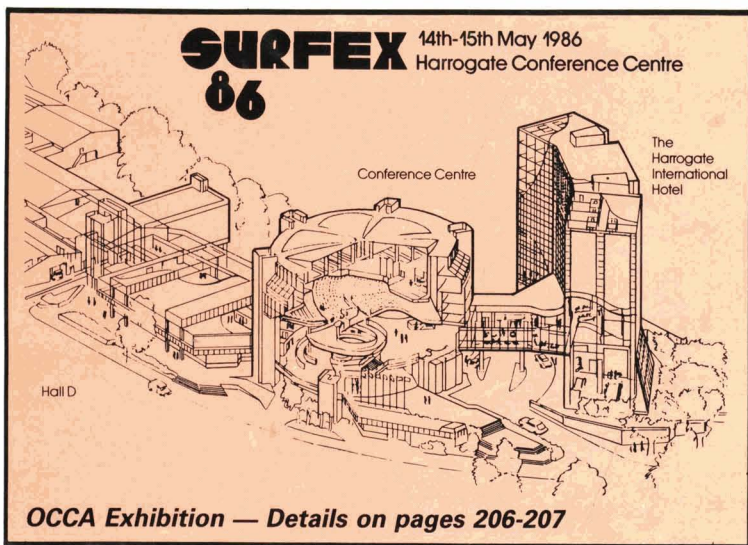




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*Also in this issue are further papers from the OCCA Conference*

- **Cationic electrodeposition primers over zinc coated steels.  
Part 1: Effect of voltage and substrates on coating quality**
- **Oxo-acetates—new solvents for high solid paint formulations**
- **Plastics as a painting substrate**

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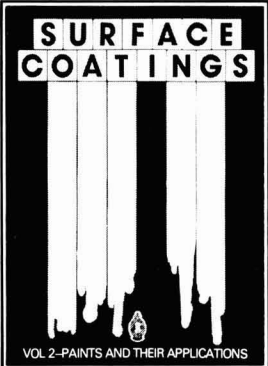
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 Paint Manufacture: Processing Operations  
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Ultraviolet-Cured Coatings  
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 Metal Cleaning and Pretreatment  
 The Selection of Decorative Paints  
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 Industrial Coatings: Application and Curing Methods  
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 Technical Service in the Surface Coatings Industry  
 Standardisation, Inspection and Accreditation in Australia  
 Statutory Requirements of the Paint Industry  
 Appendix: Paint Calculations  
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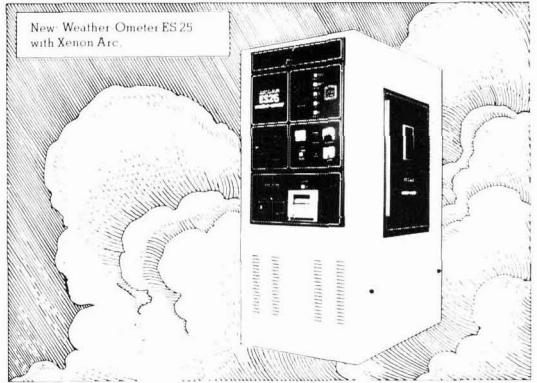
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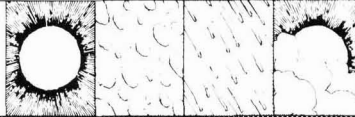
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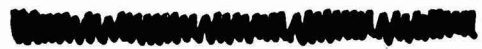
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# Cationic electrodeposition primers over zinc coated steels. Part 1: Effect of voltage and substrates on coating quality

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## Summary

The automobile industry is turning more and more to zinc coated steels to improve corrosion protection. Considerable amounts of galvanized and zinc alloy coated steels presently are used in production and their proportion of the steel contained in an automobile will rise in the future. These surfaces, along with the rest of the vehicle, normally are primed with cationic electrodeposition primers and results have been excellent. However, under certain conditions cationic electrodeposition primers can give pits and craters over zinc alloy and galvanized steels. This is a cause for concern. Therefore, the authors set out to recreate the problem, determine the mechanism of defect formation, and devise process or paint changes that would prevent the occurrence of the craters.

The problem was reproduced over a variety of zinc coated steels and a wide range of physical and analytical techniques were applied to characterize the defects. Conventional cationic electrodeposition primers have a high tendency to crater, but the newer high build primers are more resistant to cratering. There are two mechanisms for formation of the defects: electrical discharge (dielectric failure of the wet film) in the bath and gassing. Defects are associated with the zinc on the surface, but with high build primers, the craters occur more often with deposition over zinc-iron alloys.

Craters can be prevented or greatly reduced by using high build cationic electrodeposition primers rather than conventional ones, operating at lower voltages, using smoother substrates, and controlling AC ripple to suppress high voltage peaks.

## Introduction

Automobile companies all over the world are turning increasingly to zinc coated steels (galvanized, zinc alloys) to improve the corrosion resistance of steel surfaces both on the exteriors and interiors of cars. However, such steels often are thought of as being difficult to paint and some have been observed to give appearance problems such as craters and pinholes with cationic electrodeposition primers applied at relatively high voltages (Figures 1 and 2). Because of the increasing use of zinc coated steels and the potential problems in painting them, it was important to develop an understanding of the behaviour of cationic electrodeposition primers over such steels and to develop means of controlling that behaviour. Therefore, it was decided to investigate the behaviour of conventional and high build cationic electrodeposition primers over a wide range of zinc coated steels, with particular interest in the craters and pinholes that could occur. It was first considered important to reproduce the defects, relate them to surface and other properties of the steels, then determine the mechanism of defect formation, and finally develop solutions to the problem in terms of process or product

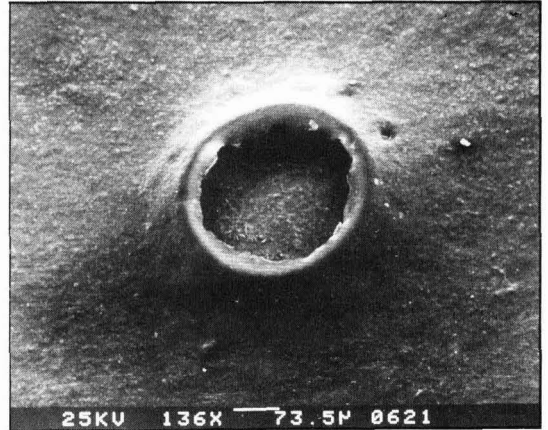


Figure 1. Volcano-like crater in conventional e.d. primer film on automobile part. Scanning electron microscope photograph taken at 136X.

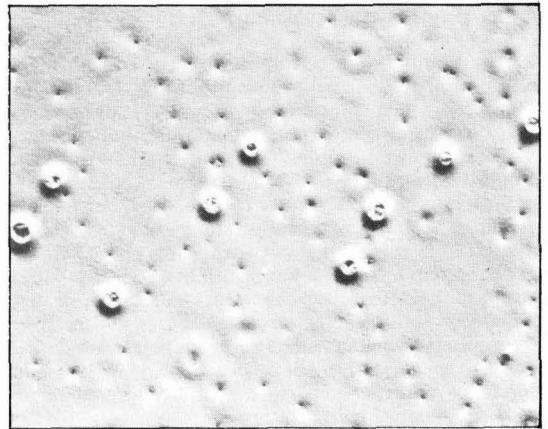


Figure 2. Pits and craters in high build primer film coated in the laboratory. Photograph taken with Polaroid MP-4 Camera at 10X.

changes. The ultimate aim is to be able to produce defect-free coatings over all types of zinc coated steels even at relatively high voltages. This paper mainly covers the defects, how they occur, and their relationship to properties of the steel.

Previous investigators<sup>1-4</sup> in this area have characterized the defects, have shown their dependence on voltage, and

in some cases, <sup>2,4</sup> have considered the effects of the composition of the metal coating on the steel. They have provided a good base on which to build, but the exact mechanism of defect formation has yet to be established and there is little information on how to solve or avoid the problem. In addition, earlier investigators worked only with conventional electrodeposition primers, not the newer high build coatings. The authors were in a position to compare the behaviour of conventional and high build coatings and to make experimental process and bath changes, if necessary; and also had access to a number of US and overseas zinc coated substrates.

Another source of information concerning performance of electrodeposition primers over zinc coated steels is the accumulation of observations by technical service and automobile plant paint personnel over the years. Most of this work is unpublished and much of it is qualitative, but it provides a great deal of useful information, particularly in terms of causes and possible solutions to the cratering/pinholing problem. The authors have appreciated the willingness of those in the field to share their knowledge.

## Experimental

### 1. Outline of methods

Conventional and high build electrodeposition primers were deposited on a number of zinc coated steels and other substrates over a wide range of voltages using minipanel and a small scale, low power coating system. Optical and scanning electron microscopy, cameras, and video equipment were used to characterize films before, during and/or after baking. Many of the substrates were characterized by roughness, solid surface tension, and energy dispersive x-ray (EDX) measurements.

### 2. Coater and related equipment

Electrodeposition was carried out in a stirred bath which was a modified Princeton Applied Research corrosion test cell (see Figure 3). The power source was a Heathkit Model IP-17 regulated (very low ripple) high voltage, low amperage power supply. Cell modifications included addition of a specimen holder and replacement of the original Luggin capillary Vycor tip with a platinum tip. The specimen holder consisted of a stainless steel rod (6 mm diameter, 18 cm long) that was machined to give a 3 cm flat at the bottom and a hole was drilled and equipped with a screw to hold the specimen (substrate) to be coated. Specimens were 2.5 cm × 7.5 cm coupons (minipanel) cut from panels or automobile sheet metal parts. A hole was punched at the top of each coupon to allow fitting to the specimen holder. Three graphite rods surrounding the cathode (specimen) were the anodes.

The cathode potential,  $E_c$ , was measured with respect to a saturated calomel reference electrode via a Luggin capillary (to avoid the IR drop through the paint) using a Keithley 600B electrometer. Another, identical, electrometer was used to measure the current. The potential and current were recorded on a dual channel recorder (Omniscribe, Houston Instruments) as a function of electrodeposition time. It is difficult to relate lab electrodeposition bath voltages to those in automobile assembly plant baths. However, our minicoater results appear to translate to behaviour at 50-100 volts higher with automobile bodies in a typical large bath.

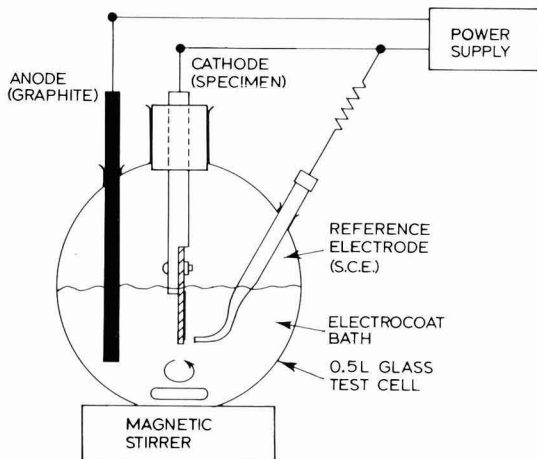


Figure 3. Electrodeposition apparatus (minicoater).

### 3. Materials

The paints used were a conventional automotive aminomodified epoxy primer and a high build primer (UNI-PRIME®). The substrates included a wide range of galvanized and zinc alloy coated steels, zinc sheet, and cold-rolled steel (used as a control). The basic types are listed in Table 1. Some were purchased from commercial panel suppliers, but most came from automobile and steel companies. A few of the substrates were cut from production car or truck sheet metal parts. Some were pretreated (zinc phosphate), whereas others were not. The authors' experience as well as that of some users of zinc coated steel is that pretreatment has little effect on the tendency to produce defects. This has been borne out by a recent paper<sup>4</sup>. Some substrates were used as received, but any that appeared at all oily (such as all the nonpretreated samples) or dirty were cleaned with acetone and trichloroethylene before use.

Table 1.  
Basic types of substrates tested

Cold-Rolled Steel
Hot-Dipped Galvanized (HDG)
ULTRASMOOTH® HDG
Electrogalvanized
Zinc Sheet
Galvanneal Zinc-Iron Alloy
Zinc-Iron Electroalloy
Zinc-Nickel Electroalloy
Iron-Zinc (High Iron) Alloy
Zinc-Nickel-Iron Electroalloy
1 1/2 Side Galvanized (One Side HDG, Other Side Galvanneal Zinc-Iron Alloy)
Zinc-Aluminium Alloy

### 4. Electrodepositions

The first task was to see whether the minicoater could

reproduce the pits and craters seen on production parts. A series of two minute depositions were carried out at constant voltage at two voltages (200, 300V) at 24°C (75°F) with both types of electrocoat over representative substrates. The specimen was placed in the bath with the power off, then the voltage was turned up to the desired level by hand which took about 4-5 seconds. The film thicknesses at 300V were about 15 µm for the conventional coating and 30-35 µm for the high build coating. Freshly deposited films were examined by eye and sometimes with a microscope, then baked and checked for cratering. The coupons were rated in terms of no, low, moderate, or high numbers of craters. These classifications translate roughly to 0, 1, 5, 20 craters/cm<sup>2</sup>. No difficulty was experienced in reproducing the problem.

Later, after the preliminary results had been reviewed and more substrates had been received, a series of cratering threshold experiments were carried out using the high build coating only. These were one and two minute depositions done at a number of voltages in 20V steps with a maximum of 340V. When the approximate threshold had been determined, additional depositions were carried out at 10V above and below that point in order to determine the threshold somewhat more exactly.

## 5. Microscopy

Many deposited films, both baked and unbaked, were examined and often photographed for defects and defect precursors under one or more of the following microscopes and a camera (which also could be used as a low power microscope):

- Leitz Orthoplan, metallurgical optics (50-200X) with Combiphot camera attachment
- Zeiss Stereo with zoom objective (8-40X)
- Polaroid MP-4 camera with 35 mm and 75 mm lenses (1-20X)

In addition, some films and a number of substrates were examined with a scanning electron microscope with an energy dispersive x-ray attachment (EDX) for identification and mapping of elements in coating and substrate subsurfaces.

## 6. Observation and recording of baking process

It was important to determine the sources of the pits and craters, yet these defects or their precursors were difficult to identify in the unbaked films. Therefore, a hot plate bake technique<sup>5</sup> was used in which the minipanel was placed on the platen of a Thomas Model 40 Kofler-type microscope hot stage preheated to 180°C and the baking process observed. In order to have a permanent record (and one that could be slowed down or speeded up), a video system comprised of a Zoomar Macro-Kilar 1:2.8/90 lens (at a setting to give ~ 40X), Bausch & Lomb Camera, and Panasonic NV-8950 recorder was used to record the process.

## 7. Surface analysis

Surface roughness/profile measurements were made with a Gould Surfanalyzer 150 which employs a moving stylus probe. The signal was converted from analogue to digital

with a Nelson Analytical Model 762 data station and processed with a Hewlett Packard Series 200 Model 16 microcomputer. The arithmetic average roughness was calculated along with an average maximum peak-to-valley height based on the five greatest peaks and five lowest valleys in the interval examined.

Solid surface tensions were determined using the Owens-Wendt-Kaelble method<sup>5-7</sup> in which drops of methylene iodide and distilled water are placed on the surface and the contact angles measured. These values and the relevant surface tensions are substituted in the equation

$$\frac{\gamma_1 (1 + \cos \theta)}{2} = (\gamma_1^d \gamma_s)^{1/2} + (\gamma_1^p \gamma_s^p)^{1/2}$$

where  $\gamma_1$  and  $\gamma_s$  are the surface tensions of the liquid and solid, respectively, and the d and p stand for the nonpolar (dispersion) and polar components of the surface tension ( $\gamma = \gamma^d + \gamma^p$ ). The equation is used to calculate the components of the solid surface tension which are added to get the total value. These parameters may be used to compare the wettabilities and degrees of polarity of the various substrates.

