencing 7.00 p.m.

#### 1983

#### January

Joint meeting with Midlands Section. Details to be announced.

#### Thursday 24 February

"Paints for concrete", joint lecture by T. Forrester-Coles, CEGB, and J. P. Bourne, Mebon, to be held at the BR School of Engineering, London Road, Derby, commencing 7.00 p.m.

#### Thursday 24 March

"Product finishing", to be held at the BR School of Engineering, London Road, Derby, commencing 7.00 p.m. Details to be announced.

#### Friday 15 April

Annual general meeting and social event. Details to be announced.

*Hon. Secretary:* J. P. Bourne, BSc, AInstM, 4 Steeple Close, Breadsall, Derby DE2 2DE. Tel: 0623 511000, ext 34/36 (Business).

## Newcastle

Unless otherwise stated, all meetings will be held in the Students' Common Room, St Mary's College, Elvet Hill Road, Durham, commencing 6.30 p.m.

#### 1982

#### Thursday 2 September

"Corrosion - the vulture of metallurgy" by M. Clarke of London Polytechnic.

#### Thursday 7 October

"Quality assurance relative to corrosion prevention systems" by P. Hanson of Scientific and Technical Services Ltd.

#### Thursday 4 November

"Finishing in electrical engineering" by L. F. Prior of NEI Reyrolles Ltd.

#### Thursday 2 December

"Colour measurement by colorimeters" by D. A. Plant.

**OCCA**  
**news**

#### 1983

#### Thursday 3 February

"Polyurethanes - heavy duty aspects" by D. Charlton of Bayer, Plastics and Surface Coatings Division.

#### Friday 18 February

Annual ladies' night, to be held at the Five Bridges Hotel, Gateshead.

#### Thursday 3 March

"Business cycles" by F. M. Smith of Ciba-Geigy plc, New Venture Group.

#### Thursday 7 April

Annual general meeting.

*Hon. Secretary:* S. Lynn, CChem, MRSC, 19 Waskerley Close, Sunnyside, Newcastle upon Tyne NE16 5XX. Tel: 0632 604791 (Business).

## Scottish

Unless otherwise stated all meetings will be held at the Beacons Hotel, 7 Park Terrace, Glasgow, commencing 6 p.m.

#### 1982

#### Thursday 14 October

"Paint performance under railway service conditions" by D. M. Bishop, Scientific Service Division, British Rail Technical Centre, Derby.

#### Thursday 11 November

Joint meeting with SDC "Successful exporting for the small business" by A. S. Wales, MBE of Stewart Wales Somerville Ltd, commencing 7.30 p.m.

#### Thursday 9 December

Student invitation lecture "Alkyds: the workhorse of the industry" by R. H. E. Munn, Cray Valley Products Limited.

#### 1983

#### Friday 14 January

Annual dinner dance at the Albany Hotel, Glasgow.

#### Wednesday 19 January

Joint Scottish Section and Eastern

# OCCA news

Branch works visit to and sponsored by Abbey Chemicals Limited, Houston Industrial Estate, Livingston, commencing 6.30 p.m. prompt.

## Thursday 10 February

"Decorative paints. Market pressures on the formulator" by R. D. Mearns, Goodlass Wall & Co. Ltd.

## Thursday 10 March

Lecture on industrial finishes by D. Hopper, International Paints Limited.

## April

Annual general meeting followed by ladies' evening. *Date and details to be announced.*

*Hon. Secretary:* R. Hill, CChem, MRSC, ATSC, Ciba-Geigy (UK) plc, Hawkhead Road, Paisley PA2 7BG; Tel: 041 887 1144 (Business).

## Eastern Branch

Unless otherwise stated, all meetings will be held in the Murrayfield Hotel, 18 Corstorphine Road, Edinburgh, commencing 7.30 p.m.

### 1982

#### Friday 8 October

Annual skittles match, to be held in the Murrayfield Indoor Sports Centre, Edinburgh, commencing 7.00 p.m. prompt. *(To be confirmed.)*

#### Wednesday 17 November

"Resins etc. for inks, liquid and paste" by I. Drury of Lawter Chemicals. This is a sponsored lecture.

