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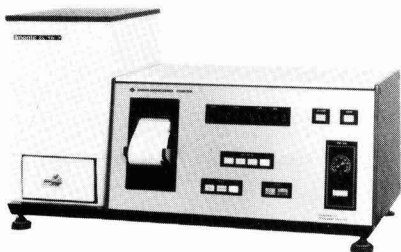
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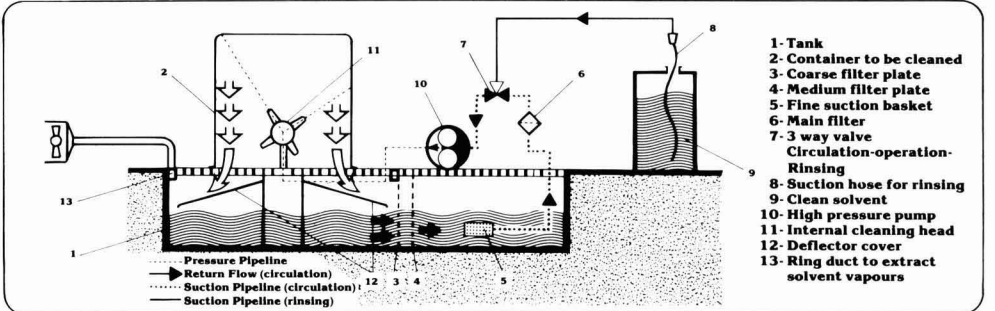
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Transactions and Communications

Stability and flocculation in a latex paint. Part 1: the influence of dispersants on particle stability*

By M. J. Jaycock† and G. J. Kayem‡

Chemistry Department, University of Technology, Loughborough, Leicestershire LE11 3TU, England

Summary

A fundamental investigation of the colloidal stability of particles in a charge stabilised water-based latex paint produced some surprising results regarding the influences of the dispersants. It was found that while both the pigment and latex dispersants – sodium hexametaphosphate (SHMP), and sodium dodecyl sulfate (SDS) respectively – improved the stability of the

pigment component, the pigment dispersant had a detrimental effect on latex stability and caused latex flocculation at fairly low concentrations. Although SDS generally improved significantly the stability of the latex, it was found to be capable of dissolving the latex when conditions permitted micelle formation.

Keywords

Types and classes of coatings and allied products

latex coating

Raw materials for coatings

surface active and rheological agents

dispersing agent

Processes and methods primarily associated with

manufacturing or synthesis

flocculation

Stabilité et floculation dans une peinture-émulsion. 1: L'influence des agents de dispersion sur la stabilité pigmentaire

Résumé

Une investigation fondamentale de la stabilité colloïdale de particules dans une peinture-émulsion à base de l'eau et où la charge électrique a été stabilisée, mettait en évidence certains résultats inattendus à l'égard de l'influence qu'exerçaient les agents de dispersion. Bien que tous les deux agents de dispersion, sodium hexamétaphosphate (SMHP) pour le pigment et sodium dodécyle sulphate (SDS) pour le latex augmentaient la

stabilité de la fraction pigmentaire, on a trouvé que l'agent de dispersion de pigment exerçait une influence nuisible sur la stabilité du latex et même aux concentrations assez faibles, provoquait la floculation du latex. Quoique le SDS augmentait sensiblement la stabilité du latex, on a trouvé qu'il était capable de dissoudre le latex où les conditions favorisaient la formation de micelles.

Stabilität und Flokkulation in einer Latexfarbe. 1: Der Einfluss der Dispergiermittel auf die Teilchenstabilität

Zusammenfassung

Einige überraschende Resultate wurden, hinsichtlich des Dispergiermitteleinflusses, von einer grundlegenden Untersuchung der kolloidalen Stabilität der in einer Aufladung stabilisierten wässrigen Latexfarbe liegenden Teilchen hervorgebracht. Es wurde gefunden, dass obwohl das Pigment- und auch das Latexdispergiermittel, bzw. Natriumhexameta-phosphate (SHMP) und Natriumdodezylsulfat (SDS), die

Pigmentstabilität verbessert, wirkte das Pigmentdispergiermittel einen schädlichen Einfluss auf die Latexstabilität und verursachte zu etwa niedriger Konzentration Latexflokulation. Während im allgemeine das SDS die Latexstabilität bedeutsam verbessert, befand man, dass es fähig war, wenn die Bedingungen die Micellenbildung erlaubten, das Latex zu lösen.

Introduction

Refs. 1, 3-12, 21

This paper and part 2 to follow derive from a project undertaken to determine the factors affecting particle

stability during storage as well as particle flocculation during the drying of a latex paint.

In spite of the realisation of the importance of colloid chemistry in latex paint formulation, there has been as yet no integrated, fundamental colloid chemical investigation

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of latex paints. Publications on the individual colloidal behaviour of pigment or latex are abundant in the literature (e.g. references 1 and 21), yet few of these involve systems used commercially. It appears to be usually assumed that since the pigment dispersant is negatively charged, it will have negligible influence on the stability of a negatively charged latex. We wish in this paper to question that assumption.

In order to perform such a study it was necessary to choose a model system and appropriate experimental techniques. Given the present state of knowledge in colloid chemistry, it was decided to study a charge stabilised emulsion paint system.

The system selected consisted of a vinyl acetate homopolymer (PVAc) latex with sodium dodecylsulfate (SDS) as its dispersant, and an alumina surface treated rutile pigment (AT-rutile) whose dispersant was sodium hexametaphosphate (SHMP). The experimental methods used were electrophoretic mobility measurements and adsorption studies, which have both been extensively described and discussed elsewhere³⁻⁶. Only those aspects related to stability and flocculation will be considered in this paper.

Theoretical

The stability of a colloidal dispersion with respect to flocculation is indicated by the magnitude of the stability ratio, *W*. This describes the bi-particulate interaction leading to aggregation and is given approximately by:

$$W = 2R \int_0^{\infty} \frac{\exp(V_T/kT)}{(H + 2R)^2} dH \dots \dots \dots (1)$$

Where *R* is the particle radius, *H* the perpendicular distance between the two interacting particle surfaces, *k* is Boltzmann's constant, *T* the absolute temperature, and *V_T* the total potential energy of interaction between the particles. By the Derjaguin-Landau-Verwey-Overbeek (DLVO) theory⁷, *V_T* is a summation of *V_R*, the repulsive electrostatic energy arising from double-layer interaction, and *V_A*, the attractive energy deriving from van der Waals forces, being dependent upon the nature of the interacting particles only.

$$V_T = V_A + V_R \dots \dots \dots (2)$$

From equations (1) and (2) at low electrolyte concentrations where *V_A* can be safely assumed to be constant, it is clear that *W* increases as *V_R* increases, so that a rise or fall in *V_R* implies a rise or fall in stability. Effectively any experimental method that makes it possible to determine changes in *V_R* by measurement of zeta potential (electrokinetic potential), ξ , will allow qualitative and maybe semi-quantitative assessment of changes in stability.

The theories of the electrical double layer as enunciated in the works of Helmholtz⁸, Gouy⁹, Chapman¹⁰ and later modified by Stern¹¹, allow assignment of two potentials in the double-layer around a charged particle, viz: ψ_0 the surface (wall) potential, and ψ_d the Stern plane potential.

By means of a technique such as micro-electrophoresis, which measures the particle electrophoretic mobility, *U*, it

is possible to calculate ξ exactly. If the assumption is made that the shipping plane in the electrophoretic measurements is the same as that for particle collision, then the ξ potential may be used in *V_R* calculations. It is also probable that the ξ potential is nearly the same as ψ_d . The ξ potential can, in many cases, be evaluated from the Henry¹² equation, which for non-conducting particles is:

$$\xi = \frac{U6\pi\eta}{\epsilon} \frac{1}{[1+0.5f(\kappa R)]} \dots \dots \dots (3)$$

Where η is the solution viscosity, ϵ the dielectric constant, and *f*(κR) is the Henry term dependent on the ionic strength which determines the Debye-Hückel parameter, κ . In Equation (3), ξ will rise or fall with *U* at constant ionic strength. Using Equation (3) permits estimates of ξ to be made and hence predictions of stability.

Experimental

Refs. 3-6, 14

Reagents

The water used was triple distilled, and the pH was adjusted by the addition of AR grade ammonium hydroxide.

The SDS was supplied by Cambrian Chemicals Ltd and although of technical grade it was found to be of very high purity as determined by surface tension measurement and methylene blue titration. The critical micelle concentration (cmc) was 8.03×10^{-3} mol dm⁻³ at $25.0 \pm 0.2^\circ\text{C}$. It was used without further purification.

The polyphosphate (SHMP) was obtained from BDH Chemicals Ltd and was found to have a molecular weight, *M_w*, of 2.02×10^3 by viscometry in aqueous sodium bromide solution, using the method described by Strauss *et al*¹³. The concentrations of SHMP quoted in this paper were calculated on the assumption that the corresponding number average molecular weight, *M_n*, is 1700.

Materials

Pigment The pigment was an alumina surface treated rutile (AT-rutile) supplied by courtesy of BTP Tiioxide Ltd. This pigment had a surface area of approximately 15.6 m² g⁻¹ as measured by the nitrogen BET method. The mean particle diameter was $0.25 \pm 0.03 \mu\text{m}$ as found by transmission electron microscopy and $0.28 \mu\text{m}$ by X-ray sedimentation; the latter measurement was determined by BTP Tiioxide Ltd Central Laboratories.

Latex PVAc latex was prepared in the laboratory by seeded emulsion polymerisation of vinyl acetate monomer supplied by courtesy of Dr E. L. Zichy of ICI Ltd, using SDS as the emulsifier and AR grade ammonium persulfate and sodium metabisulfite as initiator⁶. The undiluted latex was 40 per cent wt/wt in concentration. The particle diameter was determined by transmission electron microscopy to be $0.26 \pm 0.02 \mu\text{m}$. For the purpose of the investigations described hereafter, this latex was dialysed exhaustively against distilled water until a constant pH and conductance were attained (12 days). Conductimetric titration of the ion exchanged PVAc latex indicated the presence of strong and weak acid surface groups which were attributed to sulfate (SO₄⁻), sulfonate (SO₃⁻) and carboxyl (CO₂⁻) groups⁵. The number average molecular weight of the polymer was 1×10^6 .