## Results

### 1. Cratering tendencies

The conventional electrodeposition coating had a higher tendency to crater than did the high build coating as shown in Table 2. The conventional coating cratered at high and

Table 2.

Cratering tendencies of conventional and high build cationic E. D. Primers (Two minute depositions at 24°C)

Substrate	200V		300V	
	Conventional	High-Build	Conventional	High-Build
Cold-Rolled Steel	None	None	None	None
Zinc sheet	None	None	Moderate	None
Hot-dipped galvanized	None-Low	None	Moderate	None-Low
Polished (rolled) HDG	None-Low	None	Moderate	None-Low
ULTRASMOOTH				
HDG	None	None	Low-Mod	None
Galvanneal	Moderate	None-Low	High	High
Pol. (rolled) Galvanneal	Mod.	None-Low	High	High
Electrogalvanized	None	None	Mod.	None
Zinc-Nickel Electroalloy		None		None-Mod.*
Zinc-Nickel-Iron Alloy		Low		High
Zinc-Aluminium Alloy		None		None
Iron-Zinc (High Iron) Alloy				None-High
Zinc-Iron Electroalloy				High

\*Depending on uniformity of surface

low voltage over most substrates, whereas the high build coating only cratered at high voltage over certain substrates. It was decided to place the emphasis in this research on the high build coating because it did a better job of distinguishing between substrates and because it is believed that such coatings will supercede conventional electrodeposition primers in general use.

Table 3.

*Cratering threshold voltages for high build primer*

Substrate	Two minute depositions at 24°C (75°F)
Cold-Rolled Steel	>340V
Zinc Sheet	>340V
Hot-Dipped Galvanised	290->340
ULTRASMOOTH® HDG	>340
Polished (rolled) HDG	320->340
Galvanneal Zn-Fe Alloy	220-260
Pol. (rolled) Galvanneal	250-260
Electrogalvanized	320->340
Zn-Ni Electroalloy (uniform surface)	>340
(non-uniform surface)	280
Zinc-Aluminium Alloy	>340

Cratering thresholds for the high build coating over a number of substrates are given in Table 3. These and the results at 300V indicate that there is a greater tendency to crater over zinc-iron alloys than over galvanized (zinc only) steels. Some of the galvanized steels, such as Armco's Ultrasmooth®, had particularly low tendencies to crater, being quite similar to cold-rolled steel.

**2. Results of microscope studies**

Initial examinations were done of production and laboratory produced defects. Two types were seen: small pits or pinholes and larger volcano-like craters. Both types may be seen in Figure 2. Unbaked and baked films over representative substrates then were examined. Unbaked films deposited over substrates with low cratering tendencies were bumpy and quite irregular (Figure 4a, 5) compared to a top coat or other sprayed coating, but flowed out on baking to give smooth films (Figure 4b). Unbaked films over substrates with high cratering tendencies were extremely rough and irregular with holes, bumps, and peculiar balloon-like bubbles (Figures 6a, 7). On baking, such a film flowed out to a considerable extent, but many pits and craters were left (Figures 2, 6b).

Experiments were carried out in which unbaked films were treated with solvent or ashed at 450°C, procedures which normally remove the coating. Microscopy showed that in some areas crater-like structures remained with collars of highly resistant material (Figure 8), presumably due to curing in the vicinity of the defect during deposition. Other investigators have seen similar behaviour<sup>2,4</sup>.

Many of the defects, particularly in unbaked films, showed signs of damage or disturbance at the center as might be expected from an electrical discharge (Figure 9). Some had beads of metal in this area as shown in Figure 10.

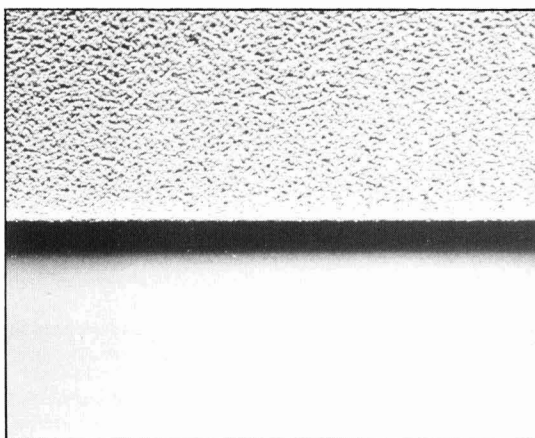


Figure 4. Unbaked (4a, top half) and baked (4b, bottom half) high build primer films over zinc phosphated cold rolled steel. Polaroid MP-4 photograph taken at 10X.



Figure 5. Higher power (100X) photograph of unbaked high build primer over zinc phosphated cold rolled steel. Typical rough and bumpy but fairly regular surface.

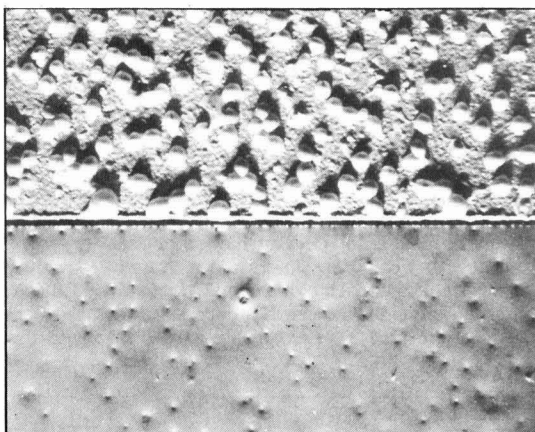


Figure 6. Unbaked (6a, top half) and baked (6b, bottom half) high build primer films over galvanneal zinc-iron alloy. Photograph taken at 10X.



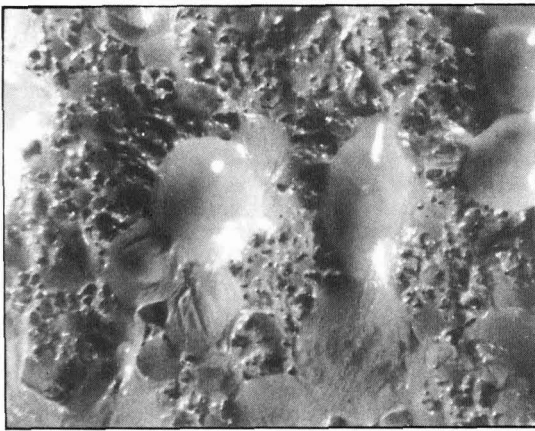


Figure 7. Higher power (50X) photograph of unbaked high build primer film over galvaneal zinc-iron alloy.

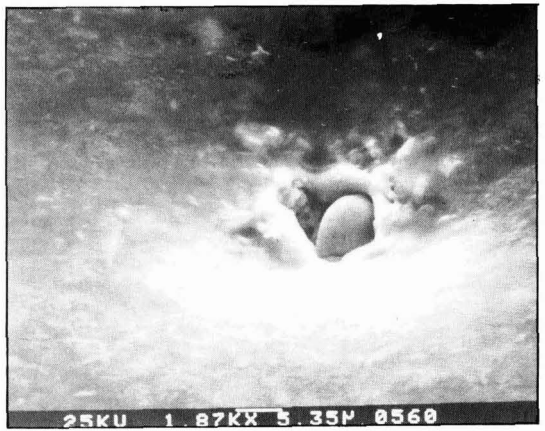


Figure 10. Bead of metal in the center of a crater in an unbaked conventional e.d. film. SEM photograph taken at 1870X.

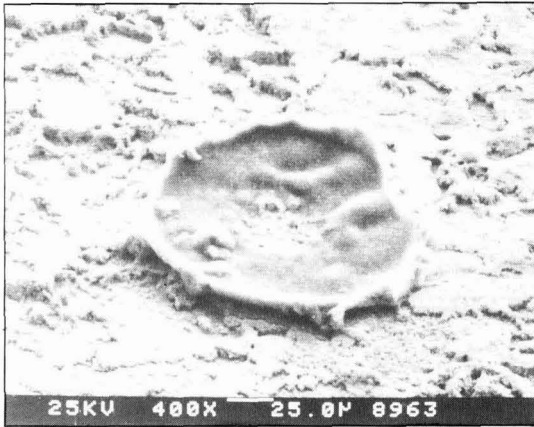


Figure 8. Crater region after ashing at high temperature. Note collar that remains after rest of coating is removed. Scanning electron microscope photograph at 400X.

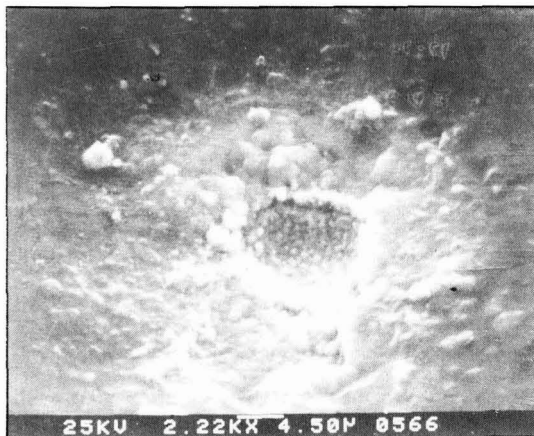


Figure 9. Scanning electron microscope photograph (2220X) of the center of a crater in an unbaked conventional e.d. primer film.

### 3. Observations of the baking process

Hot plate bakes showed that films over substrates with low cratering tendencies "melted" and flowed out in a matter of seconds. Films over problem substrates underwent all sorts of processes: some pits flowed out while others did not, some of the balloon-like bubbles broke and disappeared, others sank down into the film, still others remained partly or completely on the surface, but changed shape to give the volcano-like structures mentioned previously.

### 4. Surface analyses

Roughness measurements showed differences between the substrates with the zinc-iron alloys tending to be rougher than either hot-dipped or electrogalvanized substrates. Some of the zinc-iron alloy specimens were so rough that they would have been considered unacceptable for automotive use in the US, whereas some of the hot-dipped galvanized surfaces were exceptionally smooth. There were considerable variations within a given type of substrate, probably reflecting the different sources of the steel. Maximum peak-valley distances appeared to differentiate better between substrates than did the arithmetic average, the usual measure for roughness for automotive steel. The former is more indicative of the "spikeyness" of a surface. Values for some representative substrates are given in Table 4.

Solid surface tension measurements were carried out because an earlier paper<sup>1</sup> had indicated that the tendency to crater might be due partly to the inability of the coating to wet the surface, i.e. a function of the wettability of the surface. Differences were noted in the solid surface tensions and polar components of various substrates (Table 5) and these will be discussed in the next section.

### Discussion of Results

Early work<sup>1</sup> on cratering over galvanized steel concluded that craters were caused by gassing (hydrogen evolution) and this view is shared by most people in the electrodeposition area. For example, Japanese scientists speak of "gas pings" in describing the defects. However, more recent papers<sup>2,4</sup> concluded that the cause was

Table 4.

## Relationships between cratering and surface roughness

Metal	Roughness ( $\mu\text{m}$ )		High build coating Cratering	
	Average	Ten-point	Onset Voltage*	at 300V*
Cold-rolled steel	0.6-2.0	4.2-11.7	>340V	None
Zinc				
Zinc Sheet	0.2	2.2-2.9	>340	None
Hot-dipped galvanized	0.5-0.8	3.9-5.9	$\geq$ 340	None
ULTRASMMOOTH <sup>®</sup> HDG	0.7-0.8	4.5-5.2	>340	None
MONOGAL <sup>®</sup> 1 1/2 Galv. (HDG Side)	1.0	6.2	$\geq$ 340	None
Electro galvanized (Japan)	0.9-1.0	5.6-7.0	$\geq$ 340	None
Electro galvanized (Italy)	1.2	7.6	320	None
Zinc-Iron Alloys				
MONOGAL <sup>®</sup> 1 1/2 Galv. (Zn-Fe Side)	0.7	4.9	260	Low
A-40 Two Side Galvanneal	0.8-1.0	6.0-7.2	250	High
Galvanneal (from 1 1/2 Galv.)	1.3	7.8-10.0	230-250	High
Two Side Galvanneal (Japan)	1.3-1.5	8.9-10.9	230	High-V. High
Zinc-Nickel Alloys				
Uniform Appearance	1.0-1.2	5.0-7.5	>340	None
Non-Uniform	1.2	7.5	280	Mod.
Rough Alloy	1.8	11.8	>340	None

\*Data from roughness panels and those coated at same time only. May differ from data in other tables.

electrical discharge in the bath due to dielectric failure of the wet film. The authors of the present paper have seen evidence for both mechanisms and believe that they operate at the same time and both occur at points of high field strength (and, therefore, high current density) on the surfaces of substrates.

The evidence for gassing includes the observation on surfaces of coatings that show cratering of balloon-like structures that are very difficult to rinse off or otherwise remove. With crater producing substrates, the higher the voltage, the more and larger balloons (and the higher the number of craters). In addition, definite bubbling was observed during bakes of coatings over crater producing substrates. Sufficient hydrogen from the water electrolysis that occurs during deposition could be trapped in the coating and, possibly, in the zinc and/or zinc phosphate layers to produce a number of defects.

The evidence for electrical discharge includes flashes of light seen during deposition of unpigmented coatings and highly cured regions (as shown by solvent and ashing resistance) circling some of the craters. The high temperature of an electric spark would be sufficient to cure the film and such cure would explain both the lack of flowout of the defects on baking and the inability of the bath to coat over the pits. The occurrence of high temperature electrical discharges also could explain the beads of metal (zinc and/or iron) sometimes seen at the bottoms of craters (Figure 10).

Table 5.

## Solid surface tensions and polar/non-polar components of various surfaces

Substrate	Solid surface Tension $\gamma_s$	Non Polar Components	Polar Components
Zinc Phosphated Cold-Rolled Steel	42.3 Dynes/cm	34.9 Dynes/cm	7.4 Dynes/cm
Galvanized Steel	45.7	36.1	9.6
Galvanneal Zinc-Iron Alloy Coated Steel	53.2	36.1	17.1
Air-Dried High Build E. D. Coating	53.2	33.5	19.7

Results for metals are mean values from measurements on 4-6 specimens each, from different sources. Some galvanized and galvanneal specimens were pretreated, others were not. Surface tensions appeared to be independent of pretreatment.

In order to answer the question of how these sparks occur, it is necessary to consider the surface of the metal substrate. Regardless of how smooth it looks, the metal is quite rough on a microscopic or sub-microscopic basis and has a number of peaks or spikes. In the electrodeposition bath there will be high field strengths at these spikes. The hypothesis is that these spikes act as lightning rods and discharge occurs in the same manner as lightning striking a lightning rod. In addition to metal surfaces being rough, there are indications in the literature<sup>4</sup> that, with alloys, conductivity varies across the surface. High conductivity spots would be even more apt to act as lightning rods.

With regard to the effect of surface roughness on cratering, early results pointed to a correlation between roughness and cratering tendency within a given type of zinc coated steel. Later results (Table 4) do not support this strongly, but there is a trend towards somewhat high threshold voltages (by 10-30V) and/or fewer craters with smoother substrates. The authors believe that the chemistry and homogeneity of the surface are more important than the degree of roughness. In fact, roughness may well be a function of these rather than being an independent property.