#### Wednesday 1 December

"Alternative means of pigmentation" by a speaker from Sachtleben GmbH. This is a sponsored lecture.

### 1983

#### Wednesday 19 January

Joint Scottish Section/Eastern Branch meeting. Works visit to and sponsored by Abbey Chemicals, Houston Industrial Estate, Livingston, commencing 6.30 p.m. prompt.

#### Friday 11 February

"Burns Supper", to be held as usual in the

Commodore Hotel, Marine Drive, Edinburgh. *Details to be announced.*

#### Wednesday 2 March

Joint Institute of Printing/Eastern Branch (OCCA) meeting. *Details to be announced.*

#### March/April

Saturday morning works visit to the Shell/Eso Plant at Mossmorran, Fife, by coach only. *Details to be announced. (To be confirmed.)*

#### Wednesday 6 April

Annual general meeting followed by "Scotch whisky – an appreciation of the process and the product" by K. W. Delahunt of Scottish Grain Distillers Ltd.

*Hon. Secretary:* A. McKendrick, 56 Ormidale Terrace, Edinburgh. Tel: 031 554 1131 (Business).

## Thames Valley

Unless otherwise stated, all meetings will be held at the Crest Hotel, Beaconsfield, commencing 7.00 p.m.

### 1982

#### Thursday 23 September

Lecture/film/tasting on Harvey's Sherries by courtesy of J. Harvey and Sons (ladies welcome).

#### Thursday 28 October

"Motor-car finishing in Europe – the technological challenge for the future" by J. Inshaw. ICI buffet lecture.

#### Thursday 18 November

"Operating aspects of UV curing for metal decorating" by J. Emmerson. Metal Box buffet lecture.

### 1983

#### Thursday 20 January

"Theories of adhesion and developments in water-based adhesives" by M. Hodgson of Unibond.

#### Friday 11 February

Annual dinner dance to be held at Great Fosters, Egham.

#### Thursday 17 February

Works visit to ICS Newbury – including practical demonstrations and buffet – commencing 7.00 p.m.

#### Thursday 17 March

"Extenders in paint systems" by R. McGuffog of ECC.

#### Thursday 14 April

Annual general meeting.

*Hon. Secretary:* A. W. Fell, BSC, ATSC,

LRSC, 4 Hadrians Gate, St Peter's Estate, Brackley, Northamptonshire.

## West Riding

Unless otherwise stated, all meetings will be held at the Mansion Hotel, Roundhay Park, Leeds 8, commencing 6.30 p.m. Would members please note that all meetings taking place on a Tuesday will take place on the 1st Tuesday in every month, and also take particular note of the changed starting time.

### 1982

#### September

West Riding Chairman's Golf Trophy at the Knaresborough Golf Course. *Details to be announced.*

#### Tuesday 7 September

"Purchasing in the competitive 80s" by O. Brosh, purchasing director of SPL Holdings Ltd.

#### Tuesday 5 October

"Trends in the supply of feed stocks for petrochemicals" by R. A. C. Chappell (Chairman of the West Riding Section) of Shell Chemicals (UK) Ltd.

#### Tuesday 2 November

"The pigmentation of thixotropic alkyl gloss paints – theory and practice" by J. E. Hall of BTP Tioxide Ltd.

#### Friday 26 November

Dinner dance at the Crown Hotel, Harrogate.

#### Tuesday 7 December

"Some aspects of modern analytical techniques" by B. Davies, senior infrared product specialist of Perkin Elmer Ltd.

### 1983

#### Tuesday 1 February

"Recent developments in powder coatings" by D. M. Heath, technical manager of Holden Surface Coatings Ltd.