Experimental methods

Electrophoretic mobility measurements Mobility measurements were performed by means of a carefully standardised¹⁴ Pen Kem Inc. Laser Zee Meter (Model 400 A). Investigations were carried out on the pigment (AT-rutile) and latex (PVAc) as a function of the concentration of the individual dispersants and also in mixed dispersant systems. Whenever mixed dispersant systems were used, the solid (latex or pigment) was first dispersed in its "normal" dispersant before adding the other ("antagonist") dispersant. Full details of these experiments are available elsewhere^{3,5,14}. Mobility measurements were also performed on the pigment and latex dispersions as a function of time.

The pigment dispersions for electrophoretic measurements were made by dispersing 0.05 g ultrasonically in 75 cm³ of dispersant solution at pH 8 using a 19 mm titanium probe at 20 kHz and 60 μ m amplitude for 5 minutes. The resulting dispersion was transferred to a 1 dm³ volumetric flask and addition solutions and/or water added to make the final volume 1 dm³ and the pH 8.00 ± 0.05 .

Results and discussion

Refs. 3, 5

Effect of dispersants on pigment and latex stability

The electrophoretic mobilities of AT-rutile and PVAc latex as a function of the individual dispersant concentrations are shown in figures 1 and 2. In each figure the point corresponding to zero dispersant concentration corresponds to the mobility, U , of the material at pH 8.00 ± 0.05 in the absence of dispersants. In the assessment of the effect of each dispersant it is worth noting that for the polyphosphate (SHMP) an equilibrium concentration of approximately 6×10^{-4} mol dm⁻³ corresponds to about 1 per cent wt/wt SHMP based on AT-rutile (pigment) weight, while for SDS, 1×10^{-3} mol dm⁻³ is equivalent to 1 per cent wt/wt based on PVAc latex weight. The foregoing concentration values were arrived at by using experimental adsorption isotherms published elsewhere^{3,5}.

In Figure 1 it can be seen that the electrophoretic mobility of AT-rutile pigment is negative and generally, when the dispersant concentration is less than 1 per cent wt/wt (the maximum usually tolerated in an emulsion paint), the effect of SHMP and SDS is to make the mobility more negative. Therefore, it can be said that both SHMP and SDS improve the stability of the AT-rutile pigment. This improvement in stability arises from the specific adsorption of SHMP or SDS by the pigment.

In Figure 2, the effects of SDS and SHMP on the mobility of PVAc latex are seen to be opposite. Increases in SDS make the mobility of the latex more negative, whereas SHMP causes the opposite effect. Hence, SDS improves the stability of the PVAc latex while SHMP decreases it. In fact SHMP is so detrimental to the stability of the latex system that in the absence of SDS the latex flocculates rapidly when the SHMP concentration exceeds 2×10^{-4} mol dm⁻³. This rapid drop in the mobility of the latex could be due to adsorption of sodium ions into the inner region of the double-layer (Stern layer) of the latex/solution interface together with the effect of the rapid

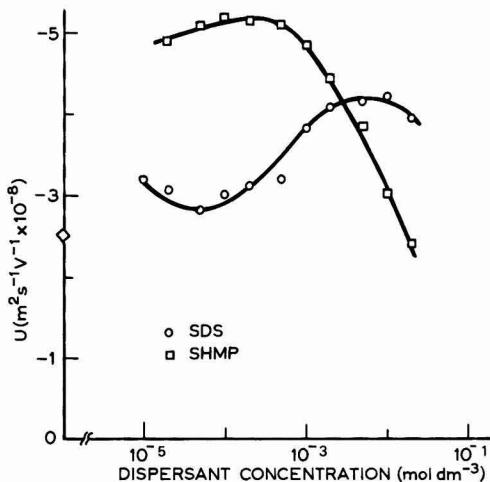


Figure 1. The mobility of AT-rutile as a function of dispersant concentration at pH 8.00 ± 0.05 and $25.0 \pm 0.2^\circ\text{C}$

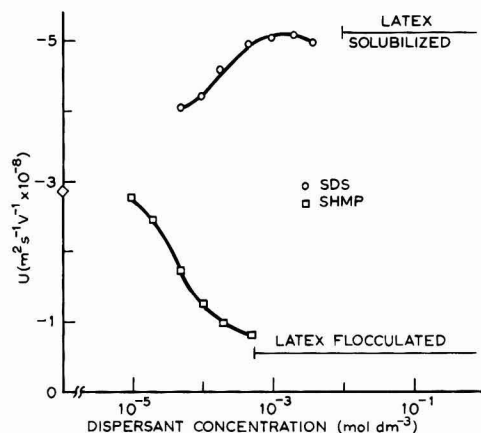


Figure 2. The mobility of PVAc latex as a function of dispersant concentration at pH 8.00 ± 0.05 and $25.0 \pm 0.2^\circ\text{C}$

increase in κ . Further inspection of Figure 2 shows that although SDS improves latex stability it does not do so throughout the concentration range; and when the concentration of SDS exceeds the cmc which is at 8×10^{-3} mol dm⁻³, the SDS tends to dissolve the latex. Solubilisation of the latex was evidenced by the observation that the latex dispersion became transparent without any flocculation or sedimentation taking place. Thus the influence of SDS on the stability of the PVAc latex is favourable only if precautions are taken to keep the equilibrium concentration of SDS below the cmc. Some ξ potential values calculated from electrophoretic mobility values using Equation (3) are shown in Table 1. For particles having the same sign of potential, a ξ potential value of 25/mV is usually sufficient to ensure adequate stability at low ionic strength.

Since in our model latex paint system SDS is the

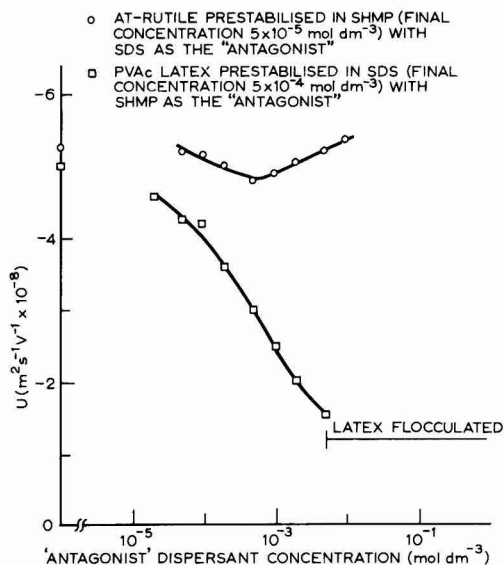


Figure 3. The mobility of pigment and latex pre-stabilised in their "normal" dispersants as a function of "antagonist" dispersant concentration at pH 8.00 ± 0.05 and $25.0 \pm 0.2^\circ\text{C}$

Table 1
Some converted ξ potential values for AT-rutile and PVAc latex

AT-rutile (pH 8.00 ± 0.05 , $25.0 \pm 0.2^\circ\text{C}$)		
SDS concentration (m mol dm ⁻³)	Mobility (m ² s ⁻¹ v ⁻¹ × 10 ⁻⁸)	ξ potential (mV)
0	-2.65	-52
1.0	-3.85	-58
5.0	-4.19	-62

PVA latex (pH 8.00 ± 0.05 , $25.0 \pm 0.2^\circ\text{C}$)		
SDS concentration (m mol dm ⁻³)	Mobility (m ² s ⁻¹ v ⁻¹ × 10 ⁻⁸)	ξ potential (mV)
0	-2.80	-58
1.0	-5.00	-75
5.0	-4.91	-70

"normal" dispersant of the latex, SDS can be regarded as the "antagonist" dispersant with respect to the pigment (AT-rutile), and conversely SHMP being the "normal" dispersant of the pigment it is the "antagonist" dispersant with respect to the latex.

The electrophoretic mobilities of the latex and the pigment in mixed dispersant solutions, that is, solutions containing the "normal" as well as the "antagonist" dispersants, are shown in Figure 3. It is important to remember that in all cases the pigment or latex was first dispersed in its "normal" dispersant before the addition of the "antagonist" dispersant.

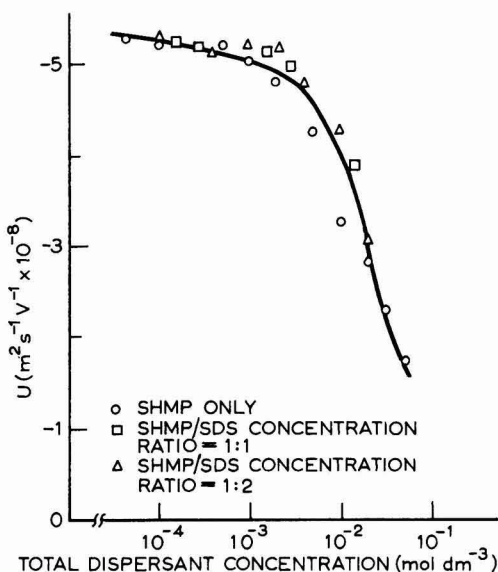


Figure 4. The mobility of AT-rutile in mixed dispersant solutions at fixed ratios of SHMP to SDS concentrations at pH 8.00 ± 0.05 and $25.0 \pm 0.2^\circ\text{C}$

As far as mobilities of pigments in mixed dispersants are concerned it is worthwhile to consider the following two separate series of experiments:

1. Mobilities of pigments and latex in solutions where the concentration of the "normal" dispersant is constant while the "antagonist" dispersant concentration is varied.
2. Mobilities of pigment and latex in solutions where the ratio of the "normal" to the "antagonist" dispersant is constant but the total dispersant concentration is varied.