Solid surface tension results (Table 5) show differences between cold-rolled steel, galvanized, and galvanneal, but the crater-causing galvanneal surface should be more easily wet (has a higher solid surface tension) than the others. The galvanneal surface also gives the best match with the surface of an air-dried high build electrodeposition coating. (The latter material should be fairly representative of the coagulated layer at the coating-substrate interface). Beyond this, microscopic examination showed that the craters do not look like the type caused by wetting problems. Therefore, surface tension effects can be ruled out as a cause of the pits and craters.

In the field, the defects have been associated with high degrees of AC ripple, the alternating component of direct current. A rectifier produces direct current, but it is a

pulsating current because the AC current that is rectified (made to flow in one direction) is pulsating. Through the use of the correct rectifier and/or capacitor/choke combination, low-ripple (small voltage variation) DC can be produced, but many of the older single phase rectifiers give very high voltage peaks, greater than 400V in some cases. The high voltage and its cyclic nature both contribute to dielectric failure. In general, experience in the field has been that the greater the ripple, the worse the cratering, and modification or replacement of rectifiers has solved even severe cratering problems. A recent paper<sup>8</sup> has confirmed ripple with high voltage peaks as a cause of cratering.

There is a strong probability that the two mechanisms for cratering are manifestations of the same electrochemical process, a form of the phenomenon called rupture. Certainly, the gassing, the appearance of many of the defects, the growling and crackling sound that accompanies their formation, the off-scale currents and unstable voltages at the beginning of depositions on crater-producing substrates (see Figure 11) all suggest rupture.

As pointed out in the results section, zinc-iron alloys have a greater tendency to cause cratering than do zinc or iron surfaces. This would seem unfortunate for the auto industry as their manufacturing people like the weldability, paint adhesion, and corrosion resistance of zinc-iron alloys<sup>9</sup>. However, defect-free films over these substrates can be produced through use of high build primer and control of voltage and AC ripple. In fact, excellent results currently are being obtained under such conditions with vehicles built mainly of 1 1/2 side galvanized, the exterior surface of which is galvanneal-type zinc-iron alloy.

It should be pointed out that all the zinc-iron alloys discussed so far have been high zinc, low iron (~85/15 Zn/Fe). High iron alloys ( $\geq 60$  per cent Fe) supposedly do not give craters and have been advocated as topcoats for normal zinc-iron alloys<sup>10</sup>. However, in this work depositions have been carried out (all at 300V) over high-iron alloys, including a number of panels of one specific type, and have shown considerable variation in the degree of cratering ranging from none to severe. It is possible that localized high zinc regions in the other wise high iron surfaces cause the cratering. The high zinc regions could have been on the surface originally or could have appeared due to breakthrough at thin spots by cleaning, pretreating, or the electrodeposition process itself.

With thin coatings of high iron alloys over normal zinc-iron alloys, there is a concern that sanding of burrs, scratches, and other metal defects during automobile manufacture will cut down into the underlying crater-producing alloy giving rings or spots of craters. The authors found that sanded panels of one of the high iron alloy/high zinc alloy combinations gave severe cratering.

Zinc-nickel alloys are being considered as alternatives to zinc-iron alloys and Japanese experience has indicated that the zinc-nickel combination is less apt to cause cratering. However, recent US work<sup>11</sup> would indicate that the improvement is only slight. We only have examined three zinc-nickel alloy coated steels so far. The conclusion is that there is less cratering tendency over zinc-nickel than over zinc-iron as long as the zinc-nickel alloy does not contain iron as well. However, one zinc-nickel alloy did show cratering at relatively low voltages. Unlike the other zinc-nickel alloys, this one had spangle-like spots over much of

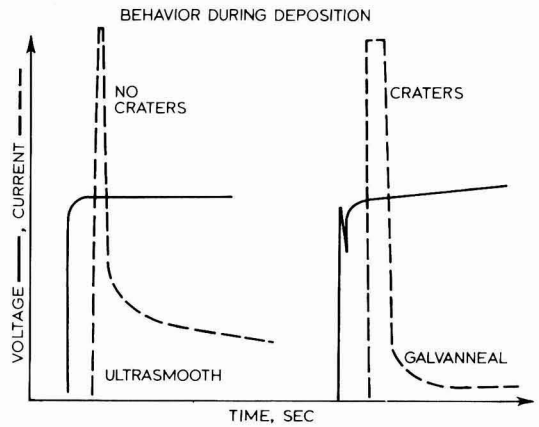


Figure 11. Generalized voltage-time, current-time plots for depositions of high build primer at 300V over noncratering (11a) and cratering (11b) substrates.

the surface. The crater pattern followed the pattern of spots quite closely and areas without the spots gave little or no cratering. This greater incidence of cratering with increased heterogeneity fits in with one view<sup>4</sup> that a major reason for the excessive cratering of certain alloys is the non-uniform composition of their surfaces and the resultant variations in surface conductivity.

## Conclusions

Zinc coated steels can present problems for conventional cationic electrodeposition primers, but the new high build coatings (UNI-PRIME) produce defect-free films over a variety of zinc coated steels, particularly electrogalvanized and smooth hot-dipped galvanized steels, and, with control of voltage and AC ripple spikes, over zinc-iron alloys as well.

When defects occur they are caused by gassing and electrical discharge (dielectric failure of the wet film) in the bath. The electrical discharge is thought to involve peaks or spikes on the metal surface much in the same manner as lightning strikes lightning rods. The exact mechanism of this process, the gassing, and the reason why zinc-iron alloys are more prone to produce craters than other surfaces are not yet known and will be the object of future work.

## Acknowledgements

The authors would like to dedicate this paper to the memory of the late Fred Loop who was instrumental in the initiation of this work and provided considerable help and encouragement along the way. Thanks go to Ed Cowan for scanning microscope and EDX work, several important experiments, and stimulating discussions. The experimental efforts of Zorita Fisher, Kim Wilson and Elaine Winwood also are appreciated.

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## References

1. Froman, G. W., and Franks, L. L., "Technological Impact of Surfaces: Relationship to Forming, Welding, and Painting", *American Society for Metals, Metals Park, Ohio*, 1981, 315.

2. Hart, R. G., and Townsend, H. E., Soc. Automot. Eng. Paper No. 831818, P-136 (Proc. Automot. Corros. Prev. Conf., 2nd, 1983), 89.
3. Cerisola, G., Braggio, E., Bonora, P. L., and Sibille, E, in Parfitt, G. D., and Patsis, A. V., (eds.) "Organic Coatings Science and Technology", Vol. 7, Marcel Dekker, New York, 1984, 265.
4. Kitayama, M., Azami, T., Miura, N., and Ogasawara, T., *Trans. Iron Steel Inst., Japan*, 1984, **24**, 742.
5. Schoff, C. K., and Pierce, P. E., in Parfitt, G. D., and Patsis, A. V., (eds) "Organic Coatings and Science and Technology", Vol. 7, Marcel Dekker, New York, 1984, 173.
6. Owens, D. K., and Wendt, R. C., *J. Appl. Polym. Sci.*, 1969, **13**, 1741.
7. D. H. Kaelble, *J. Adhesion*, 1970, **2**, 66.
8. Hart, R. G., Soc. Automot. Eng. Paper No. 850237, SP612, "Corrosion Protection, Resistance and Testing", 1985, 61.
9. "Zinc Coated Sheet Steel: An Overview", *Automotive Engr.*, 1984, **92** (12), 39.
10. Miura, N., Saito, T., Kanamaru, T., Shindo, Y., and Kitazawa, Y., *Trans. Iron Steel Inst. Japan*, 1983, **23**, 913.
11. Coon, C. L., and Vincent, J., Soc. Automot. Eng. Paper No. 850466, SP612, "Corrosion Protection, Resistance and Testing", 1985, 75.

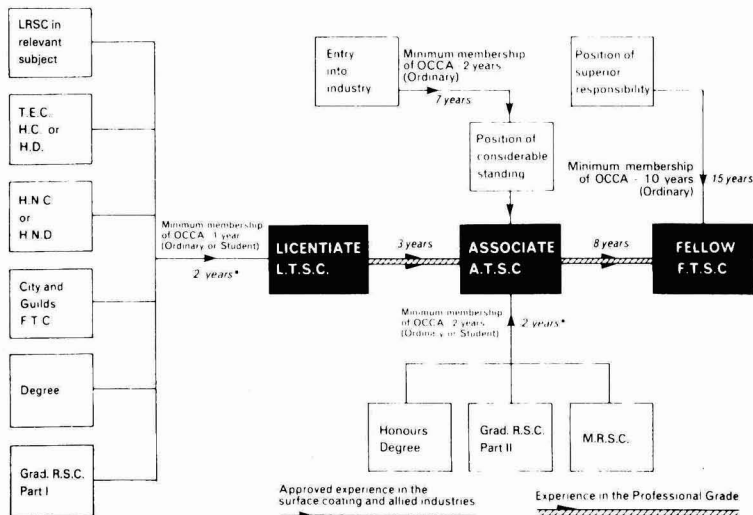
## next month's issue

The Honorary Editor has accepted the following papers for publication in the August issue:

**Progress in timber finishing in Great Britain** by E. A. Hilditch and R. J. Woodbridge  
**The role of adhesion in corrosion protection by organic coatings** by W. Funke  
**New developments in selfpolishing antifoulings** by C. M. Sghibartz

Discussions arising from some of the papers given at the Edinburgh Conference together with comments by the lecturer(s) will be appearing in the September and subsequent issues.

# Professional Grading in the Technology of Surface Coatings



Ordinary Members of OCCA are invited to apply for the "Optional Professional Grade" at Licentiate (LTSC\*), Associate (ATSC\*) or Fellowship (FTSC\*) level. A schematic representation of the regulations is shown on the left. Successful candidates will be allowed to use the designatory letters shown in brackets above, which will identify their professional status in the industry.

Anyone wishing a complete set of regulations and application form should either write to the Association's Offices or complete the Reader Enquiry Service form (printed at the back of the *Journal*) entering number 304 and stating which grade they are interested in.

\*LTSC: Licentiate (of OCCA) in the Technology of Surface Coatings. ATSC: Associate (of OCCA) in the Technology of Surface Coatings. FTSC: Fellow (of OCCA) in the Technology of Surface Coatings.

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# Oxo-acetates—new solvents for high solid paint formulations

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## Synopsis

The use of high solids coatings, which is already established to some extent in the US, will spread to Europe and the rest of the world, either in response to environmental legislation and concerns, or as these coatings show cost/performance benefits over traditional, lower solids paints.

High solids coatings need powerful, less volatile solvents than those used in traditional paints. Unfortunately, few commercial solvents meet these requirements, and some of those that do are suspect with respect to toxicity.

Oxoacetates, recently introduced to the US market under the trade name "Exxate", overcome most of these difficulties. The Exxate grades give advantages in the manufacture, formulation and application of coatings based on a range of resins.

## Introduction

The proper selection of solvents is becoming essential as the coatings industry is striving to formulate higher quality products, reduce costs and provide better worker protection.

Regulations such as the Clean Air Act, which limits the volatile organic compound emissions, are creating a need for coatings with higher solids contents, and methods to apply the coating with improved transfer efficiency.

A series of high boiling aliphatic esters was designed to exhibit the higher solvency of oxygenated materials while retaining desirable hydrocarbon solvent properties. Customer testing, and our own laboratory evaluations, confirm that these products (introduced under the trade name "Exxate"), provide a unique combination of very important performance characteristics in one molecule.

This paper describes some of our results obtained with hexyl-acetates (Exxate 600) and heptyl-acetates (Exxate 700).

## Improved molecular weight distribution control for high solids acrylic resins

In solution polymerisation, molecular weight control can be affected by temperature of polymerisation as well as the chain-transfer characteristics of the solvent. (Note: Chain transfer describes the ability of a solvent to limit the molecular weight of a growing polymer by removing the free-radical growth site from a polymerising molecule and using it to initiate a new chain.)

For high-solids (>65 per cent) coating applications, it is desirable to utilise resins having low molecular weight and narrow molecular weight distribution (i.e., low Mw/Mn) with increased cross-linking capability in order to achieve workable spray viscosities.

Exxate 700 gives lower molecular weights and narrower

Table 1.

## Low viscosity acrylic resins made in Exxate solvents

Polymerisation Solvent	Exxate 600	Methyl Amyl Ketone	Primary Amyl Acetate	Methoxy propyl Acetate	Exxate 700
Resins Solids %	68.8	69.2	68.2	68.7	68.3
Polymerisation Temperature, °C (Solvent Boiling Range, °C)	162 (164-176)	147 (150)	145 (146)	144 (150)	168 (189-202)
Viscosity, cSt at 25°C	2460	2360	4430	6200	1970
Mw (wt avg molecular wt)	5310	5250	10690	7790	3860
Mn (Nr avg molecular wt)	1590	1640	2500	1590	1310
Mw/Mn (*)	3.3	3.2	4.2	4.9	2.9

(\*) This ratio is a measure of the molecular weight distribution. Lower ratios signify narrower molecular weight distribution, (and hence lower viscosity for the same molecular weight).

molecular weight distribution than other commercial solvents tested, when used with high temperature initiators. Polymer synthesised in this manner exhibited higher coating gloss and durability.

Higher polymerisation temperatures, as utilized with the Exxate solvents are not feasible with primary amyl acetate or methoxypropyl acetate without pressure equipment, due to their lower boiling points. As a result, the resins polymerised in those solvents have undesirably high molecular weights, wide molecular weight distributions, and high solution viscosities. (Details in Table 1).

To produce low molecular weight resins with even narrower molecular weight distribution, (see Table 2) initiators having higher one-hour half-life temperatures can be used: 135°C instead of 125°C as for t-butylbenzoate.

If lower polymerisation temperatures are preferred, the desired narrow molecular weight distribution can be achieved by using the Exxate solvent in conjunction with an aromatic hydrocarbon solvent, such as Solvesso 100, which also acts as a chain-transfer agent. (See Table 3).

## Superior film properties from resins polymerised in Exxate solvents

When Exxate solvents are used instead of methyl amyl

Table 2.

*Exxate solvents achieve superior molecular weight control in acrylic polymerisation with higher one-hour half-life initiators*

Polymerisation Solvent	Exxate 600	Exxate 600	Exxate 700
Resin Solids (Wt%)	67.8	66.3	65.8
Polymerisation Temp. °C	161	161	169
Resin Viscosity (cSt at 25°C)	1,706	1,449	698
Mw	4,861	4,534	3,278
Mw/Mn	2.3	2.7	1.9
Initiator	Lupersol (a) 233-M-75	Luperox (b) 500 R	Luperox (b) 500 R
(a) Pennwalt peroxyketal.		(one-hour half-life temperature: 135°C)	
(b) Pennwalt dicumyl peroxide.			

Table 3.

*Molecular weight distribution control using Exxate 600 with aromatic hydrocarbon solvent*

Polymerisation Solvent	100% Exxate 600	100% Exxate 600	70% Exxate 600 30% Solvesso 100
Polymerisation Temperature, °C	162	150	150
Resin Solids, Wt. %	68.8	68.8	69.5
Resin Viscosity (cSt at 25°C)	2460	4179	3850
Mw	5310	7283	5790
Mn	1587	1583	1700
Mw/Mn	3.3	4.6	3.4

Table 4.