#### Tuesday 1 March

*Details to be announced.*

#### Tuesday 5 April

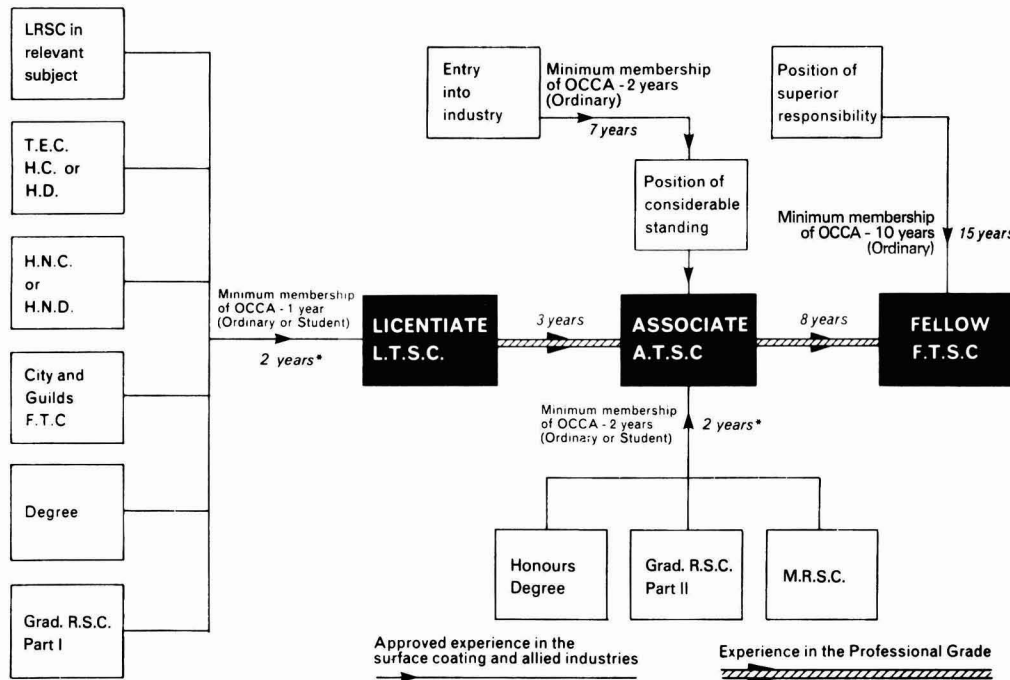
Annual general meeting

*Hon. Secretary:* Mr T. Wood, BSC, MRSC, 26 Kingstonia Gardens, Ripon, North Yorkshire. Tel: Morley 534423 (Business).

# Optional Professional Grade for Ordinary Members

## Routes to the Professional Grades

The innovation of the Professional Grade has proved to be most successful, as evidenced by the impressive list of names in the December issue of the *Journal*. For the convenience of potential applicants, a chart indicating different routes to the various grades is shown below.



\*Not necessarily after qualification – see regulations.

Note: At present there is no restriction on Students up to 21; between 21 and 25 a certificate from the employer or college confirming the course being taken is required.

## Regulations for admission to the Professional Grade – Amended February 1981

### A. Licentiate

1. Shall be an Ordinary Member of the Association and have been an Ordinary Member or Registered Student of the Association for not less than one year.
2. Shall have attained the age of 22.
3. (a) Shall be a Licentiate of the Royal Society of Chemistry in Coatings Technology or another relevant subject, such as advanced analytical chemistry, colour chemistry or polymer science.
- OR (b) Shall have passed the Higher Certificate or Higher Diploma of the Technician Education Council in Coatings Technology or other relevant subjects (or equivalent SCOTEC qualification).
- OR (c) Shall have passed Higher National Certificate or Higher National Diploma in a relevant subject (or equivalent SCOTEC qualification).
- OR (d) Shall hold the Full Technological Certificate of the City and Guilds of London Institute in a relevant subject.