Mobility curves for case 1 above are shown in Figure 3 for both the pigment and the latex. The chosen concentration of "normal" dispersant for the pre-stabilisation of pigment or latex was that which gave the maximum mobility for the minimum amount of dispersant (5×10^{-5} mol dm⁻³ SHMP for pigment, and 5×10^{-4} mol dm⁻³ SDS for latex). It is evident in Figure 3 that the mobility of the PVAc is very sensitive to SHMP because in spite of pre-stabilisation with SDS, the latex is flocculated when the SHMP concentration exceeds 2×10^{-3} mol dm⁻³. On the other hand, the mobility and hence the stability of the pigment is only negligibly affected by SDS when it is pre-stabilised with SHMP.

Figures 4 and 5 show the influence of total dispersant concentration on the mobility of pigment and latex in mixed solutions at constant ratios of "normal" to "antagonist" dispersants. In Figure 4, the presence of SDS has a very small effect on the mobility of the pigment. In Figure 5 it can be seen that when the ratio of SDS to SHMP is constant, the PVAc latex is not flocculated by ratios shown in the Figure. This is because, since the mobility is related to the ξ potential, the potential lowering

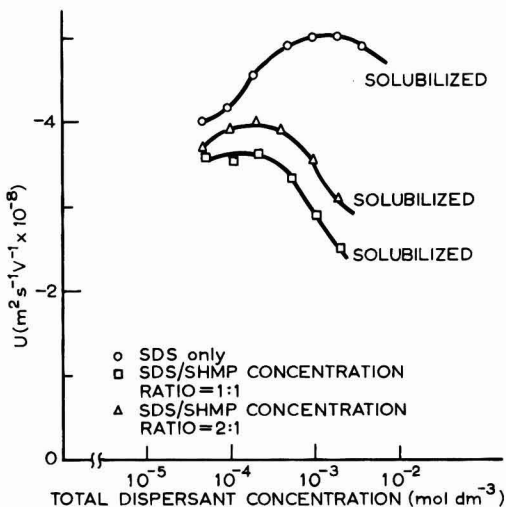


Figure 5. The mobility of PVAc latex in mixed dispersant solutions at fixed ratios of SDS to SHMP concentrations at pH 8.00 ± 0.05 and $25.0 \pm 0.2^\circ\text{C}$

effects of SHMP are counterbalanced by potential raising effects of SDS. SHMP also lowers the SDS concentration at which latex solubilisation occurs. This is because SHMP lowers the cmc of SDS giving rise to the presence of micelles, which are responsible for the phenomenon of solubilisation, at lower concentrations than in the case of SDS alone.

The results reported above show that SHMP tends to flocculate the PVAc latex while SDS solubilises the latex. Therefore, for good paint storage stability the SHMP concentration should be kept as low as pigment stability will allow, while the concentration of SDS has to be low enough to avoid adsorbed SDS problems with the latex. The mobility variations of the latex with time are shown in Figure 6. The preceding considerations suggest that one of the sources of instability in an emulsion paint is the progressive hydrolysis of the ionic groups on the latex. In fact in the presence of SHMP, hydrolysis would render the latex even more sensitive to flocculation.

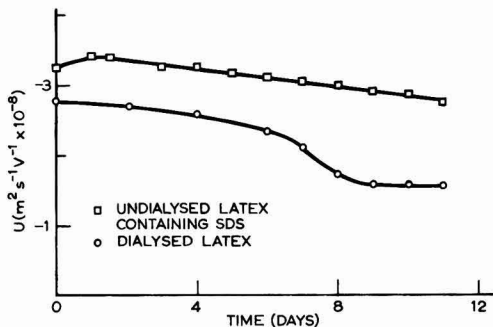


Figure 6. The mobility of diluted PVAc latex as a function of storage time at pH 8.00 ± 0.05 and $25.0 \pm 0.2^\circ\text{C}$

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Organosilanes as adhesion promoters for organic coatings. Part 2: silanes in the paints

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Summary

Organosilanes of the general formula $R-Si(OR)_3$ have been examined as adhesion promoters for two-pack urethane and epoxide paints on aluminium and mild steel substrates when incorporated into the paints prior to application. The silanes are effective at concentrations between 0.1 and 0.6 per cent by

weight and produce major improvements in the initial, wet and recovered bond strengths. Improvements in the bond strengths after exposure to other hostile environments were observed. Long-term storage tests have shown the improvements to be maintained over a period of two years.

Keywords

Types and classes of coatings and allied products

epoxy coating
urethane finish

Raw materials for coatings

miscellaneous paint additives

adhesion promoter

Properties, characteristics and conditions primarily associated with dried or cured films

adhesion

Les organosilanes en tant que promoteurs d'adhérence en revêtements organiques. 2ème. Partie

Résumé

On a étudié les organosilanes de formule générale $R-Si(OR)_3$, en tant que promoteurs d'adhérence où ils sont préalablement incorporés en peintures uréthannes à deux emballages ou époxydes pour subjectiles en aluminium ou en acier doux. Les silanes sont efficaces aux concentrations à 0,1 de 0,6% par poids, et assurent les améliorations importantes à l'égard de la

force d'adhérence initiale, à l'état humide, et après récupération. On a noté les améliorations de la force d'adhérence après l'exposition à d'autres environnements nuisibles. Les essais après stockage de longue durée ont montré que les améliorations persistent pendant un intervalle de deux ans.

Die Organosilane als Haftvermittler für organische Beschichtungen. Zweiter Teil

Zusammenfassung

Organosilane der allgemeinen Formel $R-Si(OR)_3$ wurden als vorgemischten Haftvermittler in zweikomponenten Urethan- oder in Epoxidlacken für Substraten aus Aluminium oder niedriggekohlten Stahl untersucht. Die Silane sind effektiv zur Konzentrationen von 0,1 bis 0,6 Gewichtsprozent, und liefern

wichtige Verbesserungen des Anfanges-, Nass-, wiedergewonnen Haftvermögen. Verbesserungen der Haftvermögen wurden nach Auslegung den anderen feindlichen Umgebungen bemerkt. Die nach Langzeitlagerung durchgeführten Versuche zeigten dass die Verbesserung während zweier Jahre bleiben.

Introduction

Refs. 1-3

It was demonstrated in a previous paper¹ that the use of organo-functional silanes of the general formula $R-Si(OR)_3$ as pretreatment primers for polyurethane and epoxide paint on aluminium and mild steel substrates resulted in a dramatic improvement in initial adhesion. Further, it was shown that this improvement persisted after exposure to cyclic humidity and accelerated weathering cycles. The method of application chosen was to apply the selected silanes from a dry methyl ethyl ketone solution and subsequently rinse in distilled water. Obviously this method is labour intensive and potentially

open to abuse, particularly if large areas were to be coated. It must be considered to be a major advantage if the silane adhesion promoter could be incorporated into a surface coating as a single-pack self-bonding component.

If such a concept were to be successful, then three major conditions must be met. First, the silane must be capable of migrating to the paint/substrate interface, second, it must be stable on the shelf, i.e. improvement in adhesion must be maintained over a practical period, and third, the silane must either be effective on all substrates, or not actively cause a deterioration in adhesion on a particular substrate. That the first condition can be met has been demonstrated for n-beta aminoethyl aminopropyltrimethoxysilane incorporated into a vinyl

paint², and that the second is possible for a period of nine months has been demonstrated in the case of the same silane and γ -methacryloxy propyltrimethylsilane in polyurethane and epoxide paints³. That the third condition may prove difficult has been shown in reference 2 where not all the silanes tested were effective and some actually produced a reduction in adhesion.

This present paper describes work undertaken to examine the possibility of incorporating silanes into two-pack polyurethane and epoxide paints while maintaining the major improvements in adhesion resulting from their use as pretreatment primers. It presents fresh and more detailed evidence for the conclusions reported in reference 3.

Experimental

Ref. 1

The materials, substrates, test methods, and surface and panel preparation were as previously described¹ with only minor modification.

Paint preparation

The silane adhesion promoters were added to the pigmented base components of the two paints and incorporated by vigorous manual stirring *immediately* prior to the addition of the curing agent. After further manual stirring, the paints were applied within 15 minutes of the addition of the silane.

Testing methods

Adhesion The basic torque shear test remained unaltered but where a "wet" adhesion test was performed, the adhesive used was a high viscosity cyanoacrylate, IS 150. The specimens were bonded in a cabinet maintained at 100 per cent relative humidity and allowed to cure for two hours before individual panels were removed for test.

Exposure tests In addition to the tests previously described, an immersion test was carried out in which the panels were totally immersed in distilled water for a period of 1000 hours and unless otherwise stated allowed to recover for 48 hours at room temperature and humidity before testing.

Experimental results

Refs. 4, 5

Effect of silane addition on initial bond strength

In order to establish the amount of silane required to produce an improvement in initial bond strength, additions of 0.1, 0.2, 0.4, 0.6, 0.8 and 1.0 per cent by weight of silane on the total weight of paint were made. The paints were applied to degreased aluminium and mild steel and tested by the torque shear technique. Reference to Table 1 will show the measured bond strengths to aluminium. Clearly the addition of the silanes improved the bond strengths of both paints. The γ -mercaptopropyl trimethoxysilane was effective at loadings of 0.2 per cent and above in both paints, with no marked advantage at the higher loadings, and the n-beta aminoethyl aminopropyltrimethoxysilane was effective at the 0.1 per cent level. In general the higher bond strengths were achieved by the use of the latter silane. It is interesting to

Table 1
Effect of silane addition on bond strength to aluminium - torque shear

Promoter paint	% Addition	Bond strength		
		MPa	psi	Area of detachment
γ -mercaptopropyl trimethoxysilane/polyurethane	none	29.1	4230	100
	0.1	31.7	4600	80
	0.2	41.6	6040	20-90
	0.4	43.1	6250	10-60
	0.6	40.3	5850	80
	0.8	37.3	5410	20-100
	1.0	38.2	5550	30-80
n-beta aminoethyl aminopropyltrimethoxysilane/polyurethane	0.1	47.9	6960	0
	0.2	47.1	6840	0
	0.4	49.3	7150	0
	0.6	48.8	7090	0
	0.8	47.4	6880	0
	1.0	48.0	6970	0
γ -mercaptopropyl trimethoxysilane/epoxide	none	30.6	4400	100
	0.1	36.4	5280	0-60
	0.2	46.8	6800	0
	0.4	44.1	6400	0
	0.6	45.5	6600	0
	0.8	46.8	6800	0-5
	1.0	49.6	7200	0-5
n-beta aminoethyl aminopropyltrimethoxysilane/epoxide	0.1	47.0	6820	0-5
	0.2	48.2	7000	0
	0.4	49.6	7200	0
	0.6	48.2	7000	0
	0.8	48.2	7000	0
	1.0	49.6	7200	0

note that in only one case did any detachment occur on the panels coated with paints containing n-beta aminoethyl aminopropyltrimethoxysilane.