*Effects of Polymerisation/Formulation Solvent on Film properties of Electrostatically-Sprayed, High Solids Acrylic Coatings*

● Solvent type:			
- Polymerisation	MAK	MAK	Exxate 600
- Reducing	MAK	Exxate 600	Exxate 600
● Film properties (a)			
- gloss at viewing angle, %			
20°	59	70	74
60°	87	88	91
- direct impact, inch-lbs	50	142	168
- color (of clear coat), Pt-Co	150	100	40
- pencil hardness	2H	2H	2H

(a) Metal panels sprayed with high speed turbobell (Ransburg) electrostatic spraygun at 28,000 rpm. Sprayed film thickness: 25 to 30 micron.

ketone (MAK), a marked improvement in gloss, impact strength and colour (of clear coat) can be achieved (see Table 4). The improvements are even more evident when the Exxate solvent is used as both the polymerisation solvent and the reducing solvent. In addition, the formulations including Exxate solvents have higher electrical resistivity which provides improved electro-spray application efficiency than obtainable with formulations based on MAK.

### Improved efficiency in electrostatically-sprayed applications

Exxate solvents have unusually high electrical resistivity for oxygenated solvents. This property helps to provide significant improvement in transfer efficiency in both metallic and non-metallic coatings, and improved "wrap-around" for greater film uniformity and better coverage.

Using MAK as a polymerisation solvent yields polymers with commercially acceptable low molecular weight and narrow molecular weight distribution. However, electrical resistivities of the resin solutions and paint formulations are quite low, resulting in less than optimum electrostatic spray performance. Using Exxate solvents, on the other hand, produces resins with similar or better molecular weights and solution viscosities, plus high electrical resistivity for good electro-spray performance.

Electrical resistivity affects the atomization characteristics of a paint during application, as well as its "wrap-around" properties and transfer efficiency when applied to an object. Maximum transfer efficiency for an electro-spray coating requires its resistivity and spraying conditions to be optimized for the spray gun and target system used. In many cases, a resistivity of 0.6-1.0 megohm is recommended. Acetates as a class have the highest resistivity among oxygenated solvents, and compare well with lower solvency hydrocarbon solvents. (See Table 5).

Table 5.

*Electrical resistivity of typical coating solvents (Ransburg Megohms)*

n-Butyl Alcohol	<0.2
MIBK (methyl-isobutyl ketone)	0.5
MAK (methyl amyl ketone)	0.3
EEac (Ethoxyethylacetate)	4.0
n-Butyl Acetate	18
Exxate Solvents	20+
Hydrocarbons	20+

Starting with electrical resistivities significantly higher than the widely recommended and traditionally accepted range of 0.6-1.0 megohm enables the formulator to use higher concentrations of polar additives such as alcohols to promote viscosity stability, or catalysts to permit lower cure temperatures. Although such polar additives will reduce the final resistivity, when an Exxate Solvent is used the final coating can maintain its resistivity in the optimum range, and thus achieve improved transfer efficiency. In the example below (Table 6), the desired resistivity could not be achieved with MAK, even with minimum catalyst levels but with Exxate 600, no difficulty occurs.

Table 6.

Effect of solvent type and catalyst concentration on resistivity

Polymerisation Solvent	Ransburg Megohms of Formulated Coating	
	Exxate 600	MAK
Catalyst (*), wt. %		
0.5	1.9	0.12
1.0	0.73	0.04

(\*) Mallinckrodt BYK-451.

Table 7.

Effect of tail solvent on transfer efficiency

Tail Solvent	MAK	Exxate 600
Non-Metallic Auto OEM Coatings		
Resistivity, Ransburg MΩ	0.18	0.70
Transfer Efficiency, %	83	94
Metallic Auto OEM Coatings		
Resistivity, Ransburg MΩ	0.07	0.31
Transfer Efficiency, %	73	83

Use of Exxate 600 in place of MAK can provide a significant improvement in transfer efficiency for both non-metallic and metallic coatings. In the example below, two sets of coatings were prepared. For each set, one was cut with MAK, and the other with Exxate 600. In statistically-designed spray tests using aluminium "broomsticks", the use of Exxate 600 increased electrical resistivity four-fold, and transfer efficiency by 10 per cent, over the values obtained with MAK (see Table 7). This improvement is especially important with metallic coatings, where the inherent lower resistivities can interfere with electro-spray application efficiency.

To achieve a uniform film and minimize feathering on all surfaces being spray-coated, the paint spray must be applied with a relatively narrow cone diameter, and must have good "wrap-around" characteristics. Coatings made with Exxate solvents provide a more uniform film coverage with less feathering and waste than those made with MAK. In addition, the average thickness of the applied film is significantly greater. (See Table 8).

Improved wrap-around characteristics were demonstrated in the previously described "broomstick" tests. In these tests, the reverse side of the samples electrostatically-sprayed with a coating made with Exxate solvent had 30% more coverage than those coated with MAK systems. Coverage on the front of the broomsticks was essentially the same for both cases while feathering was significantly reduced in the Exxate solvent system. (See Table 9).

Table 8.

Effect of tail solvent on paint cone diameter and film thickness

Tail Solvent	Exxate 600	MAK
Distance from gun to target, (m)	0.34	0.34
Resistivity, Ransburg Megohms	1.8	0.10
Spray cone diameter, (m)	0.66	0.80
Diameter of continuous film, (m)	0.55	0.57
Average thickness, (micron)	30	22

Table 9.

Wrap-around benefits with Exxate solvent in electrostatic spray coating

Tail Solvent	MAK	Exxate 600
Height of continuous film, M		
Front	0.58	0.58
Rear	0.33	0.43
Height of feathered film, M		
Front	0.15	0.05
Rear	0.41	0.25

#### Performance benefits in nitrocellulose and moisture-cured polyurethane systems

As active tail solvents with very low water miscibility, Exxate solvents offer the formulator of moisture-sensitive coatings and various air-dry coatings an additional set of benefits versus commonly used glycol ether acetates or high boiling ketones.

#### Fast solvent release from coatings

The "neat" (i.e., pure solvent: no resin) solvent evaporation rate of Exxate 600 is similar to that of ethoxyethyl acetate, and is considerably slower than that of methoxypropyl acetate or MAK. It is for this reason, plus its good solvency, that Exxate 600 functions so effectively as a tail solvent. When an even slower-evaporating tail solvent is needed, Exxate 700 is recommended.

Although methoxypropyl acetate evaporates twice as fast as Exxate 600, it is retained at significantly higher concentrations and for longer times in nitrocellulose and acrylic lacquers, and in two-component polyurethane coatings. Exxate 600 although slightly less volatile than ethoxyethyl acetate, escapes from these films at the same, or faster, rates as shown in Figure 1. The quicker solvent release from air-dry coatings achieved with Exxate 600 can shorten production time by reducing tack-free time.

#### Polyurethane coatings

For moisture-sensitive systems such as polyurethanes, the shelf life can be extended by using Exxate solvents because of the low initial water content (0.05 per cent max.), and

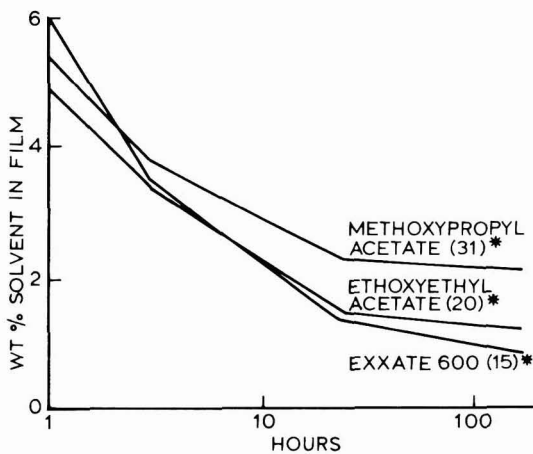


Figure 1. Solvent retention in polyester-isocyanate coating.\*  
Evaporation rates neat solvent (n-ButylAcetate=100)

Table 10.

Percentage moisture pick-up comparison at 24°C and relative humidity of 85 per cent

Time (Days)	Exxate 600	Exxate 700	Ethoxyethyl Acetate	Methoxypropyl Acetate
0	0.04	0.04	0.09	0.09
1	0.45	0.34	2.07	1.83
3	0.49	0.44	3.40	3.05
7	0.56	0.52	4.54	3.95
Solubility of water in solvent (%wt)				
	0.66	0.58	6.5	5.6

very high resistance to additional moisture pickup. (See Table 10). The rate of moisture pickup, which is proportional to the solubility of water in the solvent, also improves the pot life of polyurethanes.

### Nitrocellulose coatings

Nitrocellulose lacquers require a tail solvent which provides good flowout and blush resistance under conditions of high humidity, and short tack-free time. Exxate 600 outperforms ethoxyethylacetate in these important properties. For example, blush resistance and tack-free time were compared in a premium lacquer prepared, in one case with Exxate 600 and, in another with ethoxyethylacetate. (See Table 11 for data with metal panels and Figure 2 for nitrocellulose furniture lacquers). Under conditions of high humidity (70-85 per cent relative humidity), Exxate 600 based lacquers dried considerably faster, and with less tendency to blush. Even under normal humidity conditions, Exxate 600 systems dried 15-30 per cent faster than ethoxyethylacetate lacquers. This can reduce production time and allow products to be packaged and shipped more quickly than is possible with ethoxyethylacetate systems.

The tack-free time of a coating is dependent upon both

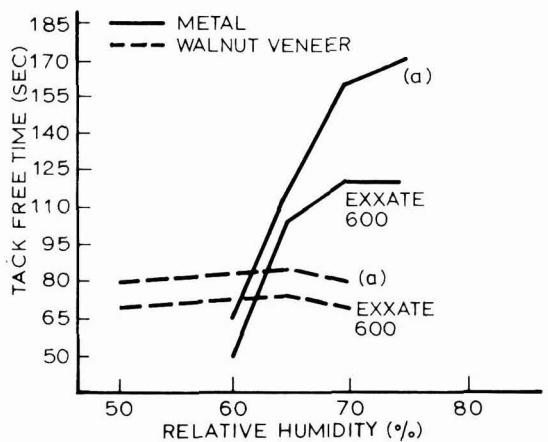


Figure 2. Exxate 600 shortens tack-free time of nitrocellulose. [(a) = Ethoxyethylacetate.]

Table 11.

Effect of tail solvent and relative humidity on tack-free time

Blush Resistance and Tack-Free Time (in seconds)*		
Relative Humidity (%)	Exxate 600	Ethoxyethylacetate
85	Sl. Blush	Blush
80	180	Blush
75	120	170
70	120	160
65	100	116
60	50	65

\* Metal panels, average of 4 runs each.

the rate of diffusion of solvent from the film and on the relative evaporation rate of the "neat" solvent. Here also Exxate 600 offers a significant advantage to the nitrocellulose formulator, by providing an effective tail solvent which also diffuses more readily from the applied film than would be predicted from "neat" solvent evaporation rate data alone.

### Conclusions

Exxate solvents provide a number of outstanding properties which enable these new solvents to outperform many ketones, glycolether acetates and other acetates in high performance coatings applications. Their properties will prove increasingly attractive as technological changes and environmental concerns increase the market's needs for higher solids and advanced resin systems.

### Acknowledgments

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# Plastics as a painting substrate

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## Summary

A common idea is that the main problem with coating of plastics is adhesion. The adhesion is controlled by purely chemical conditions such as intermolecular electromagnetic interaction between polar groups in the paint and in the substrate. Change in solvent composition does not normally affect the adhesion.

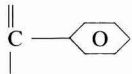
Plastic materials must be looked upon as a "living material" where the chemical composition of the surface is unknown. Except for the compound formula, moulding conditions and gate design strongly affect the surface composition. In addition to that migration of additives and other low molecular materials may affect the surface with time.

The paint manufacturers need more well-defined surfaces for their coating development in order to achieve high quality of the surface treatment. IR spectrophotometry and extraction tests are two useful methods discussed in the paper.

## Adhesion to polymer substrates

If someone working with painting or printing of plastics is asked which is the biggest problem in the process, the most common answer will be adhesion. A very common misunderstanding is that bad adhesion can be solved by using solvents that are more aggressive to the substrate. With the exception of thermosetting polymers, where release agents are used, this is not true.

The adhesion between the paint and the substrate depends on an electromagnetic interaction between polar groups in the molecules in the two materials. The very weak dipole is formed by the carbon and the benzene ring in polystyrene and this gives the polymer a low surface tension and makes it a difficult material to get good adhesion. In fact it is the most difficult material to paint in the group of "paintable plastic materials".



The surface tension of a plastic material is also a function of polar, dispersion and hydrogen bonds, where dispersion bonds are very weak and give a low surface tension. In Figure 1, there is a logarithm scale of surface tension for some different substrates and liquids. The surface tension of the substrate is measured as the critical surface tension where the liquid of a known surface tension is wetting the substrate corresponding to the rule when  $\gamma_l \leq \gamma_s$  (surface tension of the liquid is lower or equal to the surface tension of the substrate). The liquid will wet the substrate.

If it is supposed that a condition for good adhesion between the paint and the substrate is that their surface tensions do not deviate too much from each other. Then this provides one answer as to why trying to paint plastics with paints made for wood or metal, so often fails. In Figure 2 the adhesion<sup>1</sup> has been measured for a few paints on plastic substrates with different surface tension, and it can be seen that there seems to be a correlation. This is a

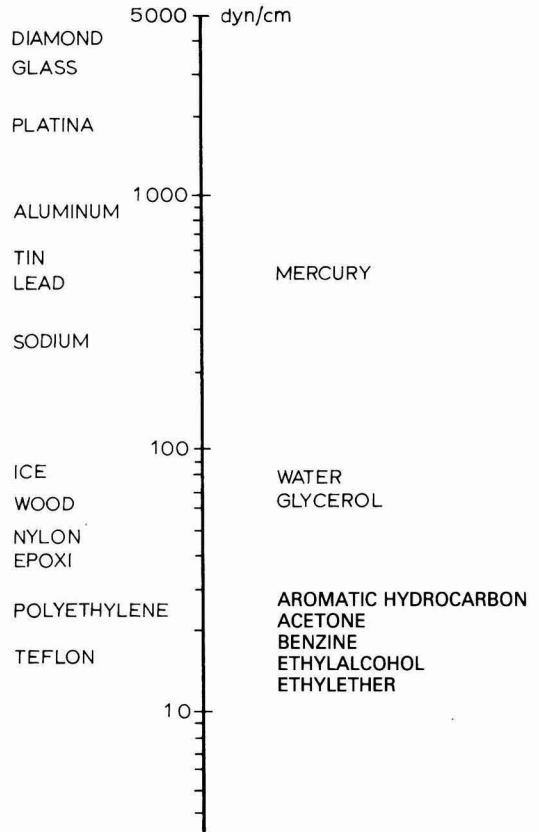


Figure 1. Surface tension of solid and liquid materials.

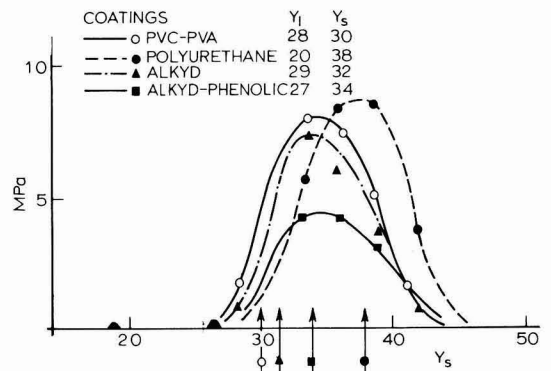


Figure 2. Adhesion for four topcoats as a function of the surface tension of the substrate.

helpful rule to predict adhesion over paint to different substrates. However, it must be said that measuring surface tensions of plastic substrates is not a very easy operation, when it depends on so many things as evaporation and absorption of solvents, surface roughness etc.