- OR (e) Shall be a graduate in a relevant subject.
- OR (f) Shall have passed Part I of the examination for the Graduateship of the Royal Society of Chemistry or Council of Physics.
- OR (g) Shall have passed such other qualifications as approved by the Professional Grade Committee from time to time.
4. Shall have attained approved experience in the science or technology of coatings. It is not expected that sufficient experience would be gained in a period of less than two years in the industry. Approved experience may be gained before, during or after the qualifications in paragraph (3) above have been attained.
5. Shall be required to satisfy the Professional Grade Committee, or some other body approved by the Professional Grade Committee in a *viva voce* examination and submit a dissertation on a subject directly associated with the science and technology of Surface Coatings or

allied materials previously approved by the Professional Grade Committee.

6. Shall normally be sponsored by three Ordinary Members of the Association in the Professional Grade (either Associate or Fellow at least one of whom is a Fellow). A sponsor will usually be a person who has knowledge of the career of the applicant. The candidate shall be in a position to furnish the name of a referee acceptable to the Committee, who can be contacted in confidence, if required. The referee will have a full knowledge of the candidate's technical and scientific achievements to date and could be the applicants employer.
7. Shall have paid the fee stipulated by the Council and have paid the current subscription payable by an Ordinary Member.

### B. Associate, being already a Licentiate

1. Shall, since his election to the Licenshiptship, have practised the science or technology of coatings for not less than three years.

Note: For the sake of simplicity, reference is made only to UK examinations etc., but equivalent qualifications overseas will naturally be accepted.

2. Shall provide evidence acceptable to the Professional Grade Committee of his increased professional skill and maturity since his election as a Licentiate.
3. Shall have published work which, in the opinion of the Professional Grade Committee, is of a sufficiently high standard OR may be required to submit a thesis or dissertation on a topic previously approved by the Professional Grade Committee OR shall hold the City & Guilds of London Institute Insignia Award.
4. MAY be required to satisfy the Professional Grade Committee or some other body as approved by the Professional Grade Committee in a *viva voce* examination.
6. Shall normally be sponsored by three Ordinary Members of the Association in the Professional Grade (either Associate or Fellow) at least one of whom must be a Fellow.
7. Shall have paid the fee stipulated by Council and have paid the current subscription payable by an Ordinary Member.
7. Shall have been an Ordinary Member of the Association for not less than ten years.
8. Shall have made outstanding contributions to the science and technology of coatings or reached a position of eminence in the industry through the practice thereof.
10. EITHER (a) shall have been an Associate of the Professional Grade for at least eight years and shown continued development.

OR (b) shall have not less than fifteen years' experience in the science and technology of coatings in a position of superior responsibility.

The nomination of a referee for a *viva voce* examination will normally be for those whose work could be of a highly confidential nature or for overseas candidates.

5. Shall normally be sponsored by three Ordinary Members of the Association in the professional grade (either Associate or Fellow) at least one of whom must be a Fellow.

A sponsor will usually be a person who has knowledge of the career of the candidate. The candidate should be in a position to furnish the name of a referee acceptable to the Committee, who can be contacted in confidence if required. The referee will have a full knowledge of the candidate's technical and scientific achievements to date and could be the applicant's employer.

6. Shall have paid the fee stipulated by Council and have paid the current subscription payable by an Ordinary Member.

### C. Associate, not already a Licentiate

#### EITHER

1. Shall be not less than 24 years of age.
2. Shall be an Ordinary Member of the Association and have been an Ordinary Member or Registered Student of the Association for not less than two years.
3. Shall hold the Graduateship of the Royal Society of Chemistry or Council of Physics or a University or Council of National Academic Awards degree recognised by the Royal Society of Chemistry or Institute of Physics as giving full exemption from the Graduateship examination.
4. Shall have attained approved experience in the science or technology of coatings. It is not expected that sufficient experience would be gained in a period of less than two years in the industry. Approved experience may be gained before, during or after the qualifications in paragraph (3) above have been attained.
5. Shall normally be required to satisfy the Professional Grade Committee or some other body approved by the Professional Grade Committee in a *viva voce* examination.

The nomination of a referee for the *viva voce* examination will normally be for those whose work may be of a highly confidential nature or for overseas candidates.