The bond strengths measured on the mild steel panels are shown in Table 2 from which it can be seen that both silanes materially improved the initial bond strength. The maximum bond strengths were achieved at loadings of 0.4-0.6 per cent for γ -mercaptopropyl trimethoxysilane in both the polyurethane and epoxide and 0.1 per cent for n-beta aminoethyl aminopropyltrimethoxysilane. There was no advantage to be gained by increasing the loading above 0.6 per cent for either silane and in general the higher bond strengths were obtained by the use of the latter silane.

Effect of water on bond strength

For these and subsequent tests a more limited range of silane additions was selected:

Aluminium/polyurethane

0.4 per cent γ -mercaptopropyl trimethoxysilane, 0.1 and 0.2 per cent n-beta aminoethyl aminopropyltrimethoxysilane

Aluminium/epoxide

0.1 and 0.2 per cent γ -mercaptopropyl trimethoxysilane, 0.1 and 0.2 per cent n-beta aminoethyl aminopropyltrimethoxysilane

Table 2

Effect of silane addition on bond strength to mild steel – torque shear

Promoter paint	% Addition	Bond strength		Area of detachment
		MPa	psi	
γ -mercaptopropyl trimethoxysilane/polyurethane	none	30.7	4460	20-100
	0.1	35.5	5160	20-80
	0.2	38.2	5550	10-100
	0.4	40.3	5850	20-30
	0.6	40.6	5900	20
	0.8	43.2	6270	30
	1.0	39.5	5730	20
n-beta aminoethyl aminopropyltrimethoxysilane/epoxide	0.1	47.9	6960	15
	0.2	45.5	6600	0-20
	0.4	47.4	6880	80
	0.6	42.4	6150	0-100
	0.8	42.4	6150	50
	1.0	45.1	6550	0-30
γ -mercaptopropyl trimethoxysilane/epoxide	none	31.5	4570	100
	0.1	36.0	5230	10-80
	0.2	36.6	5320	5-70
	0.4	39.1	5680	5-100
	0.6	40.4	5860	40-90
	0.8	40.3	5850	0-20
	1.0	40.2	5820	10-50
n-beta aminoethyl aminopropyltrimethoxysilane/epoxide	0.1	41.0	5960	30
	0.2	40.4	5870	80
	0.4	40.8	5920	20-80
	0.6	35.6	5170	90
	0.8	38.2	5550	80
	1.0	40.0	5800	30-100

Mild steel/polyurethane

0.4 per cent γ -mercaptopropyl trimethoxysilane, 0.2 and 0.4 per cent n-beta aminoethyl aminopropyltrimethoxysilane

Mild steel/epoxide

0.6 per cent γ -mercaptopropyl trimethoxysilane, 0.2 and 0.4 per cent n-beta aminoethyl aminopropyltrimethoxysilane

Selected silane/paint combinations were applied to both degreased and grit blasted panels.

Water immersion tests on aluminium panels

Reference to Table 3 will show the torque shear values for the paints applied to degreased and grit blasted aluminium panels after 1000 hours immersion. The control values clearly show that all the silane containing paints had a higher bond strength than the non-silane containing paints on both surface preparations, and the values for the polyurethane paints containing silanes on the degreased panels were slightly greater than the non-silane containing paint on the grit blasted panel. The extent of the improvement was masked by the failure to detach paint on some panels, notably the epoxide paints and the

polyurethane on the grit blasted panels. Generally, the values obtained on panels coated with the paints containing n-beta aminoethyl aminopropyltrimethoxysilanes were higher than those for paints containing γ -mercaptopropyl trimethoxysilane at the same or lower loading levels.

The "wet" bond strength values (measured while still water-soaked) showed a considerable reduction due to water immersion of the polyurethane paints; the values for the paints containing silane were only slightly higher than for the non-silane containing paint on the degreased panels. On the grit blasted panels the values were much higher and in the case of the paints containing silanes no detachment occurred.

The values recorded for the epoxide paints on degreased aluminium were considerably higher for the paints containing silane, and for the n-beta aminoethyl aminopropyltrimethoxysilane containing paints no detachment was recorded. This must be considered to be an impressive result on a degreased substrate. No detachment was recorded on the grit blasted panels for the paints containing both silanes.

The values for the "recovered" bond strengths for all the paints containing silane, with one exception, were high and greater than the "wet" bond strengths. The exception being the polyurethane paint containing 0.2 per cent of n-aminoethyl aminopropyltrimethoxysilane on the degreased panel which showed no recovery, although the measured bond strength was acceptably high.

It should be noted that no paint was detached from any of the grit blasted panels coated with paints containing silane at any stage in this experiment.

Water immersion tests on mild steel panels

Reference to Table 4 will show the torque shear bond strengths recorded on the degreased and grit blasted mild steel panels in the water immersion tests.

With only one exception the initial bond strengths of the paints containing silane were higher than the non-silane containing paints.

The "wet" adhesion values for the polyurethane paints containing silanes were all well in excess of the non-silane containing controls, particularly those on the grit blasted panels, where little or no paint was detached. Obviously the actual adhesion was in excess of the values quoted. The recovered adhesion values showed that the non-silane containing control paint failed to recover, whereas all but the paint containing 0.2 per cent of the n-beta aminoethyl aminopropyltrimethoxysilane showed a considerable recovery.

In the case of the epoxide paints, the "wet" adhesion values of those containing silane were greater than for the non-silane containing controls, and in fact the values for the silane containing paints on the degreased panels were greater than for the non-silane containing control on the grit blasted panel. The value for the paints containing 0.1 per cent of n-beta aminoethyl aminopropyltrimethoxysilane indicated an apparent improvement in adhesion under water-soaked conditions, not only was the value higher than the control but no paint was detached. The recovered adhesion values were uniformly high for the silane containing paints.

Table 3
Wet and recovered bond strengths of paints containing silanes - aluminium, torque shear

Silane addition	Surface preparation	Controls			Wet adhesion			Recovered adhesion		
		MPa	psi	Area of detachment	MPa	psi	Area of detachment	MPa	psi	Area of detachment
Polyurethane paint										
None	degreased	29.1	4220	90	7.3	1350	100	6.2	900	100
0.4% γ -mercaptopropyl trimethoxysilane	degreased	33.8	4900	90	12.5	1820	100	31.7	4600	100
0.1% n-beta aminoethyl aminopropyltri-methoxysilane	degreased	36.2	5260	100	10.1	1470	100	14.6	2120	100
0.2% n-beta aminoethyl aminopropyltri-methoxysilane	degreased	37.6	5460	30	20.0	2900	100	20.0	2900	100
None	grit blasted	33.1	4800	100	31.1	4520	5-10	36.9	5350	20-60
0.1% n-beta aminoethyl aminopropyltri-methoxysilane	grit blasted	44.2	6420	0	39.7	5760	0	48.2	7000	0
0.2% n-beta aminoethyl aminopropyltri-methoxysilane	grit blasted	45.6	6620	0	39.1	5680	0	46.8	6800	0
Epoxide paint										
None	degreased	27.6	4000	100	6.7	970	100	16.5	2400	10
0.1% γ -mercaptopropyl trimethoxysilane	degreased	32.0	4650	80	32.6	4730	0-20	44.1	6400	20-80
0.2% γ -mercaptopropyl trimethoxysilane	degreased	45.9	6660	0-5	33.1	4800	0-20	43.1	6250	0-60
0.1% n-beta aminoethyl aminopropyltri-methoxysilane	degreased	45.7	6640	0	41.3	6000	0	46.8	6800	0
0.2% n-beta aminoethyl aminopropyltri-methoxysilane	degreased	47.1	6840	0	41.3	6000	0	42.7	6200	15
None	grit blasted	32.6	4740	40	24.0	3480	20-100	36.1	5240	20-60
0.2% γ -mercaptopropyl trimethoxysilane	grit blasted	45.1	6540	0	38.6	5600	0	49.6	7200	0
0.2% n-beta aminoethyl aminopropyltri-methoxysilane	grit blasted	44.4	6440	0	41.3	6000	0	48.2	7000	0

Other environmental tests on aluminium panels

Reference to Table 5 will show the measured bond strengths of the paints exposed to humidity under condensation conditions and to accelerated weathering.

In every case the bond strengths of the silane containing paints were higher than for the non-silane containing paints and in most cases the difference was considerable, particularly after exposure to humidity. The polyurethane paints on grit blasted surfaces gave particularly high bond strengths and no detachment was recorded.

The improvement in bond strength of the epoxide paints on degreased panels subjected to high humidity was remarkable and clearly indicated the value of using silanes.