The conclusion is that the adhesion to the plastic substrate depends mainly on pure chemical connections and not on solvent attack on the substrate or surface roughness. As mentioned earlier there is one exception, the thermosetting materials where release agents are being used. In these cases a change in solvent blend may affect the adhesion. The most commonly used example is polyurethanes where polypropylene waxes often are used as release agents. Very often an increase in adhesion can be measured when NMP is added to the paint. How the solvent works in this case is hard to say, but it certainly affects the release agents so there will be more free "clean" surfaces for the paint to adhere.

### Moulding experiences

Most people who have been involved in painting plastic materials have sooner or later come across the problem of bad adhesion in local areas. This should not however, be a source of disappointment because most thermoplastics are still not cleaned before painting, and the cleaning process for thermosetting materials is by far as well defined and accurate as the corresponding process for steel. The most realistic assumption about the substrate is: *the only thing we know is that we don't know what we are painting upon.*

Figure 3, shows a spoiler made of modified PP. This spoiler was moulded at different injection speeds and different temperatures. The day after all the spoilers were painted on the same line with the same paint one after the other. The adhesion was measured with the "one mm crosshatch" plus tape in 14 different spots. The number of squares that were taken away were counted. It can be seen that there were areas where the adhesion was always good and areas where it always failed. It can also be seen the total number of squares that were taken away by the test depended on the injection speed and the temperature of the material. If the adhesion changed over the surface it can be assumed that the composition of the material varied over the surface.

If this problem is studied in greater depth it may be first stated that the modified PP consists mainly of a PP phase (homo- or copolymer) and a rubber phase (very often some sort of EPDM) as well as some PE, UV- and thermostabilizers. The rubber and the PP phase are not compatible and the rubber is distributed in the PP phase in small particles. Figure 4 shows the section of a gate to a mould. The floating front is proceeding at constant velocity, but within the front the velocity varies in radial direction from maximum to zero at the wall of the gate. Under unfavourable circumstances with a small area of the gate and a high injection pressure an assumption is that the gate will separate the different components in such a way that those with low viscosity at the existing temperature will proceed faster through the gate and concentrate on the surface of the floating front. It can be expected to find low molecular parts of PP, and PE that has been added as a Master batch or to improve moulding properties. The distribution of stabilizers as well as the ratio between PP and rubber will also change due to the situations of narrow passages.

### Percentage Loss in adhesion.

Spoiler No.		1	2	3	4	5	6	7	8	9	10	11	12	S
1	Normal	1	1	3	5	4	0	5	3	8	3	2	0	35
2	272° Fast	1	1	1	3	4	0	1	0	5	6	1	1	24
3	Slow	2	3	0	2	2	0	3	0	2	2	2	0	18
4	Normal	0	4	0	0	5	0	0	1	3	3	1	0	17
5	291° Fast	0	1	0	1	4	0	0	1	1	0	0	0	8
6	Slow	0	0	0	1	2	0	0	0	1	0	0	0	4
7	Normal	5	2	1	2	3	0	3	1	3	0	3	1	24
8	248° Slow	0	2	1	2	1	0	2	0	0	0	4	0	12

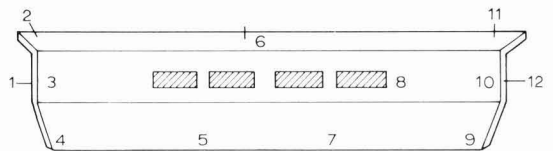


Figure 3. Per cent loss in adhesion.

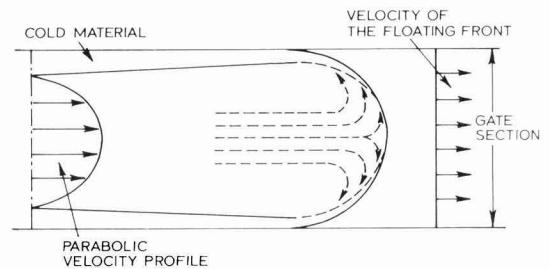


Figure 4.

The narrow gate will increase the speed gradient and increase temperature due to friction. The components found on the surface of the floating front will be found on the surface of the mould where they will be cooled down quickly and stay amorphous.

On the surface of the moulding a thin skin was found (Figure 5) of low molecular and amorphous components with a composition that varied from the main formula and may vary over the total surface. This skin is not very attractive to paint due to low molecular composition and the amorphous phase. Even if it is possible to get a good adhesion to the surface there may be a drop in cohesion in the thin skin of the moulding when the adhesion is tested.

To avoid this it is very important to work with big gates when mouldings are to be painted. The large total area of the gates will at a certain feed time reduce the velocity at the gates and minimize the separation. However, the most important thing is to know how to formulate a plastic compound. Very small additives may affect adhesion dramatically.

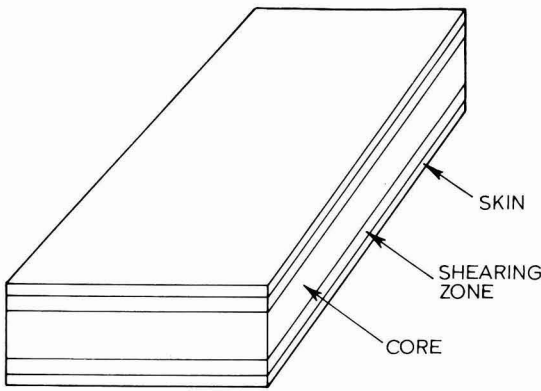


Figure 5.

A weak point is that most customers today do not specify the materials according to paintability but only to mechanical properties.

The reason for that is of course that it is not easily done. If however it is stated that the main components must be paintable separately and that the additives being used must be strictly controlled and specified this will improve the situation.

What has been said here is valid for many polymer blends as for example modified polycarbonate and modified polyesters. The PP blend is however the most difficult one due to the poor paintability of PP.

As polymer materials are not usually one component materials the surface composition may vary with the time. Migrations (Figure 6) of components due to variations in chemical conformation are not unusual and may lead to discoloration or drop in adhesion with time. A common example is the plasticizer in PVC that can completely destroy the good paint result, but many stabilizers and additives for plastics act in the same way.

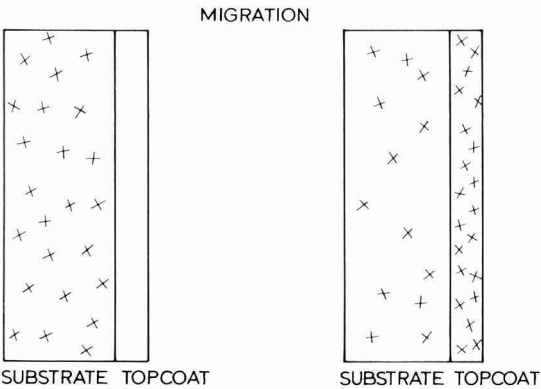


Figure 6. Migration.

group of materials and cannot be looked upon as one substrate. The low profile qualities are blends with thermoplasts and the surface composition varies a lot. Therefore paints must be designed and tested on the specific SMC composition.

### Analytical methods

A paint manufacturer is interested in the surface composition and the possible migration of ingredients in the plastic to its surface for migration. These problems are often overlooked by the compounders of the plastic.

In this paper only a method to study a surface of modified PP will be discussed.

Figure 7, shows equipment for multiple reflecting infra-red spectrophotometry. The polymer to be studied is pressed to each side of the crystal. The method measures the composition to depth of about 10-15 microns. Figure 8 shows such a diagram of TPR samples.

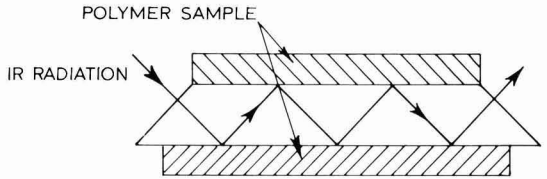


Figure 7.

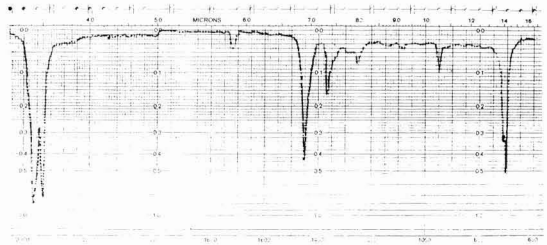


Figure 8.

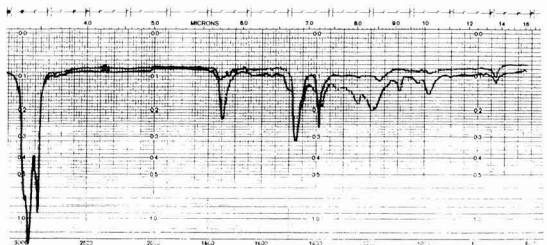


Figure 9.

If the infrared trace for every component in the material are known this method can be very useful to study how the moulding process affects the surface composition. Small

SMC (Sheet Moulding Compounds), are a non-uniform

samples at different areas of the moulding can be removed and analysed in the above mentioned process.

In combination with this an extraction test can be performed. A few grams of the substrate are added to a mixture of solvents of different polarity and kept at 40°C for four days. Solvents are evaporated and the rest are examined with IR and weighed. Figure 9 shows an infrared trace of the components extracted from two different samples of the same plastic. If the adhesion and coating properties of one material has been satisfactory then the

infrared trace can be used as a standard for the quality control of future batches.

[Received 22 February 1985

## References

1. *Painting on Plastics*. Bengt Lindberg.

NIF nr: P 37 Scandinavian Painting and Printing Ink Research Institute.

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# occa meetings

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## Midlands Section

### Genealogy

The final lecture this session of the Midlands Section was held on Thursday, 16 May 1985 at the Clarendon Suite, Stirling Road, Edgbaston, Birmingham.

Members, guests and their ladies' heard Mr Corwyn Vale give a talk on "Genealogy".

The speaker said that very few people know their ancestry back further than their great grandparents. The biggest problem is where to start. For anyone interested in tracing their family tree the speaker gave the following list of useful sources of information!

#### 1. Oral Tradition

This information is handed down from relatives or maybe the family Bible. Friends neighbours or local newspapers can also be useful.

#### 2. Census Forms

These have been taken every ten years since 1801. Those between 1801 and 1831 have been mostly destroyed. From 1841 to the present day census returns are not made public for 100 years. The returns can be found in most large main libraries or County Archive Offices.

#### 3. Public Records Office

This was set up in London at St. Catherine's House in July 1837 and contains records of all births, deaths and marriages.

#### 4. Parish Records

These may be available at the local Archive Office or Parish Church. Approximate date and location of occurrence are necessary to avoid a long search.

#### 5. Bishops Transcripts

These are copies of the Parish Records and may be of use if Parish records are lost or destroyed. Care must be taken as sometimes errors in copying have been found.

#### 6. International Genealogy Index

This is an index compiled by the Mormons of everyone in the country. It is not complete but can be useful.

A lively question time followed Mr Vales' talk with some more helpful information coming from the audience. The meeting finally closed with a vote of thanks proposed by Mrs Norma Wallace and endorsed by the audience in the usual way.

B. E. Myatt

## Ontario Section

### New developments in the Diarylide Yellow pigment group for the printing ink industry

The Ontario Section of the Oil and Colour Chemists' Association met on Wednesday, March 20 1985, at the Cambridge Motor Hotel, with approximately 35 members and guests in attendance.

Mr Wilfred Mueller-Kaul of Hoechst, travelled from Germany to give a lecture entitled "New developments in the Diarylide Yellow pigment group for the printing ink industry". The long history of each of these pigments was reviewed, in depth, and the technology of the chemistry of gravure grades was highlighted. Specialized grades for each printing process and their optimal use were examined and Mr Mueller-Kaul pointed out that the only obstacle to full automation of the ink manufacturing process is the incorporation of the pigment in the ink. This would require free flowing (for automatic metering), non-dusting, easily dispersible powders with good ink characteristics. Progress towards this end in each of the major printing processes was then described; in many cases, promising results have been obtained.

Following a question and answer session, a vote of thanks was proposed by Mr Alan Gray, Chairman.

P. Marr



# EDINBURGH CONFERENCE

26-29 June 1985

## New Substrates, New Materials, New Problems?

To coincide with the 50th Anniversary Celebrations of the Scottish Section of the Association, the Biennial Conference was held in Edinburgh at the Dragonara Hotel from 26-29 June 1985. This was the second time that the Conference had been held in Edinburgh, the last occasion being in 1959. Edinburgh was clearly a popular choice for delegates travelling from overseas and there were representatives from the following countries: Australia, Belgium, Denmark, Finland, France, Germany, Holland, Italy, Nigeria, Portugal, Singapore, South Africa, Spain, Sweden, Switzerland and USA.

Twenty-three papers—the most ever arranged for at an Association Conference—were presented in four sessions, which took place in the mornings and afternoons of Thursday and Friday. All the technical sessions were very well attended and the discussions were often extremely lively. It has long been the practice at this Association's Conferences to send preprints to delegates several weeks in advance so that the lecturers only introduce their papers briefly and this allows for a longer discussion period than at those Conferences where the papers are

presented in full. With 23 papers in four sessions, this allowed for a period of approximately half-an-hour for each paper and it was necessary for the Session Chairmen to curtail discussions occasionally in order to keep to the time schedule.

The Association has always arranged a full social programme for the benefit of both delegates and their families and, since this Conference was part of the Scottish Section's Anniversary Celebrations, this was even more crowded than usual. The thanks of those attending the Conference, as well as the thanks of the Association, are due to the Scottish Section for suggestions for the social programme and for arranging many of these, which will make the Edinburgh Conference an OCCA-sion which will be remembered by the many visitors for a long time. Particular thanks are extended to Mrs Anne Gibson (Vice President) who took over the work of liaison with the Director and Secretary, following the untimely death of the Chairman of the Scottish Section, Alex McKendrick, who had put a great deal of thought and effort into the proposals. Thanks must also be expressed to Anne's

husband, Denis, who not only supported her throughout the Conference but organised the Golf Tournament at the Royal Burgess Golf Club. Once again the help of Mrs Stephanie Giliam (wife of the Honorary Treasurer) was invaluable in acting as courier for the coach parties and ensuring that those involved returned in time to take part in other activities; Stephanie also arranged a successful tombola at the dinner and dance on the Friday which was much enjoyed.

### Wednesday 26 June

The first main function of the Conference was the customary reception of overseas delegates by the President, Honorary Officers and the Director and Secretary, which was held in the Belford Suite. The Association was to welcome representatives of other societies in the International Alliance: Mr G. Abelsnes (President of SLF) and Mrs Abelsnes, Mr J. Bauer (President of FSCT) and Mrs Bauer, Mr F. Borrelle (Executive Vice President, FSCT) and Mrs Borrelle and Dr A. Poluzzi (Vice President, FATIPEC).

After dinner, the Scottish Section



The Meeting of lecturers and chairmen of sessions: (front row, left to right) Prof C. H. Rochester, Dr G. Fettis, Mrs A. Gibson, Mr R. Barrett, Mr D. S. Newton (Hon. Editor), Mr C. N. Finlay (President), Mr J. R. Taylor (Hon. Research & Development Officer), Dr L. Valentine, Mr Z. Kalewicz, Dr V. Kaden. (Back row, left to right) Mr J. Setton (Assistant Editor), Prof Dr W. Funke, Mr A. J. Sparkes, Mr E. A. Hilditch, Mr M. Risberg, Dr C. Schoff, Mr R. J. Woodbridge, Mr H. G. Stephen, Dr J. E. McNutt, Mr J. P. de Greef, Dr M. A. Taylor, Mr P. Draper, Mr T. Entwistle, Dr R. C. Groot, Dr W. J. van Ooij, Dr Y. Perera.