#### OR

8. Shall be not less than 30 years of age.
9. Shall be an Ordinary Member of the Association and have been an Ordinary Member of the Association for not less than two years.
10. Shall have been engaged in practising the science or technology of coatings for not less than seven years and shall have attained a position of considerable standing in the industry, with appropriate responsibility for technical and scientific matters within the company.

It would be helpful if he had contributed to the knowledge and understanding of surface coatings technology by lecturing or by the publication of articles. He will also have shown himself to take a keen interest in the work of the Association by being an active member of his Section and by attendance at lectures etc., whenever and wherever possible.

11. Shall normally be required to satisfy the Professional Grade Committee in *viva voce* examination of his professional competence and also be required to submit a dissertation on a subject agreed by the Committee. In cases where the subject is of a highly confidential nature the use of a referee agreeable to the Committee may be asked to examine the dissertation.

12. Shall normally be sponsored by three Ordinary Members of the Association in the Professional Grade (either Associate or Fellow) at least one of whom must be a Fellow.

A sponsor will usually be a person who has knowledge of the career of the candidate. The candidate must also be in a position to furnish the name of a referee acceptable to the Committee who can be contacted in confidence, if required. The referee will have a full knowledge of the candidate's technical and scientific achievement and could be the candidate's employer.

13. Shall have paid the fee stipulated by the Council and have paid the current subscription payable by an Ordinary Member.

### D. Fellow

*Note:* This is the senior award of the professional grade. The Professional Grade Committee will require substantial evidence of professional maturity in the science or technology of coatings although commercial experience will be taken into account in assessing the merits of candidates.

1. Shall be not less than 33 years of age.

*The fees payable with the application are as follows:*

Fellow—£10.00 Associate—£6.00  
Licentiate—£3.00  
(Plus VAT at standard rate).

### Application

Completed application forms should be returned, together with the appropriate remittance, to the Director & Secretary at the Association's offices (except in the case of those Members attached to the Cape, Natal, Transvaal, Wellington, Auckland and Ontario Sections, who should address their forms to their Section Hon. Secretaries).

The Committee wishes it to be known that members rejoining the Association after a period in other industries may include length of service as an Ordinary Member before their resignation as part of the qualifying periods for entry into the Grade.

Students wishing to apply for entry into the Professional Grade must first make application in writing for upgrading to Ordinary Membership, giving the reasons for their eligibility for such upgrading. Applications, together with the appropriate remittance, should be addressed as for application for admission to the Professional Grade.

Potential applicants are recommended to give the fullest possible details of their appointments, including the number and type of staff under their control, and indicating to whom the applicant is responsible, as this aids the committee considerably in its deliberations.



## CLASSIFIED ADVERTISEMENTS

Classified Advertisements are charged at the rate of £5.00 per single column cm. Advertisements for Appointments Wanted are charged at £1.50 per line. A box number is charged at £1.00. They should be sent to D. N. Buddles, Assistant Editor, Oil & Colour Chemists' Association, Priory House, 967 Harrow Road, Wembley, Middlesex HA0 2SF. JOCCA is published EVERY month and Classified Advertisements can be accepted up to at least the 12th, and in exceptional circumstances the 20th of the month preceding publication. Advertisers who wish to arrange for an extension of the copy deadline should contact the Assistant Editor, D. N. Buddles at the address given above (telephone 01-908 1086, telex 922670 OCCA G).

## SITUATIONS WANTED

### Paint technologist Seeks Position at Home or Abroad

A 37 year old Ghanaian with 15 years experience in paint manufacture (especially formulation and production) and an ATSC seeks employment as a Paint Technologist in a paint, varnish and/or lacquer making organisation.

The post is sought in any English speaking African or Asian country, or in Europe.