Other environmental tests on mild steel panels

Reference to Table 6 will show the measured bond strengths on the mild steel panels. Exposure to humidity caused a marked reduction in the bond strength of the non-silane containing polyurethane paint applied to the degreased panel and this served to highlight the high values of the silane containing paints. Although the adhesion of the coatings was the major point of interest, the panels exposed to humidity were partially stripped using a non-corrosive paint remover and examined for corrosion. As can be seen from the Table, three of the panels coated with silane containing paints were completely free from corrosion although both panels of the non-silane containing controls were relatively heavily corroded. A similar but more marked effect was noted on the panels coated with

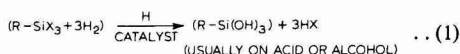
Table 4
Wet and recovered bond strengths of paints containing silanes – mild steel, torque shear

Silane addition	Surface preparation	Controls			Wet adhesion			Recovered adhesion		
		MPa	psi	Area of detachment	MPa	psi	Area of detachment	MPa	psi	Area of detachment
Polyurethane paint										
None	degreased	23.9	3450	100	12.1	1750	100	11.3	1640	100
0.4% γ -mercaptopropyl trimethoxysilane	degreased	32.5	4720	30-100	19.3	2800	100	33.9	4920	100
0.2% n-beta aminoethyl aminopropyltrimethoxysilane	degreased	44.0	6380	0	17.4	2520	70	25.5	3700	100
None	grit blasted	35.0	5070	15	21.3	3090	30	29.3	4250	20-60
0.4% γ -mercaptopropyl trimethoxysilane	grit blasted	45.1	6540	0	30.9	4490	0-5	41.0	5950	0
0.2% n-beta aminoethyl aminopropyltrimethoxysilane	grit blasted	47.0	6820	0	31.3	4550	0	32.7	4750	0-100
0.4% n-beta aminoethyl aminopropyltrimethoxysilane	grit blasted	43.3	6280	0	29.6	4300	0	41.7	6050	0
Epoxide paint										
None	degreased	31.1	4510	30-70	15.8	2300	40	19.1	2770	20-100
0.6% γ -mercaptopropyl trimethoxysilane	degreased	43.0	6240	0	26.3	3820	5	36.4	5290	10
0.1% n-beta aminoethyl aminopropyltrimethoxysilane	degreased	30.0	4350	10-40	31.9	4630	10	35.7	5180	10-80
0.2% n-beta aminoethyl aminopropyltrimethoxysilane	degreased	35.7	5180	10-30	25.4	3690	15	35.5	5180	10-80
None	grit blasted	34.2	4960	25	17.9	2600	20-100	28.7	4170	20-100
0.2% n-beta aminoethyl aminopropyltrimethoxysilane	grit blasted	45.6	6620	0	24.8	3600	15	38.9	5650	0-10

epoxide paints where only the non-silane containing controls showed corrosion. Here again, the measured bond strengths of the silane containing paints were appreciably higher. In general, the higher concentrations of silane resulted in higher bond strengths.

Long-term stability tests

In order to be suitable for a paint, long-term retention of adhesion promoting properties is required. Three factors may militate against this. Silanes are readily hydrolysed according to Equation 1:



With time these silanes condense to form higher molecular weight oligomers which are complex silanols⁴. As it is generally desirable to retain the silane as a monomer or dimer to preserve coupling activity⁵, this condensation is undesirable. Thus silanes are likely to lose their ability to act as adhesion promoters in the presence of water. The presence of water in any paint must be con-

sidered to be a distinct possibility and may arise from commercial solvents and pigments. Thus, if silane containing paints are to function after storage, the system must be dry. This means that either "dry" components must be used or a water scavenger incorporated into the paint.

A second potential source of instability is a reaction with a solvent and a third, reaction with the polymer used as the paint vehicle. These latter factors will be discussed later in the paper.

In order to eliminate water as a factor in long-term stability, water scavengers were added to both the epoxide and polyurethane paint pigmented bases. The scavengers were a mono-functional isocyanate (additive TL ex Bayer UK Ltd) and an ethyl ester of O-formic acid (additive OF also ex Bayer). The additives were used singly in the case of TL, and in combination, TL at 1 and 2 per cent by weight of the base and TL/OP at a 2:1 ratio at a 1 per cent addition. After 24 hours γ -mercaptopropyl trimethoxysilane was added to the epoxide and γ -methacryloxy propyltrimethylsilane to the polyurethane. The paints were stored in sealed containers for a total of two years, samples were removed at intervals, applied to

Table 5
Effect of environment on bond strengths of paints to aluminium – torque shear

Silane addition	Surface preparation	Controls			Humidity (1000 h)			Accelerated weathering		
		MPa	psi	Area of detachment	MPa	psi	Area of detachment	MPa	psi	Area of detachment
Polyurethane paint										
None	degreased	29.1	4220	100	25.8	3750	60-100	24.8	3600	60-100
0.4% γ -mercaptopropyl trimethoxysilane	degreased	33.8	4900	80	41.2	5980	50-100	32.0	4650	5-100
0.1% n-beta aminoethyl aminopropyltri-methoxysilane	degreased	36.2	5260	100	35.1	5100	60-100	38.1	5530	5-50
0.2% n-beta aminoethyl aminopropyltri-methoxysilane	degreased	37.6	5460	40	38.1	5530	20-100	32.7	4750	60-100
None	grit blasted	33.1	4800	0	29.2	4240	60-80	37.9	5500	5-10
0.1% n-beta aminoethyl aminopropyltri-methoxysilane	grit blasted	44.2	6420	0	48.2	7000	0	48.2	7000	0
0.2% n-beta aminoethyl aminopropyltri-methoxysilane	grit blasted	45.6	6620	0	49.6	7200	0	48.2	7000	0
Epoxide paint										
None	degreased	27.6	4000	100	23.8	3450	10-40	31.0	4500	5-20
0.1% γ -mercaptopropyl trimethoxysilane	degreased	32.0	4650	80	43.4	6300	0-20	31.0	4500	5-20
0.2% γ -mercaptopropyl trimethoxysilane	degreased	45.9	6660	0-5	48.2	7000	0	49.6	7200	0
0.1% n-beta aminoethyl aminopropyltri-methoxysilane	degreased	45.7	6640	0	46.8	6800	0	37.9	5500	0-5
0.2% n-beta aminoethyl aminopropyltri-methoxysilane	degreased	47.1	6840	0	46.5	6750	0-5	46.8	6800	0
None	grit blasted	32.6	4740	40	44.8	6500	40	33.4	4850	10
0.2% γ -mercaptopropyl trimethoxysilane	grit blasted	45.1	6540	0	48.2	7000	0	46.2	6700	0-5
0.2% n-beta aminoethyl aminopropyltri-methoxysilane	grit blasted	44.4	6440	0	51.0	7400	0	46.8	6800	0-5

degreased aluminium test panels and tested for bond strength. The bond strength values recorded are shown in Table 7.

Clearly, the paints containing water scavengers retained their improved bond strength over the two year period unlike the paints containing silane without a scavenger, which showed complete loss of improved bond strength after one year of storage. Thus possible long-term storage problems due to water seem to be soluble by the use of water scavenging additives.

Discussion

It is apparent from the data presented that the addition of γ -mercaptopropyl trimethoxysilane and n-beta aminoethyl aminopropyltrimethoxysilane to two-pack epoxide and polyurethane paints prior to their application to mild steel

and aluminium results in a considerable improvement in the adhesion characteristics of both paints.

This improvement is observable in the initial bond strength values measured before exposure to a hostile environment and to the values obtained after exposure to water under immersion conditions, humidity under condensation conditions and accelerated weathering.

Both silanes produced an improvement in bond strength in the two paints and on the two substrates tested.

There is some evidence that the degree of improvement in bond strength may be related to the level of addition and may vary slightly with the silane, paint and substrate. In general the n-beta aminoethyl aminopropyltrimethoxysilane is the more effective adhesion promoter, showing major improvements in bond strength in both

Table 6
Effect of environment on bond strengths of paints to mild steel – torque shear

Silane addition	Surface preparation	Controls			Humidity (1000 h)			Accelerated weathering		
		MPa	psi	Area of detachment	MPa	psi	Area of detachment	MPa	psi	Area of detachment
Polyurethane paint										
None	degreased	23.8	3450	100	7.6	1100	100*	25.1	3650	100
0.2% γ -mercaptopropyl trimethoxysilane	degreased	32.5	4720	30-100	36.5	5300	20-100	30.0	4350	100
0.2% n-beta aminoethyl aminopropyltrimethoxysilane	degreased	44.0	6380	0	23.8	3450	100*	36.2	5250	100
0.4% n-beta aminoethyl aminopropyltrimethoxysilane	degreased	43.1	6260	0	39.4	5720	90	34.5	5000	100
None	grit blasted	35.0	5070	15	28.8	4320	10-30*	43.1	6250	0-5
0.4% γ -mercaptopropyl trimethoxysilane	grit blasted	45.1	6540	0	41.3	6000	0-5*	47.3	6880	0
0.2% n-beta aminoethyl aminopropyltrimethoxysilane	grit blasted	47.0	6820	0	40.6	5900	0-5	47.4	6880	0
Epoxide paint										
None	degreased	31.1	4510	30-70	29.7	4310	10-60*	39.5	5730	5-60
0.6% γ -mercaptopropyl trimethoxysilane	degreased	43.0	6240	0	47.5	6900	0-10	36.0	5230	5-20
0.1% n-beta aminoethyl aminopropyltrimethoxysilane	degreased	30.0	4350	10-40	36.6	5320	5-80	44.8	6500	5
0.2% n-beta aminoethyl aminopropyltrimethoxysilane	degreased	35.7	5180	10-30	40.9	5930	10	39.1	5680	5-30
None	grit blasted	34.2	4960	25	35.5	5050	5-50*	43.7	6350	5
0.1% n-beta aminoethyl aminopropyltrimethoxysilane	grit blasted	36.7	5230	15	41.9	6080	0-20	43.9	6380	5-20
0.2% n-beta aminoethyl aminopropyltrimethoxysilane	grit blasted	45.6	6620	0	44.6	6480	10	48.2	7000	0

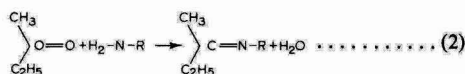
*Some corrosion on the panel

paints when incorporated at the 0.1 per cent by weight level. Although this was the lowest level investigated, it would seem possible that this silane might be effective at a lower loading. The γ -mercaptopropyl trimethoxysilane needs to be added at the 0.4-0.6 per cent level to produce an equivalent improvement.

The bond strengths measured under water-soaked conditions are particularly interesting and indicate a material improvement in the "wet" adhesion of both coatings on both substrates.