## conference diary

arranged a Special Entertainment of Scottish songs, country dancers, a piper and a fiddler. This splendid and, to so many of the delegates, novel entertainment was highly appreciated as was the lecture which followed after a brief interval by Mr A. Paterson of Whyte & McKay, who had the generosity to bring some samples of whisky to the delight of his attentive audience. During the interval, a meeting of the lecturers and the session chairmen took place, under the chairmanship of the Honorary Research & Development Officer (Mr J. R. Taylor) to discuss the way in which the papers would be presented and to allow the Session Chairmen an opportunity to meet the lecturers who would be speaking during their sessions. Photographs taken at the Overseas Reception, the performers at the Scottish Entertainment and at the lecturers' meeting appear in this report.

### Thursday 27 June

At 9.15 a.m. the President welcomed delegates to the Conference and declared the Conference open before handing over to Mr J. R. Taylor, who had arranged the papers for the sessions and who acted as chairman for the first session. The Association records its thanks to John Taylor for the work involved in providing such an interesting and wide ranging set of papers, the first of which was published in the July issue of *JOCCA*; further papers will be published in the following months and it is hoped that some of the discussions will also be available for publication.

During the morning a coach party toured the Royal Mile and Georgian Edinburgh.

After the first technical session the President and Mrs Finlay welcomed all those attending the Conference at an informal reception.

The Second Technical Session in the afternoon was chaired by Mrs Anne Gibson (Vice President).

After the session, a meeting was held of the International Liaison Committee, which was attended by delegates for FATIPEC (Dr A. Poluzzi, Vice President and Mr J. Roire, a Past President) for FSCT (Mr J. Bauer, President and Mr F. Borrelle, Executive Vice President) for SLF (Mr G. Abelsnes) and for OCCA by the President, President Designate, the Hon. Secretary and the Director and Secretary.

During the afternoon, a coach party visited the Edinburgh Crystal Works at Penicuik.

In the evening another special event was thoroughly enjoyed by 70 delegates and

their families who travelled to the Dalhousie Courte for a Jacobean Banquet. The President and Mrs Finlay were proclaimed Laird and Lady for the evening and the festivities, presided over by a Chamberlain, included the drinking of mead and the eating of food with a knife but no fork!

Unfortunately, it is not permitted to take photographs at the Banquet—at least, this is what the party unanimously informed the Director and Secretary on their return!

### Friday 28 June

The Third Technical Session, under the Chairmanship of Dr Leslie Valentine took place in the morning. For the families a guided tour, including Edinburgh Castle, took place.

At 12.30 p.m. the President and Mrs Finlay held a reception in the Belford Suite for Council Members, overseas Presidents, session chairmen and lecturers.

In the afternoon, the final Technical Session was chaired by Mr Ron Barrett (the Chairman of the Scottish Section). A coach tour which included a visit to Hopetoun House (the home of the Marquis of Linlithgow) was arranged for delegates and their families.

The President closed the Technical Sessions at 4 p.m. and thanked all those who had contributed to the highly successful technical part of the Conference.

The Association records its thanks to Don Newton (Hon. Editor) and to John

Taylor (Hon. Research & Development Officer) who helped at all the technical sessions by distributing forms for the recording of comments in the discussions and to Mr J. Setton (Assistant Editor) who assisted lecturers with the presentation of slides and was present throughout the sessions to help delegates.

Following the final session, the Association held its Annual General Meeting at 4.15 p.m., a report of the Proceedings of which appears elsewhere in this issue of *JOCCA*.

In the afternoon the Golf Tournament took place at the Royal Burgess Golf Club.

In the evening the final event of the Conference—the Association's Dinner and Dance—was held in the Riverside Suite of the Dragonara Hotel. Prior to the dinner, guests were received by the President (Mr C. N. Finlay) and Mrs Finlay, together with the Lord Provost and Lady Provost of Edinburgh.

At the end of the reception, guests took their places at the tables and applauded as the piper escorted the President and Mrs Finlay, together with the Lord Provost and Lady Provost to the Top Table.

The menu had been chosen by the Scottish Section Committee to have a distinctly Scottish flavour, including, naturally, the haggis. This was brought forward with ceremony by the Chef, accompanied by the Piper and Mr Angus McLean (President 1977-79) gave the address to the haggis in a robust and eloquent manner, which was much enjoyed by the company.



At the Overseas Reception (from left to right): Mr R. H. Hamblin (Director and Secretary, OCCA), Mrs Abelsnes, Mr G. Abelsnes (President, SLF), Mrs Finlay, Mr C. N. Finlay (President, OCCA), Mr J. Bauer (President, FSCT), Mrs Bauer, Mrs Borrelle, Mr F. Borrelle (Executive Vice President, FSCT), Dr A. Poluzzi (Vice President, FATIPEC).

# THE SCOTTISH SECTION'S EVENING



The Piper leading in the Cruachan Dancers, who were trained by Beatrice Jones.



Andrew Hamilton, who conducted the Evening and regaled the company with traditional Scottish songs.



One of the many colourful dances performed with enthusiasm and greatly applauded.



Tremendous interest was taken in the talk on whisky by Mr A. Paterson of Whyte & McKay Ltd.



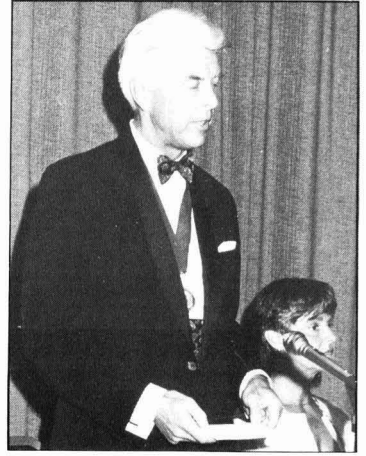
Scottish airs played to the company by Jim Fergusson.

*Photographs of the Scottish Section's Evening Entertainment were taken by A. G. Ingram Ltd.*

## conference diary



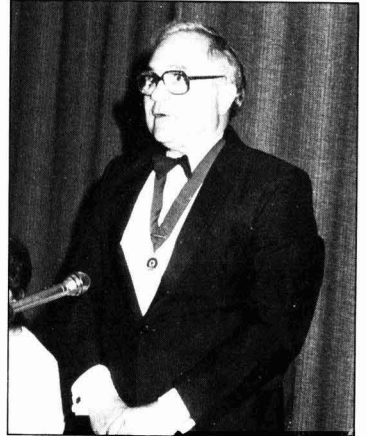
All four Technical Sessions were very well attended.



Prior to Dinner on the Friday evening, the guests were received by the President and Mrs Finlay and the Lord Provost and Lady Provost of Edinburgh.



The Haggis! Mr Angus McLean (President 1977-79), the Piper and the Chef drink the traditional toast, proposed by Mr McLean to the obvious enjoyment of the company.



The main speakers at the dinner were (top to bottom): Mr G. Abelsnes (President, SLF), Mr C. N. Finlay (President, OCCA) and Mr J. Bauer (President, FSCT).

*The photographs, other than those of the Scottish Evening Entertainment, were taken by Gimi Scappaticci.*



## conference diary

After the dinner, following the loyal toast by the President, the toast to the Association was proposed by Mr G. Abelsnes (President, SLF) who complimented the Association on the organisation of such a memorable conference and extended a welcome to any who were planning to visit the SLF Conference in Oslo in September.

The President replied on behalf of the Association and thanked Mr Abelsnes for his kind remarks. He welcomed delegates, lecturers, chairmen of technical sessions and thanked them for their contribution to the success of the Conference. In welcoming the Lord Provost and Lady Provost, he also welcomed the other guests of the Association—Dr A. Poluzzi (Vice President, FATIPEC), Mr J. Bauer (President, FSCT) and Mrs Bauer and Mr F. Borrelle (Executive Vice President, FSCT) and Mrs Borrelle. He extended a welcome to his personal guests, Dr P. Dodgson, OBE., and Mrs Dodgson, and thanked Dr Dodgson for the way in which his company, Durham Chemicals, had supported him throughout his term of Presidency. He also wished to express his thanks to his wife, Jean, for her help during the past two years.

He had a special welcome for the ladies who added grace and charm to the function and he concluded his speech by proposing a toast to the Association's guests and the ladies. Replying on behalf of the guests, Mr J. Bauer (President, FSCT) expressed the thanks of all guests for the hospitality shown by the Association during the Conference, extended a welcome to any who were planning to visit the FSCT's 50th Paint Show and Convention at St Louis, Missouri in October and concluded by thanking the Association, on behalf of the ladies, for the beautiful present of Edinburgh Crystal which had been made to each lady.



The new President of OCCA, Mr R. B. Redman, (right) being congratulated by his predecessor, Mr C. N. Finlay, after receiving the Presidential Insignia.

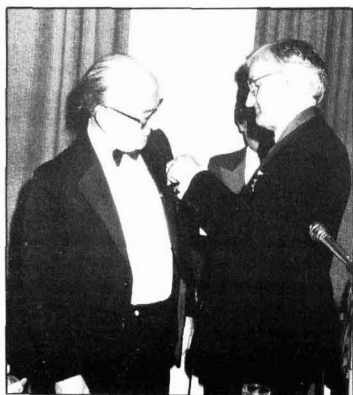
Following Mr Bauer's speech, the investiture as President of Mr F. B. Redman, who had been elected President of the Association at its Annual General Meeting in the afternoon, took place.

Mr C. N. Finlay invested Mr Redman with the Presidential Insignia, using the traditional form of words:

*Frank Benson Redman, in accordance with the resolution passed at the Annual General Meeting this afternoon, it is now my duty to invest you with the Insignia as President of this Association and I charge you to guard well the interests of our Association and at all*

*times to uphold the dignity of your high office.*

In return, Mr Redman presented Mr Finlay with his Past President's medallion, inscribed with his name and years of service, which would act as a memento of his Presidency and his work on behalf of the Association. In this he had been most ably supported by Mrs Finlay, both in their visits to Sections in the United Kingdom and overseas and also to the Conventions of sister societies abroad. It was a tradition to present the wife of the retiring President with a gift of her choice and Mrs Finlay had chosen to augment a Royal Doulton dinner service.



Mr C. N. Finlay (left) receiving his Past President's Medallion from Mr F. B. Redman (President).



Mrs Finlay was presented with a gift of her choice—the augmentation of a Royal Doulton Dinner Service—by the President for her support to the outgoing President during his term of office.



The incoming President's Lady, Mrs Redman (right) receiving the President's Lady's Medallion from the outgoing President's Lady, Mrs Finlay.



The Director and Secretary had taken no chances on this gift being dropped by him so that it had been sent to Mrs Finlay's home and he felt sure that the gift would serve to remind her of the affection in which she was held by the many members she had met during her husband's term as President.

Mrs Finlay thanked the Association in a charming speech, saying how much she had enjoyed the last two years and the kindness which had always been extended to her. She concluded her speech by presenting Mrs Redman with the medallion worn by the President's Lady. Mrs Redman thanked Mrs Finlay and looked forward to serving the Association in the coming

years.

This concluded the formal part of the proceedings and the President (Mr F. B. Redman) and Mrs Redman retired with the Lord Provost and Lady Provost while the room was prepared for dancing, which then took place.

During the evening the Sam Sharp OCCA Conference Golf Trophy and replica were presented by Mrs Redman to Mr S. T. Harrison, winner of the competition. The Pearson Panke Trophy—first awarded in 1983—was won by Mr D. Jonas, but he had had to leave the Conference before the Friday evening and the presentation could not, therefore,

take place.

After the tombola, dancing continued until 1 a.m. when the President wished all those who had attended the Conference a safe journey to their homes.

### Saturday 29 June

Following breakfast, delegates dispersed and it was expected that many who had attended would return for the next Conference, which is scheduled to take place in Eastbourne 17-20 June, 1987, to coincide with the 50th Anniversary Celebrations of the London Section.

R. H. H.

## news

### SURFEX 86

#### Nearing a sellout

With more than nine months still to go, SURFEX 86, the new concept exhibition for the surface coating industries to be held in Harrogate in May 1986, is almost sold out.

Surfex 86, organised by the northern sections of the Oil & Colour Chemists' Association, is a new national exhibition which has been formulated to combine the best features of theatre and hotel room shows, housed in standardised, modular units in an open plan theatre style. Thus, the high costs of more traditional theatre exhibitions are avoided but the open bustling environment maintained.

The exhibition, which will attract visitors from the paints, printing inks and allied surface coating industries, will be held on 14th/15th May 1986 in Hall D and the reception and gallery areas of the recently built Harrogate Conference Centre. Hospitality suites are also available, through the SURFEX organisers, in the adjacent International Hotel, which is linked to the Centre by a first floor walkway.

Shell scheme stands of various sizes from 4.5 to 9 square metres are offered, as well as more open sites of 12 square metres with backing and half height side walls. Prices, which include carpet, lighting and electrics range from £550 to £1,200 per unit with a limit of two units per company or division.

Harrogate is a spa town with an ample supply of hotels and restaurants and is



situated close to the A1, midway between London and Edinburgh. It is easily reached by road and Inter City trains from London terminate a few minutes' walk from the centre. Leeds/Bradford Airport is 14 miles to the south.

Firm bookings have been received from the following exhibitors:

Allied Colloids Ltd

Samuel Banner Ltd

Baxenden Chemical Co

Blythe Burrell Colours Ltd

E. P. Bray & Co. Ltd

Byk Chemie GmbH

CIBA GEIGY Pigments

CIBA GEIGY Plastics

Cray Valley Products

Croxtan & Garry Ltd

Diamond Shamrock UK Ltd

Durham Chemicals Ltd

ECC International Ltd

Eiger Engineering Co.

Elektro-Physik

Ellis & Everard

Ernstroem Minerals AB

Floridienne UK Ltd T/AS Micro Products

Foscolor Ltd

Fuel & Metallurgical Journals Ltd  
John Godrich Consulting Engineers  
H. Haeffner & Co. Ltd  
Haeffner Engineering  
Harlow Chemical Co. Ltd  
Heubach UK Ltd  
Hoechst UK Ltd  
Kenroy Dispersions  
Kirkless Chemicals Ltd  
Kirstol Ltd  
K & K Greef Ltd  
Lawrence Industries Ltd  
Marlow Chemicals Ltd  
Mastermix Ltd  
Metal Box Ltd  
NL Chemicals UK Ltd  
Paintmakers' Association  
Paint Research Association  
Pearson Panke  
The Q-Panel Co. Ltd  
Reed Plastic Containers Ltd  
Resinous Chemicals Ltd  
Sandoz Products Ltd  
SCM Chemicals Ltd  
Scott Bader & Co. Ltd  
Shear Chemicals Ltd  
Sheen Instruments Ltd  
Shell Chemicals UK Ltd  
Silberine Ltd  
Steetley Minerals Ltd  
Sun Chemicals Ltd  
Tego Chemie Service  
Tioxide UK Ltd  
Torrance & Sons Ltd  
Union Camp Chemicals Ltd  
Wengain Ltd

## ICI plans stronger international base in colours and fine chemicals

ICI Organics Division, one of the world's leading suppliers of dyes, pigments and fine chemical intermediates, is to restructure its European operations in a move to boost profitability in the colours sector.

The restructuring is a response to problems of overcapacity, low growth and changed market patterns which have affected the textile dyes industry in particular over the last few years.

While ICI will continue to supply the full range of product types and services for the colours market, the restructuring will involve rationalising capacity to meet changing customer demands and concentrating manufacture to make more effective use of plant and technology within Organics Division's six works in the UK and France

Together with other moves to streamline ICI Organics' European manufacturing and administrative organisation and facilities, the measures are intended to reduce overall fixed costs by around 15 per cent over the next three years.