*Please reply in strictest confidence to:*  
**Box No. 514**

## BOOKS ON OFFER

Varnish Constituents – Chatfield (1944 edition)  
Synthetic Resins Chemistry – Martin (1947)  
Varnish Manufacture and Plant – Chatfield (1957)  
Ink Manual – SBPIM (1961)  
Handbook of Adhesives – Skeist (1962)

*Anyone interested in obtaining the above volumes should contact:*

**Mr W. F. Daggett, 3 Barn Close, Littlehampton, West Sussex, BN17 6JU.  
Tel: Littlehampton (09064) 3142.**

## SITUATIONS WANTED

### Member with wide experience seeks challenging position

Member of OCCA (in the Professional Grade) with extensive experience in the surface coatings industry: R & D, technical service, market R & D, marketing and sales, advertising and PR. Also, experienced technical writer, general lecturer, book contributor and author of many papers. Seeks an executive sales/marketing or technical appointment; positions in general management, admin., PR, teaching or scientific journalism would be eagerly considered.

**Replies in strictest confidence to Box No. 511.**

## AGENCY ON OFFER

### Business Opportunities Abroad in Dyes and Preparations

An agency in Zimbabwe wishes to specialise in the importation of dyes and colour preparations from Britain.

Communications addressed to the box number below by companies interested in receiving further particulars will be forwarded by air mail.

*Reply in strictest confidence to*  
**Box No. 516**

## BOOKS SOUGHT

### Paint Technology Manuals Wanted

The following "Paint Technology Manuals" are sought: Parts I, II, IV and VI.

*Please contact: Mr S. K. Ghosh, 22A Mandeville Gardens, Flat W/3, Calcutta 700019, India.*

## APPOINTMENTS

## SURFACE COATINGS

### South America

Our client, an international surface coatings manufacturer, has a vacancy for a Technical Service Representative in one of their South American operations. The position will interest a mature person with experience of surface coatings formulations and their applications.

Excellent benefits package and relocation. Please apply, with full c.v., to **Box No. 517**, c/o JOCCA, Priory House, 967 Harrow Road, Wembley, Middlesex HA0 2SF, England.

Please indicate in a covering letter those companies to which you do not wish your application sent.

## SITUATIONS WANTED

### Part-time Consultancy

Recently retired CBE, PhD with wide experience in the UK and abroad in company management and selling seeks part-time consultancy.

**Replies in confidence to  
Box No. 510**

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# JOCCA

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## INDEX TO ADVERTISERS

Further information on any of the products advertised in this *Journal* may be obtained by circling the appropriate number on the *Reader Enquiry Service (RES)* form. The numbers are shown in brackets below. Enquiries will be forwarded to the organisations concerned.

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<p><b>O</b></p> <p>OBS Machines Ltd ..... (203)      Cover</p> <p>OCCA Bath Conference ..... (199)      ii</p> <p>OCCA Professional Grade ..... (204)      iii</p> <p>iv</p>	<p><b>T</b></p> <p>The Society of British Printing Ink Manufacturers Ltd .....      Insert</p>

# The amazingly versatile CENTRIMILL -the best from OBS!



The Sussmeyer/Oliver + Batlle Centrimill is an advanced multi-purpose machine which will pre-mix, disperse, grind and dissolve raw materials widely used in the paint, printing ink, pharmaceutical, cosmetic and adhesive manufacturing industries. The machine has been internationally acclaimed and embodies many user advantages. It is designed for one man operation, utilises one motor for both grinding and discharging procedures, uses a variety of 3mm micro grinding media, and will process all pigments, including Prussian Blue and Carbon Black, with equal efficiency. For full product information on the superbly engineered, remarkably versatile Centrimill, contact OBS Machines today.

## OBS MACHINES LIMITED

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Milton Keynes, MK12 6HR.  
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Telex: 825663 (OBSUK G)

Reader Enquiry Service No. 203

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

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

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Mr. C. Hubbard Davis, Founder, Sub-Tropical Testing Service, Inc. (1904-1977)  
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FINNTITAN TiO<sub>2</sub> pigment grades every  
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RR grades for maximum exterior  
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RD grades for universal and special  
applications

RF grades for plastics and colour  
concentrates

Anatase grades for paper and man-  
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NB: In the grade designation  
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sion speed

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perties in the most exacting industrial  
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\*) FINNTITAN pigments sell today in more than 60 countries all over the world