The long-term storage tests clearly indicate that a suitably "dried" paint containing silane retains its improved bond strength for periods of at least two years and this would appear to be adequate for all practical purposes. It is worth considering the remaining two factors which could militate against storage stable silane modified paint.

Aminosilanes are known to react with oxygenated solvents such as ketones, commonly used in both polyurethane and epoxide paint formulations. For example γ -aminopropyltrimethoxysilane will react with methyl ethyl ketone to form a ketamine plus highly undesirable water according to Equation 2.



Thus, the potentially interesting silane n-beta aminoethyl aminopropyltrimethoxysilane described previously¹ as a pretreatment primer would be unsuitable for use as an additive in epoxide and polyurethane paints.

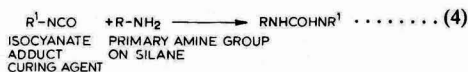
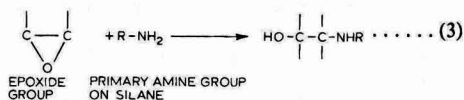
The third potential source of instability is the possible

Table 7
Long term storage tests on the paints containing silanes – torque shear

Silane	Drying agent	Controls			3 Months			12 Months			24 Months		
		MPa	psi	Area of detachment	MPa	psi	Area of detachment	MPa	psi	Area of detachment	MPa	psi	Area of detachment
Polyurethane paint													
None	none	11.8	1710	100	13.6	1980	90	17.9	2600	60	14.7	2130	100
γ -methacryloxy propyltrimethylsilane	none	27.0	3920	30	19.5	2830	50	10.9	2850	90	12.3	1780	100
γ -methacryloxy propyltrimethylsilane	1% TL	26.7	3880	50	31.3	4550	30	39.4	5710	40	34.0	4930	50
γ -methacryloxy propyltrimethylsilane	2% TL	26.0	3770	80	31.3	4550	40	38.8	5630	50	35.5	5140	50
γ -methacryloxy propyltrimethylsilane	2% TL/2% OP	25.2	3660	60	32.0	4650	90	40.6	5890	50	39.7	5760	60
Epoxide paint													
None	none	24.1	3500	10	22.4	3250	50	21.8	3160	70	20.8	3010	80
γ -mercaptopropyl trimethoxysilane	none	32.2	4680	10	27.2	3940	30	23.0	3330	60	20.6	2990	80
γ -mercaptopropyl trimethoxysilane	1% TL	30.7	4450	5	37.1	5380	30	34.2	4960	20	33.9	4920	20
γ -mercaptopropyl trimethoxysilane	2% TL	32.9	4770	0	34.1	4950	30	35.1	5090	30	34.9	5060	30
γ -mercaptopropyl trimethoxysilane	2% TL/1% OP	30.7	4450	10	30.5	4430	80	32.4	4700	40	33.4	4840	20

reaction of a candidate silane with a polymeric component of the paint, either base resin or curing agent.

Examples of such reactions are shown in Equation 3 for the resin reaction and Equation 4 for the hardener:



This latter source of instability may not prove as intractable or limiting as the water and solvent reactions, as the silane may be added to either the base or the curing agent component.

In order, then, to pursue the self-bonding concept, considerable care will be necessary to eliminate water and to select the appropriate silane which will not react to the detriment of its coupling properties with any component of the paint. The two silanes investigated in this present

report appear to be suitable as additives. It must be stressed that the use of any particular silane as an additive must be thoroughly investigated for long-term stability before a final choice is made.

Conclusions

From the work reported it may be concluded that organosilanes function effectively as adhesion promoters when incorporated into paints of the two-pack epoxide and polyurethane type. The improvement in adhesion on initial application applies also to the adhesion under water-soaked conditions and after exposure to other hostile environments.

Long-term stability of paints containing silanes can be achieved by the use of water scavengers and careful selection of solvents.

[Received 22 January 1982

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The future of the refinishing industry*

By A. D. White

Accident Repair Division, Patrick Motors Ltd, Lifford Lane, King's Norton, Birmingham, West Midlands B30 3NX, England

Summary

The difficulties of this section of the motor industry are described.

Customers insist that repairs to accidental damage should be completed in the minimum possible time, whilst at the same time they expect that the repair should exactly match the remainder of the bodywork.

The paint industry is criticised because a development by one

manufacturer is copied by the remainder, with the result that new developments appear and then there is a period of stagnation until some other manufacturer introduces something new and the same cycle is repeated.

The need for better colour matching is stressed and the author considers the future should be bright for this part of the industry, if it is provided with the materials it needs.

Keywords

Types and classes of coatings and allied products

automotive finish

Miscellaneous terms

development

L'avenir de l'industrie de reparation d'automobiles

Résumé

On décrit les difficultés auxquelles ce secteur de l'industrie automobile fait face.

Chaque client exige que la réparation des dégats à la suite d'un accident soit achevée dans le delai le plus bref, tandis qu'en même temps il s'attend à ce que la réparation doit s'accorder exactement avec l'ensemble de la carrosserie.

On critique l'industrie de peintures parceque le moment où un nouveau développement est effectuée par un fabricant, ses con-

currents en font des copies, de sorte qu'une gamme de tels developpements font leur apparence et puis il y a une période de marasme jusqu'à ce qu'un quelconque fabricant introduise quelque chose de nouveau, et alors le même cycle recommence encore une fois.

On souligne le besoin d'un meilleur système de contretypage de couleurs et l'auteur estime, à l'égard de ce secteur de l'industrie automobile, que l'avenir devrait être propice, pourvu qu'il soit fourni des produits dont il en a besoin.

Die Zukunft der Autolackierindustrie

Zusammenfassung

Die gegen überstehenden Schwierigkeiten dieses Industriesektors werden besprochen.

Die Kunden bestehen darauf, dass die Reparatur zu zufälligem Schaden so schnell wie möglich fertiggestellt werden sollen, und zwar die durchgeführte Reparatur mit der übrigen Karrosserie übereinstimmen soll.

Die Lackindustrie wird kritisiert, da eine Entwicklung eines

Fabrikanten von allen seiner Konkurrenten kopiert wird, so dass neue Entwicklungen erscheinen und dann kommt eine Trägheitszeit vor, bis irgendein anderer Fabrikant etwas neues darstellt, und darauf wiederholt sich der selbe Zyklus.

Die Notwendigkeit für bessere Farbarmusterung wird betont und der Autor glaubt, dass die Zukunft hinsichtlich dieses Sektors der Industrie günstig soll, wenn er mit den erforderlichen Gütern beliefert werde.

Before examining the future, it would seem valuable to spend some time looking at the past. In the early days of car production brushed air drying finishes, which were finely varnished, were the norm, and from them, with the advent of the spray gun and compressed air technology, we moved to the more rapid drying nitrocellulose.

As production has increased, the motor car has become the prime factor in people's minds, in that they rely upon its services to the exclusion of most other forms of trans-

port. Personal transport has become the second most expensive purchase in the lives of the population today, the car takes precedence to the exclusion of other things in people's lives.

With the original product, the new motor car, the owner may be justified in criticising the finish. The standard has deteriorated as technology has increased. Considering the product finish of 25 to 30 years ago compared to the finishes of today, the latter would be considered as

*Paper presented at the Thames Valley Section's "Vehicle refinishing" seminar held on 22 October 1981.

undercoat or semi-gloss, for in days gone by gloss was of paramount importance. In the last few years this state of affairs has improved with the advent of the metallic coating with a clear top coat and we now see improved gloss levels that we may be proud of.

The situation as seen from a refinisher allied to a main distributor is as follows. We are subjected to pressures from all sides, firstly there are the sales staff who sit in their palatial offices offering their glossy motor cars for sale and telling the owner "you can have it tomorrow" when the car has not even had the transit wax removed or the pre-delivery inspection (PDI) carried out.

They then have to find excuses to explain to the customer why he cannot take delivery of his pride and joy. Once the PDI is completed the paintwork is checked and it is at the PDI stage that the owner expects delivery of the vehicle. It is then that any work required has to be carried out quickly and the owner is told that he can have the vehicle the next day' in actual fact the problems could take three or four days, hard work to correct. The amount of rectification of factory problems is too high and I would suggest that the paint finish should be examined more closely, as a reduction in the incidence of bad paintwork would improve the sale of motor cars since there would be fewer refinishing problems, especially with regard to the correction of bad colour and finish. Secondly there is the gentleman who is driving his pride and joy along a road and has a collision, which is "never his fault".

The problem is that the motorist relies too heavily on his motor car and to be without it is like having his legs cut off. Of course refinishers realise the inconvenience of being without a set of wheels, but there are times when motorists must do without them. Another aspect of accidents is that the person involved must not be ridiculed for having had such an accident. He will bring the car to the refinishers as soon as possible so that no one else notices the damage, and when he takes the vehicle away after the repair he does not want anyone to know that he has had an accident. The paint must therefore match perfectly and although the car may be 10-12 years old it must look as good, if not better, than when first delivered. He also requires his car to be painted immediately, preferably within the next hour, and therefore the work is performed under extreme pressures to satisfy the motorist's ego.

Turning to what the refinishers are presented with in the way of materials to achieve the impossible - they fall into three broad classes. Firstly the cellulose type modified synthetic with the characteristics of fast drying, fair gloss from the gun, polishability, ease of use, brushability and re-coatability but with the drawbacks of sinkage, poor weathering compared with the original finish, and a long time cycle from start to finish.

Secondly there are the low-baked synthetic finishes which until recently have provided finishes of high gloss, low surface penetration (giving ease of application on suspect substrates) but with problems of spot repair and polishability together with a major problem of re-coatability after a short time.

Thirdly and most recently is the two-pack type material, (the best product given to us by the paint industry), with good hold-up, low surface penetration, rapid dry facility, ease of spot repair and re-coatability and other things desirable in a paint film. On the negative side, however, two-pack material has one great drawback namely high

toxicity. Expensive equipment is required to protect the sprayer as well as secondary personnel. The problem today is that this type of product is being used in the trade without the recommended precautions being taken by body-repairers who in my opinion are un-professional and who are causing our trade to be looked upon as a back-street industry. I consider that not enough thought has been given to possible abuse and that sales of the product should be restricted to professional undertakings having the correct equipment for its use. Its introduction in the last five years has worried many refinishers in that they are polluting the atmosphere with material whose long term effects are not known. We are told that there is no problem: we were told that there was no problem with radiation at one time, but find now there is. What we require today, if use of this type of coating is to continue, is to clean up the product and reduce or eliminate the toxic hardener.