The latest moves are a further development in ICI's drive to improve its cost competitiveness and expand its product and market base, which included the acquisition of the colours business of PCUK of France, in late 1982. In addition to being a

major supplier of colours to the textile, leather, paint, printing ink, plastics, paper and reprographic industries, ICI Organics Division is also the principal supplier of a wide range of fine organic chemicals to ICI's rapidly expanding international business in agrochemicals, pharmaceuticals, speciality chemicals and polyurethanes, servicing ICI sales worth more than £1 bn. a year.

According to Tony Rodgers, Chairman of ICI Organics: "Actions taken over the last few years have expanded ICI's product range and markets for colours and fine chemicals intermediates at the same time as improving our competitive position by rationalisation and modernisation of all our facilities.

"With this broad product, customer and manufacturing base, ICI is now better placed to face up to the volatile market and other structural problems still affecting some sectors of the colours industry. The latest measures to restructure our capacity in line with changing market patterns and to continue to improve our efficiency reflect ICI's determination to take the further actions necessary to remain in the forefront as a profitable supplier to all our customer industries, as competitive as any producer in the world".

*Reader Enquiry Service No. 30*

## Major US acquisition for Burmah Speciality Chemicals

Agreement has been reached for Burmah Speciality Chemicals, one of the key strategic divisions of the Burmah Group, to acquire Advance Process Supply Inc., a privately owned American company, and its subsidiaries at an investment cost of \$25 million inclusive of Advance's external funding.

Advance is a major manufacturer and supplier of screen printing inks, equipment and materials in North America. Based in Chicago, the company has five manufacturing plants in the USA and a nationwide network of thirteen depots, with two more in Canada, selling and distributing direct to screen printers.

Advance will form part of Burmah Speciality Chemicals' printing inks sector, alongside the UK-based Sericol group of companies and Nazdar Europe, a smaller but important French screen printing ink manufacturer acquired in March this year. Sericol, which has grown very rapidly in recent years, is a leader in screen printing inks and associated products in the UK, and has well established sales and distribution companies in France, West Germany and Switzerland.

Jonathan Fry, chief executive of Burmah Speciality Chemicals, comments: "This acquisition is our largest to date. Advance, together with Sericol, will make our screen printing inks business a major force in this rapidly growing international market. We are confident that the interchange of technology between Sericol and Advance will enable both to penetrate more markets in Europe and North America".

*Reader Enquiry Service No. 31*

## products

### New IPCO aluminium roof coating

A new aluminium roof coating which is claimed to be unique in that it can be used for flat roof repairs without a primer and yet gives a result free from bitumen "bleed through" has been introduced by Industrial Protective Coatings (UK) Ltd of Holyhead.

IPCO 310 Aluminium Roof Coating is claimed to be suitable for all types of conventional roof structures, but ideal for flat roofs because of its high resistance to ponding water. Its special formulation en-

sure that there is no reaction with bitumen and therefore priming is not necessary, saving significantly on time and labour costs.

A single-pack, moisture-cured, polyurethane-based membrane, IPCO 310 provides long-term, tightly bonded, jointless and flexible waterproofing for exposed roofs. Extensibility is greater than 300 per cent.

Being a solar reflective membrane, the coating helps to reduce both roof temperature and thermal movement of the roof structure. It also provides fire retardant properties and reduces flame spread in the event of fire.

Industrial Protective Coatings (UK) Ltd, manufacturers and markets throughout the world a range of high performance surface coatings for a wide variety of industrial applications.

*Reader Enquiry Service No. 32*

**Rust neutralizer in a spray can**

Brunnox<sup>®</sup> the first rust neutralizer in a spray can, was specially developed for the treatment of rusty iron and steel by Enviro-Chemie, Switzerland. Rust and iron react tanate complex layer results. It is said to be harmless for the environment as it contains no lead, no zinc, no chromate.

The Epoxy in the spray concentrate creates a water resistant coat. It is, after a drying time, primer for the topcoat. Brunnox<sup>®</sup> is said to offer many facilities for the car industry, car accessories, hobby and do-it-yourself. The Brunnox<sup>®</sup> spray is very easy to apply and it can be overcoated, after a drying time of about six hours, with all paints, also with two component paints. It is best qualified for special paints such as chlorcaouchouc, vinyl and two-component paints on basis of polyester, acrylic and epoxy. The epoxy resin shows very good solvent resistance. Also an etching by over-painting is avoided. This is very important as spray paints often contain aggressive solvents. Brunnox<sup>®</sup> also does not soften at higher temperatures and will not swell when it gets into contact with water.

*Reader Enquiry Service No. 33*

**New universal plastics cleaner**

Glasurit has launched a universal cleaner which is, it is claimed suitable for use on all types of paintable plastic surfaces. As a result it is no longer necessary to test the plastic for solvent sensitivity prior to cleaning.

Glasurit pioneered the painting of plastics with the introduction of its Universal Plastics System (UPS) last year. Comprising of a primer, surfacer and top coat, UPS is suitable for application to any type of paintable plastic. It removes the need for time-consuming and complicated tests to determine the type of plastic to be painted and the associated confusion and error.

Used together, the universal cleaner and plastics system make the entire process of cleaning and painting plastics much faster, simpler and more accurate since it is now completely test-free. The system is compatible with all Glasurit two-pack, top coat paints and is suitable for air dry or force dry environments.

*Reader Enquiry Service No. 34*



**Glasurits Universal Plastics System (UPS)**

**New pump for heaviest material**

Latest addition to Graco's range of heavy-weight pumps is the "Blockbuster", which is said to have been designed to pump the very heaviest and most aggressive materials used in modern-day production processes.

The pump is mounted on a twin-post hydraulic ram with a specially-designed cone-shaped inductor plate to induce priming of the pump.

The delivery hose is supported by an articulating boom, which provides a work envelope of up to 80 sq. ft., and the extrusion gun supplied will apply the material at any required angle to facilitate the use of templates. The valving is specially designed to maintain flexibility of the hose

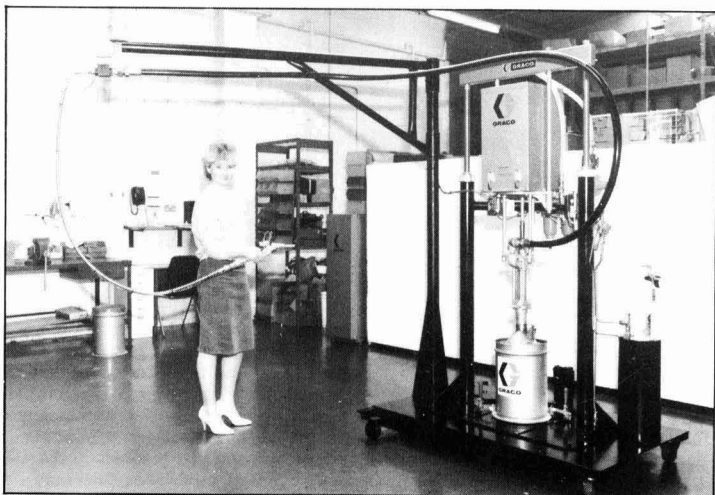
during use, and to avoid kick-back at the gun when the operator starts and stops the flow of material.

Depending upon the material and delivery rates required, a number of Graco powerheads can be selected to give a delivery pressure of up to 5,000 psi at ratios of up to 55:1.

The indicator plate is available in stainless steel which allows the handling of corrosive, acidic or other aggressive materials.

Typical uses include the application of reinforcement materials to lightweight composite structures; application of very high viscosity adhesives and sealants; metered-shot filling of cavities.

*Reader Enquiry Service No. 35*



**The new GRACO "Blockbuster" pump**

**literature**

**Tin Research Institute Annual Report 1984**

The Annual Report of the International Tin Research Council for 1984 gives details of the extensive research and development activities undertaken by its operative arm, the International Tin Research Institute. In particular it shows new developments in technology are being exploited to widen the uses of tin.

*Reader Enquiry Service No. 36*

**Casamid range**

Thomas Swan Co. Ltd of Consett, Co. Durham, manufacturer of speciality chemicals, has produced a new publication providing information on over forty epoxy resin curing agents produced within its Casamid range.

The eight-page publication provides physical data for each product, together with notes on principal applications. These include most heavy-duty coating systems in

common use; products are described for solvent-based, solvent free, water-based and powder coatings.

*Reader Enquiry Service No. 37*

**Wall chart**

A new full 4-colour descriptive wall chart featuring a comprehensive range of self-adhesive safety signs, tapes and pipe/ne bandings, etc., updated to include recent legislative changes is available free on request from Focal Displays Ltd of Mitcham, Surrey.

Detailing signs from the mandatory Hazchem, IMCO and BS1710 pipeline marking systems through to barrier tapes, floor lane marking tapes and vehicle liveries, etc., the chart also includes labels relating to the recently introduced Classification, Packaging and Labelling of Dangerous Substances Regulations 1984.

*Reader Enquiry Service No. 38*

technical and development director of Evode Group plc. He will be spearheading the group's new product and business development activities.

\* \* \* \*

SCM Chemicals, a division of SCM Corporation, has named **Mr Peter C. Firing** president of its Baltimore-based worldwide pigments operations. Mr Firing is chairman of the boards of SCM Chemicals Limited in the United Kingdom and SCM Chemicals Ltd in Australia.

SCM Pigments is the world's third largest producer of titanium dioxide, the white pigment used in the paint, paper, rubber, and plastics industries.

\* \* \* \*

Thomas Swan & Co. Ltd of Consett, Co. Durham, manufacturer of speciality chemicals, has appointed **Mr Anoop Kapitan** as projects manager for its Consett works.

In his new post Mr Kapitan will be responsible for setting up existing plant for special projects and for the design and development of new process schemes.

**people**

**Mr V. Vohralik** has been appointed group

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# Proceedings of the Annual General Meeting



The twenty-third Annual General Meeting of the Incorporated Association was held on 28 June 1985 at 4.15 p.m. at the Dragonara Hotel, Edinburgh with the President (Mr C. N. Finlay) in the chair.

There were 40 members and two visitors present. The notice convening the meeting was read.

## Apologies

Apologies for absence were received from Mr D. H. Vettwinkel, Mr D. J. Silsby, Mr A. C. Jolly and Mr S. I. van der Werf.

## Minutes

The President asked the meeting to take as read the minutes of the twenty-second Annual General Meeting held on 13 June 1984 as printed and circulated in *JOCCA* pp 248-251 inclusive, September 1984.

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 1984

The President, introducing the Annual Report of the Council for 1984, commented that the financial position had improved as had been forecast at the Annual General Meeting in 1984 so that in two years the Association had recovered from a deficit (when adjustment had been made for the prior year) of approximately £32,000 in 1982, to a forecast deficit of nearly £9,000 in 1983, and a surplus of £3,788 in 1984. This had required a tremendous effort and the Association's thanks were due not only to the Director and Secretary and his staff but also to those sections which had contained their expenditure and in some cases produced surpluses. The production cost of the *Journal* had been most carefully considered by the Hon. Editor and the Director and Secretary and this had made a distinct impact on the outcome. He felt that Council wished to be in a position where income from Exhibitions (on which so much dependence had been placed in the past) could be regarded as a bonus rather than the way in which the Association's other activities were financed. It already appeared that the space for the next exhibition to be held in Harrogate, 14 and 15 May 1986 would soon be completely sold and it was of the utmost importance that every effort was made by Sections and Members to encourage as large an attendance of visitors as possible.

He then formally moved the adoption of the Report.

Mr B. F. Gilliam (Hon. Treasurer), seconding the adoption, wished to add his thanks to the efforts made over the past two years by the Director and Secretary and his staff and urged Section Committees to continue to consider ways in which they could contribute surpluses to the consolidated accounts of the Association. He then seconded the adoption of the Annual Report and the statement of accounts for 1984.

The President asked for comments. Mr F. B. Windsor asked if there was any indication of the present state of Section finances.

The Director and Secretary replied that all Section Hon. Treasurers were asked to send in returns (to 30 June) for the Association's half year accounts, which would then be considered first by the Finance Committee and then presented to Council. Until that time it was not possible to see how the Sections had fared since the beginning of the year and he asked all Section Chairmen present at the meeting to ensure that their Sections' returns were forwarded as quickly as possible, on the forms sent to Section Hon. Treasurers in May.

There being no other questions, the Annual Report of the Council and the statement of accounts for 1984 were formally adopted by the meeting.

## Election of President (1985-87)

The President stated that, as indicated on the agenda, Mr F. B. Redman had been nominated by the Council and he now asked the Annual General Meeting to accept the nomination.

This was carried unanimously with acclamation.

Mr F. B. Redman thanked the meeting for the trust placed in him and stated that he was looking forward to his term of office. He then asked Mr C. N. Finlay to preside for the remainder of the Annual General Meeting and at the Conference Dinner later in the day.

## Election of Vice-Presidents of the Association

Mr C. N. Finlay 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 following the practice for many years one Vice-President was resident in South Africa and another in New Zealand, where

Divisions of the Association had been formed from the Sections in those countries. The following were then elected as Vice-Presidents:

- (i) Mr R. P. Johannsen
- (ii) Mr D. Kimber
- (iii) Mr A. C. Jolly
- (iv) Mr T. Entwistle
- (v) Mr R. Spargo
- (vi) Mr G. R. Robson
- (vii) Mr R. Saunders

## Election of Honorary Officers of the Association

Mr C. N. Finlay asked the meeting to accept the nominations of Council as printed on the agenda *en bloc*.

On being put to the meeting it was unanimously agreed to elect the honorary officers as follows:

Honorary Secretary: Mr L. J. Brooke  
Honorary Treasurer: Mr B. F. Gilliam  
Honorary Editor: Mr D. S. Newton  
Honorary Research &  
Development Officer: Mr J. R. Taylor  
Honorary Technical  
Education Officer: Mr. H. J. Clarke

## Announcement of election of Elective Members to Council 1985-87

Mr C. N. Finlay read to the meeting the following report received from the Association's auditors, Cooper & Lybrand:-

1 *We have scrutinised the voting papers for the three elected members of the Council received from the members in the United Kingdom and General Overseas Sections, and certify that the votes cast show that the following obtained the largest number of votes:-*

1. J. T. Calderbank
2. H. Young
3. P. L. Gollop

2 *Six voting papers were rejected as not being in order.*

London, 20 June 1985

Coopers & Lybrand  
Chartered Accountants

## Chairman of Sections for the coming session

The names of the section chairmen to serve



Registered Students (under 21)

£11.00 per annum

Registered Students (21-25)

£16.00 per annum

By resolution of Council, Value Added Tax will be 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 G. Hutchinson that Coopers & Lybrand (Chartered Accountants) be reappointed auditors of the Association and their fee for 1985 be £1,250. This was seconded by Mr M. G. Bentley and carried unanimously.

### Jordan Award 1983-1984

Mr C. N. Finlay stated that the Jordan Award was instituted in 1967 by Mrs Marjorie Jordan in memory of her late husband, Dr L. A. Jordan, who was President of the Association 1947-49 and became an Honorary Member 1955. The late Mrs Jordan wished the award of £100 to be made for the best contribution to the science or technology of surface coatings by a Member, under the age of 35 of any nationality, working in either the academic or industrial field. On this occasion the Jordan Award Committee had decided to confer the Award upon Mr B. A. Canterford for his paper entitled *Painting and Sealing of M.D.F.* He then presented the certificate to Mr Canterford.



Mr B. A. Canterford (right) receiving from the President (Mr C. N. Finlay) the Jordan Award Certificate for 1983-84.

### Vote of thanks to retiring Council members

Mr G. Fowkes proposed a vote of thanks to those members who were retiring from Council and pointed out that a great deal

of work was carried out by members both at Council and section level and this required a great deal of support from their companies which he felt sure was appreciated by the Association. Although some of those retiring might feel that they now had time to pursue other activities he felt sure that many would be recalled to serve on Council in other capacities. He felt that the members present would like to show their gratitude for the service given to the Association by those who had served as Vice-Presidents, Elective Members, Section Chairman and Section Representatives and he proposed a vote of thanks to those members, which was carried with acclamation.

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

Mr R. J. Woodbridge proposed a vote of thanks to the Honorary Officers of Association. He felt sure that the members understood the considerable work done to ensure the smooth working of the Association by Mr L. J. Brooke (Honorary Secretary), Mr B. F. Gilliam (Honorary Treasurer), Mr D. S. Newton (Honorary Editor) for his work on the Journal, Mr J. R. Taylor (Honorary Research and Development Officer) who had admirably produced the technical programme for the Conference and Mr H. J. Clarke (Honorary Technical Education Officer) for his work in the field of technical education. He asked the Annual General Meeting to show their appreciation to the Honorary Officers of the Association and this vote of thanks was carried with acclamation.

### Vote of thanks to retiring President

The Director & Secretary called upon Mr D. J. Morris (Immediate Past President) to propose a vote of thanks to the retiring President.

Mr D. J. Morris stated that a great deal of progress had been made during Mr Finlay's presidency and drew particular attention to the goodwill engendered by his visits abroad to the New Zealand and South African Divisions and to other organisations such as OCCA Australia, FATIPEC and the FSCT. Mention had already been made of the improved financial position since Mr Finlay became President, study groups had been operating and new thoughts had been given to the biennial Exhibition.

He asked the meeting to show their appreciation and the vote of thanks was carried with acclamation.

Mr Finlay thanked Mr Morris for the way in which he had proposed the vote of thanks and the members for its kind reception and he asked to continue to support the projects started in the last two years.

on Council for the coming year were given as follows:

Bristol .....	Mr M. H. Prigmore
Hull .....	Dr C. G. Crawforth
London .....	Mr K. H. Arbuckle
Irish .....	Mr P. Holmes
Manchester .....	Mr F. B. Windsor
Midlands .....	Mr E. C. Wallace
Newcastle .....	Mr R. G. Carr
Scottish .....	Mr R. Barrett
Thames Valley .....	Mr A. W. Fell
West Riding .....	Mr T. M. Wright
Ontario .....	Mr R. Purnell
Cape .....	Mrs C. J. de Villiers
Natal .....	Mr T. Say
Transvaal .....	Mrs H. Gaynor
Auckland .....	Mr M. F. Newton
Wellington .....	Mr R. E. Elliott

### Membership Subscription Rates

Mr C. N. Finlay asked the meeting if they would accept the items on membership subscriptions covered by agenda items 11(a), (b) and (c) *en bloc* and this was agreed.

Mr B. F. Gilliam (Honorary Treasurer) pointed out that, in accordance with Article 11, resolutions concerning subscriptions had been passed at two successive Council meetings on 20 February 1985 and 10 April 1985 and were now placed before the Annual General Meeting for confirmation. He proposed, Mr L. J. Brooke seconded and it was agreed without dissent that:

- The 1985 Ordinary and Associate Membership subscriptions for those members attached to the three sections of the South African Division and the Ontario Section were SA Rands 43 and Canadian \$38 respectively.
- The 1985 Ordinary and Associate Membership subscriptions for those members attached to the two sections of the New Zealand Division were NZ \$30 and that this did not include receipt of the Journal by those members unless payment of an additional amount is made individually to the Association's offices.
- With effect from 1 January 1986 the annual membership subscription rates in the various categories of membership shall be as follows:

Ordinary or Associate Members	£32.00 per annum
Retired Members	£11.00 per annum

## Any other competent business

Mr T. Entwistle wished to propose from the floor a formal vote of thanks on behalf of the members of the Association to the Director and Secretary and his staff at Priory House for the tremendous effort

which had been made in such difficult circumstances and this was carried with acclamation.

There being no other competent business, Mr C. N. Finlay declared the meeting closed at 4.45 p.m.

**OCCA  
news**

# Report of Council Meeting

A meeting of the Council took place at 1.30 p.m. on Wednesday 10 April, 1985 at the Great Northern Hotel, King's Cross, London N1. The President (Mr C. N. Finlay) was in the Chair; there were 20 members present.

Before commencing the business of the meeting, the President asked members to stand in silent tribute to the memory of Alex McKendrick (Chairman, Scottish Section) and of John Tooke-Kirby (a former Chairman of the London Section) who had died. The President reported that the Association were represented at both funerals and it was intended to publish obituaries in the *Journal* in due course.

The Agenda for the Association's Annual General Meeting on 28 June was finalized and the accounts for 1984 were adopted for publication in the Annual Report of the Council for 1984. The estimates for 1985, submitted by the Finance Committee, were adopted.

Mr R. Saunders reported that the Bristol Section would be willing to help with the arrangements for the 1986 Annual General Meeting which would take the form of a Council and Past Presidents' Reunion Luncheon—followed by a lecture—before the AGM.

Mr Arbuckle asked if consideration could be given to arranging the venue for the 1987 Conference at a place near London as the London Section would celebrate its 50th Anniversary in that year and the Edinburgh Conference had been arranged in 1985 to commemorate that Section's 50th Anniversary.

The Director and Secretary asked if Eastbourne would be considered a suitable choice since it was necessary to reserve accommodation at such places many years ahead and a provisional booking had been made at Eastbourne for June 1987. The members of the London Section at the meeting felt that this would be an excellent choice and the Council asked the Director and Secretary to confirm arrangements with the Grand Hotel, Eastbourne (the venue of several previous OCCA Conferences).

Council received a list showing the numbers of members attached to each Section whose 1985 subscriptions had not

been received and noted with pleasure that the total was less than the two previous years.

The grave situation arising from the voluntary liquidation of the *Journal* printers and the problems of transferring the work to another printers were explained to the Council. The delays incurred would mean that the March and April issues of the *Journal* would be late but everything possible was being done.

It was reported that an offer had been received from Dr L. A. Simpson of Tioxide UK to present a paper on behalf of the Association at the FATIPEC Congress to be held at Venice (September 1986) and this was accepted.

With regard to the Edinburgh Conference, it was noted that the brochures had been despatched at a later date than usual, since considerable difficulty arose in finalizing the programme but almost the same number of applications had been received by the date of the Council Meeting as at a similar date in 1983. However, Council was reminded that it was particularly important to make the Conference a memorable one and many more applications were required since on the last occasion there were many day registrations from the Northern Sections and these did not seem to be forthcoming at present. All members were asked to exert as much pressure as possible on companies.

Information was tabled on the next Association Exhibition, to be known as "SURFEX 86" which will be held at the Harrogate Exhibition Centre 14-15 May 1986.

It was reported that the Professional Grade Committee had approved two applications for Associateship (one of which would be deferred until period of membership was fulfilled) and had upgraded one Associate to Fellowship. In addition the Committee was pleased to report that the first two successful candidates from the Ontario Section's Dip. Tech. course had been admitted to Licentiate status and two further applications for this grade were awaiting vivas. It was felt that not enough of the younger members were aware of the amendment to the regulations which now allowed

candidates for LSTC to submit "written evidence" in place of a set dissertation.

Votes of thanks to the retiring President and members of Council were proposed and carried with acclamation.

There being no other business, the President thanked members for their attendance and declared the meeting closed at 3.40 p.m.

## West Riding Section

### Roses Games Evening

On Tuesday 14 May 1985 the West Riding Section hosted the inaugural Roses Games evening with the Manchester Section at the Scotland pub, Birstall. In between heavy thunderstorms four keen Crown Green bowls matches took place on the waterlogged green, the remaining contestants deeming it more sensible to stay indoors and play traditional pub games such as dominoes, cribbage etc, or merely chat and reminisce in the convivial surroundings.

With scores standing level the event was settled by the last dominoe game, West Riding's Vice Chairman, Jim Hemmings and partner John Mason, just getting the better of Manchester Secretary, Stuart Heyes and partner, Graham Fielding.

Hugh Young, the immediate past chairman of the West Riding section, presented his donated shield prize for this new event to West Riding chairman, Terry Wright, who commiserated with his Manchester counterpart, Barry Windsor, on the closeness of their defeat.

Following a buffet supper the Manchester contingent gained their revenge with the aid of a loaned (loaded?) set of liar dice. The overall view of the 32 participants being an excellent evening and we all look forward to next year's return venue in the Manchester area.

T. M. Wright

## Bristol Section

### Ladies Night

The Bristol Section Annual Ladies Night took place on Friday 29 March 1985 at the Harbour Suite, Unicorn Hotel, Bristol. There was the usual good attendance of 148 persons at the Ladies Night and everyone enjoyed the dancing and the annual "get together of old friends". A toast was proposed to the ladies by Mr R. Saunders which was endorsed by the Bristol members present. The response was made by Mr Finlay.

*J. R. Taylor*



At the Bristol Section Ladies Night shown from left to right are: Mr and Mrs R. Staples (President of the Birmingham PVLC), Mr and Mrs H. Young (Chairman of West Riding OCCA), Mr and Mrs R. Saunders (Chairman of Bristol OCCA), Mr and Mrs C. N. Finlay (President of OCCA), Mr and Mrs E. Wallace (Chairman of Midlands OCCA), Mr and Mrs I. Bolam (Chairman of Newcastle OCCA) and Mr R. H. Hamblin.

## Ontario Section

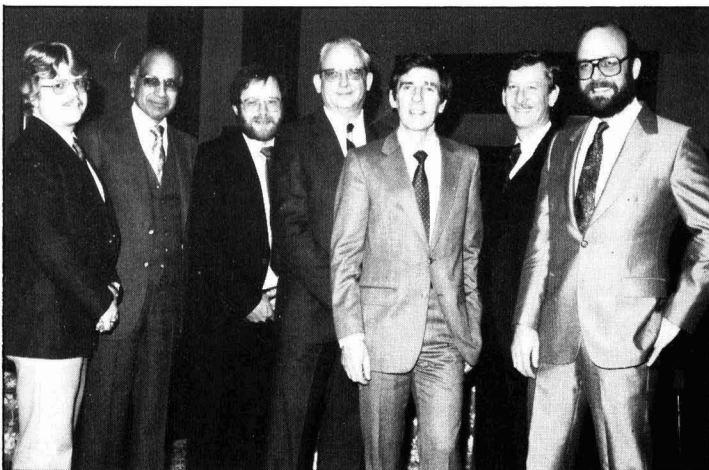
### 1985 Dinner Dance

The Ontario Section's Ninth Annual Dinner Dance was a great party and a thorough success. Held in the Humber Room of the Old Mill Inn on Saturday February 9 1985, the event was attended by a record number of couples. Arrangements were made by Bob Purnell of Bowers Printing Inks. The pleasant duties of welcoming guests and awarding prizes were performed with flair by Alan Gray of Dominion Colour and Mr Purnell.

Following a succulent dinner of roast duckling in Cumberland sauce, the participants took to the parquet for an evening of fine dancing to both tradition and modern rhythms.

The moon was long gone before the last gift-laden celebrants left the antique halls, vowing to return for the big Tenth Annual in 1986.

*J. F. Ambury*



Ontario Section Committee members at the Annual Dinner Dance, from left to right: Douglas Pratt, Shirish Patel, Robert Purnell, Peter Birrell, Alan Gray, John Ambury and Ian Sharples.

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# SURFACE COATINGS

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Prepared by OCCA Australia

As a consequence of the comments and criticisms of the first edition of "Surface Coatings" (1974), it was decided to produce a second edition with a different approach. While it has again been designed to serve as a guide and a reference document for students, it is also intended to provide an up-to-date, in-depth treatment of all relevant areas of paint technology.

The work is presented in two volumes, the first extensively reviewing the raw materials used in surface coatings, and the second the technology of the products that use them. Volume 1 will also be of considerable benefit to students, technologists and others in related industries such as inks, adhesives, ceramics, textiles and cosmetics, and raw material suppliers. It provides an excellent introduction to polymer science, pigments, solvents and additives. This edition reflects the movement towards aqueous systems: the chapters on alkyds have been reduced in this edition from six to three, and the four solvent chapters combined. Conversely the emulsion chapters have been doubled to six, and three new chapters on aqueous resins added. Volume 2, whilst retaining the basic manufacture, application and technology coverage, is based on completely updated contributions. There are additional chapters on lacquers, powder coatings, UV-cured coatings and decorative paint selection. Reflecting the increasing impact of computers, there are new chapters on automated colour matching and applications in resin and coating formulation.

Volume 1 is available by placing orders (prepayment only) through the Oil & Colour Chemists' Association at £27.50 (inc. p&p in the UK) plus £2.50 for orders sent overseas by surface mail.

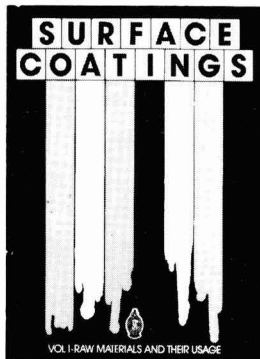
Volume 1 - Hardback - 408 pp.

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Sheen Instruments Ltd .....	(384)	cover
Sub-Tropical Testing Service Inc .....	(309)	209



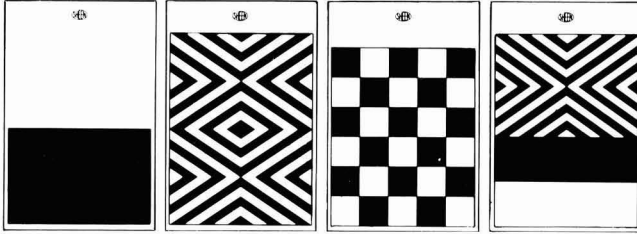


# HIDING POWER CHARTS



Our hiding power charts meet the requirements of most popular tests used to determine or compare hiding power and contrast ratios of pigmented coating materials such as paint, emulsions and inks.

Our charts are UV cured and their lacquer is resistant to MEK. They are suitable for use with most organic, water based or solvent borne coatings.



301-A

301-B

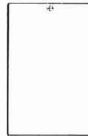
301-C

301-D

SIZE OVERALL : 250 x 180mm COATING AREA : 350 cm<sup>2</sup>



301-E

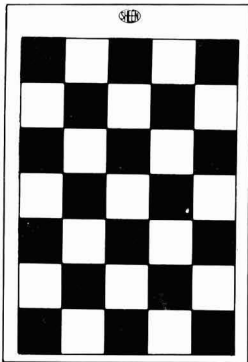


301-F  
Glossy

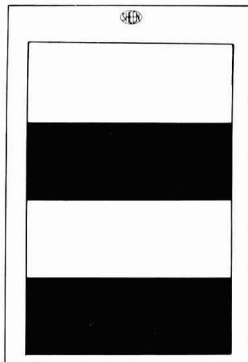


301-G  
Uncoated

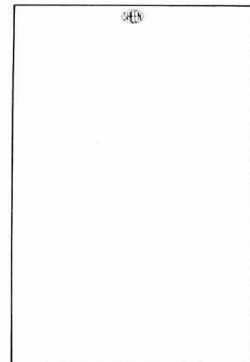
SIZE OVERALL : 150 x 100mm



301-H



301-J



301-K  
Glossy

SIZE OVERALL : 420 x 300mm (A-3) COATING AREA : 1000cm<sup>2</sup>

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