It is not clear how this can be achieved but it must be achieved. Human lives are being put in jeopardy and I would suggest that the paint industry looks very hard at the supply of materials to the refinish trade in order to eliminate the risk to this trade.

Looking at the paint manufacturing industry with the eyes of a refinisher indicates that it is an industry which seems to run along the lines of "follow my leader". One manufacturer does research on a product line or system and all the rest follow, and if one looks back over the last 20 years it can be seen that every three to five years a totally new product emerges from one stable followed next year or the following year by similar products from other suppliers. This stop go syndrome is counter productive and does not effectively present the refinish trade with products which are wholly suited to the problems which we encounter. In the last 15 years the equipment used in our industry has improved out of all recognition. Before this time, spraying of motor cars was being carried out in the open shop with fans in the walls extracting the mist-laden air direct to the outside atmosphere. Now we have booths, fully air-conditioned, warmed to the correct temperature and with air cleaned upon entry and exhaust; this eliminates the problem of dirt or dust deposition on the film and the expelling of dirty air to the outside world. Together with this, ovens are available which enable the temperature of the cars to be raised sufficiently for the applied film to dry off in a speedy manner allowing finishes that are of high gloss requiring little or no polishing and resembling the original finish as closely as it is possible to do so.

Problems always come with good things and with the installation of a spray booth and an oven, the shop usually requires to increase its through-put if it is going to maintain its profitability. They are expensive tools and require large amounts of fuel and in these days of high-cost energy we must demand products which can be dried at very low temperatures. The future requires, therefore, high efficiency spray-booths and ovens and I would suggest that all manufacturers of these products look at this aspect as a priority for the near future.

Turning to the question of colours in refinishing. Each day we are presented with a problem: vehicles produced in a multitude of colours from all parts of the world. There are varying standards of colour control. The vehicle manufacturing industry says that colour plays a major role in the sale of the product, it helps to attract the public into the showroom. But the problems presented to the

refinishing industry are many. Paints are produced by the original manufacturers and sold to the car makers. The problems are in obtaining a refinish product which exactly matches the original and thus gives no indication that the operation has taken place.

Much of the trouble that is experienced in colour matching in the refinish trade is the fault of the paint manufacturers. If only the original product was controlled at source and at the motor manufacturers, and the original finish formulated with the refinisher in mind, problems would be reduced. It is often stated that one cannot get this or that shade because the pigmentation is different from the original material, it cannot be ignored that there is a serious problem created by the paint manufacturers and it is of no use to suggest to the refinisher that if he carried out the application in a particular way or added a tint that he could produce a colour passable to the owner. What the refinisher requires are materials which can be guaranteed to match first time with the least amount of trouble. I realise that the control of technique of application is out of the hands of the paint manufacturers to a great extent, but if a greater control of media and solvent balances were achieved then this phenomenon would be greatly reduced.

The shelves of the refinishers are littered with variants of colours (not including colours where there may be some excuse because the colour is influenced by spraying techniques). These colours may have five, six or even seven variants in a three year life. If the basic colours are not right where is the industry going? With metallics it is always stated that it is operator trouble when the colour varies. Most cars are sprayed by machine but the problem remains – perhaps refinishers have machine problems also? Refinishing would be easier if only paint manufacturers would try to overcome the colour problems that are encountered. My plea for the future regarding colour is to minimise colour variations in the next 20 years – a difficult task but with all the technology available not an insuperable one.

It is very difficult to look into the future in the present era of declining world supplies of fossil fuel, some of which will be exhausted by the year 2000.

“The age of the car is declining with a more efficient public transport system needed.” This is not necessarily true. The world’s supply of energy will continue with new finds of oil or natural gas as well as other alternatives, the costs of these fuels will be greater though and today the use of the motor car has decreased, with fewer gallons of fuel sold and less miles travelled. This in turn reduces the wear and tear on cars and brings down the accident rate – not one for one but about one for three, so that for every accident occurring two years ago the refinisher is faced with a contraction in his industry of about a third. It might be thought that to talk of accidents in this way is regrettable but one person’s misfortune is another’s business. Refinishing sales are directly related to the accident statistics – less accidents mean less paint sold, it is as simple as that. The refinishing industry relies upon bad weather, wet leaves, snow, ice etc. for its income. The refinishing industry does not wish for people to be maimed or injured but it is a fact of life that what is required is a greater use of cars to generate small bumps that injure the car and not the occupants. If one listens to weather experts, then our climate is supposed to be getting colder and we are re-entering an “ice age”, if this is true then the refinishers may be still in business in the year 2000.

At the turn of the century it appears that the materials required for use will have to be relatively cheaper. At present a high price syndrome exists, it does not seem to matter how much the price goes up, they are still used. But with a down-turn in the industry, competition will force more and more manufacturers to look at the waste occurring within their industry. Materials will have to be more easy to use, fool proof in fact. We are in an era of high technology but the trade has always employed people who have not had a great deal of education. However, to look at some of the instructions for new products one would need a degree to work out the mix or the colour formulae. We also need materials which are non-hazardous to the surrounding personnel and inhabitants. We do realise that you can protect the personnel spraying today’s products but in looking forward why should we use hazardous materials when I am sure the technical ability is at hand within the paint industry to produce materials which are not as dangerous as some we have today. We also require materials that will dry with the minimum amount of time and cost, and which may also be applied in the minimum time with facilities which are cheap to provide. Surmising the materials required by the painter in a Utopian future: fast drying in one or two minutes, cost nil, non-hazardous to health or the surroundings, colour perfect, gloss to match the original finish and with a speed of application such that the vehicle may be returned to the owner before the event! A tall order, but I have no doubt that the paint industry can produce it. May I just throw in a few ideas, the costs of oil-based products are constantly rising – what about water. I realise that such materials are unsuitable today but it may help to make an analogy, look at some of the decorative emulsions on the market today in the semi-gloss range and look at the gloss on the motor car produced today, there is not much difference is there?

Sometimes I think that we look at the motor car with “rose coloured spectacles”. The gloss on cars manufactured in most parts of the world is abysmal if we compare it with that of 20 years ago. If we continue on this downward trend the cars of 20 years hence will be painted in matt finish, so marked has the standard declined.

It is easy, I know, to suggest materials to be used; technology advances so quickly and we must be prepared to deal with all future eventualities. Motor cars at present are built of steel, plastics were tried but with high oil costs this form of construction may not be the panacea it was first thought. Aluminium may be used more extensively, together with high tensile steel so as to reduce the weight of the bodyshell to enable better petrol consumption, but we must look for new materials not based on oil or its derivatives that can be produced in a cheap way to reduce the costs of motoring to the public. With the introduction of such materials I do hope that the paint industry reacts quicker than it has done in the past when we have had materials like plastic bumpers being painted with vehicle finishes which flaked off within weeks of application.

I would like to conclude by saying that this industry of multi-million pound sales per year can have a bright future if it provides the correct products at the right time, but it will have to change its thoughts radically, over and over again. We see a bright idea marketed by one manufacturer and then see it copied by the conglomeration, then there is a period of no activity followed by another from some other manufacturer and that, in turn, is copied by the rest.

A comment I constantly hear from people in the manufacturing industry is "I know about that", but perhaps they forget about it and even more possibly think that research is too expensive. I realise this but without this research those in the industry will die or be overtaken by competitors. We have a great industry and I consider it to be the best in the world – let us keep it that way by

paint manufacturers giving refinishers products that work, that are, as I have said before, "fool proof", that are clean and that do not require a degree in science on the part of the operator to use.

[Received 19 November 1981]

Next month's issue

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

Novolac-based soya epoxy esters for surface coatings by *D. Agrawal and A. K. Vasishtha*

High build paints based on chlorinated rubber/coal tar pitch binders by *J. J. Caprari, H. R. Pressa, B. del Amo and C. Lasquibar.*

Stability and flocculation in a latex paint. Part 2: flocculation in the drying paint film by *M. J. Jaycock and G. J. Kayem*

Refinishing over the next ten years by *T. J. C. Tyler*

OCCA meetings

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

West Riding

Trends in the supply of feedstocks for petrochemicals

A lecture meeting of the West Riding Section was held at the Mansion Hotel, Leeds on Tuesday 5 October 1982.

The lecture was given by the Section's Chairman, Mr Ron Chappell of Shell Chemicals (UK) Ltd, and was on the above topic.

Mr Chappell concentrated his talk on the potential changes that may occur in the future supply of organic feedstocks such as oil, gas, coal, etc. He suggested that some of the changes would be affected not only by the changing world economic scene, but also by the attitude adopted by Government.

The speaker went on to give a breakdown, illustrated by slides, of petrochemical demand in Western Europe. A breakdown of the individual feedstocks such as ethylene, benzene and propylene in terms of outlets was also illustrated.

It was shown that plastics was the major outlet for ethylene and propylene and it was suggested that the economics of the petrochemical industry would be determined to a substantial extent by what happens to plastics.

Several examples were given of one polymer replacing another due to feedstock price changes.

Mr Chappell highlighted, with the aid of graphs, the very poor rate of growth in demand for organic chemicals in Western Europe. He predicted that the consumption of typical feedstock will drop significantly in the future as a result of OPEC countries becoming prime suppliers of finished products.

The speaker went on to discuss the types of feedstocks available for cracking. These included: gasoil, naphtha, butane, ethane and liquid propane. The yield and capital costs of the different types of crackers were illustrated. It was shown that ethane crackers were currently the cheapest to run. However, it was suggested that flexible units are becoming more popular.

In the final part of his talk, Mr Chappell gave a resumé of the types of raw materials available and how they may influence the types of feedstocks produced. He also introduced the idea of "biomass" as a potential new raw material source.

In conclusion Mr Chappell predicted that as far as producing feedstocks for chemical and plastics was concerned, oil, or more specifically naphtha, would remain the major feedstock for many years to come. He also suggested that the petrochemical industry would probably invest increasingly in crackers designed for more flexibility since there will be regional preferences for certain feedstocks due to local availability and Government encouraging exploitation of local indigenous resources.

After a lengthy discussion period, the vote of thanks was proposed by Mr T. Wright.

D. V. Maltman

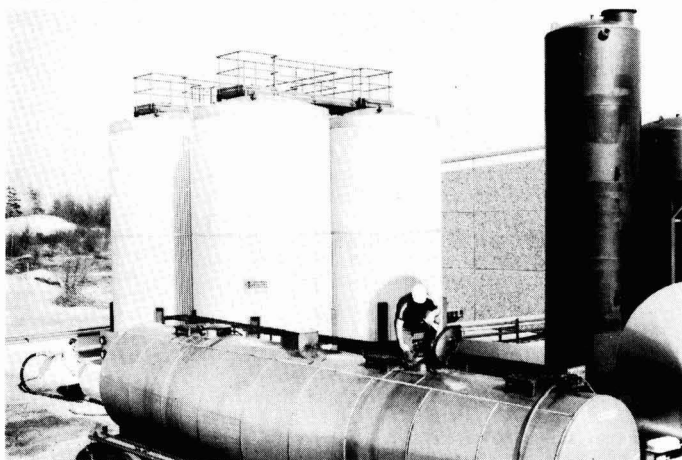
news

New wax production plant

Dussek Campbell, one of the world's largest specialists in blending waxes and related products for industry, has recently opened a new factory in West Germany. Situated at Geesthacht near Hamburg, the plant has been designed to incorporate all the latest wax handling and production techniques, whilst its location is ideal for access to raw materials as well as for servicing Germany and the rest of the continent.

Based in the UK, Dussek Campbell is a subsidiary of Burmah Speciality Chemicals Ltd, a part of the Burmah Oil

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



Transport of heated liquid product at the tank farm



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A. T. G. Rodgers
Chairman Designate
ICI Organics Division.

A. T. G. Rodgers,
Chairman Designate
ICI Organics Division.

Broadening of Dyes & Pigments Manufacturing Profile

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Reactive	Orange bar	Blue bar
Disperse	Orange bar	Blue bar
Acids – mainly for Wool	Orange bar	Blue bar
mainly for Nylon	Orange bar	Blue bar
Directs	Orange bar	Blue bar
Leather	Orange bar	Blue bar
Basics	Orange bar	Blue bar
Modified basics	Orange bar	Blue bar
Premetallised	Orange bar	Blue bar
Sulphur	Orange bar	Blue bar
Vats	Orange bar	Blue bar
Indigo	Orange bar	Blue bar
Solvent	Orange bar	Blue bar
Pigments		
Phthalocyanine blues	Orange bar	Blue bar
Phthalocyanine greens	Orange bar	Blue bar
Azo	Orange bar	Blue bar
Toners	Orange bar	Blue bar
Vat	Orange bar	Blue bar
Inorganic	Orange bar	Blue bar

OD210

The words *Procion*, *Dispersol*, *Nylomine*, *Neutrichrome*, *Solanthrene*, *Monastral*, *Monolite*, *Lutetia*, *Vynamon*, *Polymon*, *Waxoline* and *Thermoplaste* are trademarks.



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Branches and Agencies throughout the world. Service to customers in more than 80 countries.

Group. The company produces over 300 different products including wax coatings and hot melts for packaging, casting waxes, waxes for rubber compounds, telecommunication cable filling and power cable insulating compounds as well as melting and application plant in pursuance of their policy of providing a complete service to industry.

The new Geesthacht factory is the latest addition to Dussek Campbell's operations which are located at Crayford and Bury in England, and also in Canada, Australia and South Africa with sales offices in New Zealand and Singapore.

Reader Enquiry Service No. 31

Readers' views sought on iron and steel protection

The British Standards Institution Technical Sub-Committee BDB/7/1 "Protection of iron and steel structures from corrosion" is considering the need to revise two documents. The secretary, Mr J. B. Stubbs, would welcome the views of all readers. See page 454 (BSI News), 1st column, of this issue for further information.

Reader Enquiry Service No. 32

Ensecote Lithgow purchased by Säkaphen

After 18 years as the UK licensees of the Säkaphen group, whose headquarters are in Gladbeck, West Germany, Ensecote Lithgow Ltd of Buckley has now been purchased by that group and re-named Lithgow Saekaphen Ltd.

Originally known as James Lithgow (UK) Ltd, the company was purchased by Newton Chambers Engineering in 1979 and became a member of the Ensecote Holdings Group in the summer of 1981, changing its name to Ensecote Lithgow Ltd.

The company's activities as one of the leading specialists in the application of anticorrosive coatings and linings will remain unchanged. Production and application of their own well-proven Calvinac coating continues, as does the company's sole UK licence for the Säkaphen range.

Reader Enquiry Service No. 33

Distributor for Binks-Bullows

Binks-Bullows Ltd has appointed Air Power Centre to handle sales, distribution and servicing of spray finishing systems throughout Lancashire and the north west of England. Binks-Bullows claims to be Britain's leading manufacturer of automated spray painting systems. Binks' products are used in all types of manufacturing industry and include hand spray guns as well as sophisticated robots and other automated systems.

Air Power, with offices and service centres in Preston and Liverpool, opened a new centre in Salford on 4 October 1982 to handle their increasing specialist consultancy activities in compressed air products and spray finishing systems.

Reader Enquiry Service No. 34

new products



The new Atlas HPUV Indoor Actinic Exposure System

Accelerated indoor weathering

The colour stability of materials exposed to typical office/store lighting may be studied in the new Atlas HPUV Indoor Actinic Exposure System marketed by Westlairs Ltd.

The HPUV was specifically developed to test thermoplastic components which had been experiencing field failures. Over two years of development work by a major office equipment company, its suppliers and Atlas has gone into the design of the HPUV. Many materials – such as coatings, fibres, dyestuffs, inks, photographic films, plastics and the like – subject to long term indoor lighting exposure may be tested on an accelerated basis in the Atlas HPUV.

Reader Enquiry Service No. 35

New cleaner/degreaser from International

International Paint has introduced a new surface cleaner and degreaser called Spirit Wipe. It is described as being particularly suitable for use on synthetic and acrylic paint surfaces.

The product will remove waxes and silicones as well as general dirt and grease contamination, leading, International claims, to good paint adhesion and, therefore, durability.

Reader Enquiry Service No. 36

Portable filter

A new portable filtration station from Rayscot is aimed at providing a solution to all the intermittent filtration applications around production and pilot plant areas.

Fitted with a suitable pump, the self-contained unit can be moved from one application to the next.

Reader Enquiry Service No. 37

news

New melamine resin

BIP Chemicals has introduced a new isobutylated melamine resin.

Designated BE673, this latest addition to the Beetle range is said by its manufacturer to have an unusual balance of properties in that it cures under both cold and forced conditions in the presence of acid. This makes it a useful crosslinking agent in the formulation of wood finishes or fast curing paper lacquers.

As the sole amino component, and in combination with Beetle alkyd resin BA549, BIP says it can be used in wood finishes where the amino part is at least 70 per cent of the total resin content.

Further, it can also be used in conventional heat-cure finishes or, because of its high tolerance to aliphatic hydrocarbons, in non-aqueous dispersions or as a modifier for long-oil alkyds.

Reader Enquiry Service No. 38

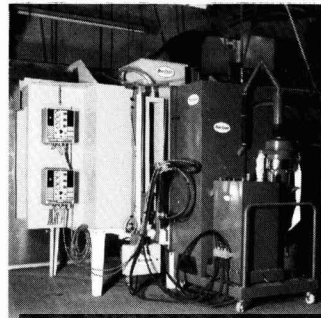
Overspray powder recovery

The range of Nordson Cartridge Booths (NCB) has now been extended.

The efficient recovery of oversprayed powder is the key to powder coating economy. The NCB systems meet this demand.

An example quoted by the manufacturer is for an automatic four gun system working on a single shift, the NCB's high recovery efficiency can represent a saving in powder of the order of £8,000 p.a. over a conventional booth. The small additional cost of a Nordson Cartridge Booth system, it is claimed, is rapidly recovered in only a few months operation.

Reader Enquiry Service No. 39



A Nordson Cartridge Booth

news

New Dead-stop titrators

Schott-Geräte GmbH has extended its range of titration equipment with the introduction of two dead-stop titrators, the TR 151 and the TR 152. The two new models can be combined with one or two piston burettes for all polarisation current titrations in aqueous and non-aqueous solutions. They incorporate fully automatic titration speed controllers which can be switched on when required. As a result, it is claimed, very accurately reproducible determinations can be achieved right up to the end of the titration, even with extremely dilute solutions.

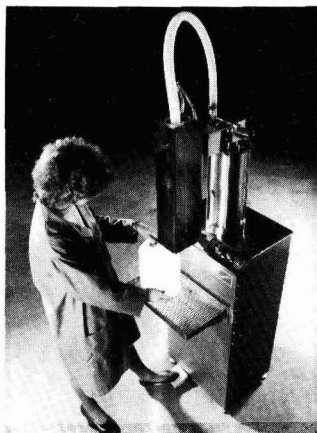
Reader Enquiry Service No. 40

New Bexuda filling machines

Single and twin-headed semi-automatic filling machines are the first of a new range of fillers to be introduced by Bexuda, a division of Paxall.

The new semi-automatic machines will handle non-foaming and foaming liquids of all viscosities and fine solids in suspension. The size of containers filled range from 0.25-5 litres or larger. According to Bexuda the minimum guaranteed accuracy is ± 0.25 per cent by volume on all measures.

Reader Enquiry Service No. 41



Single and twin-headed semi-automatic liquid filling machines from Bexuda

Water jet/spray gun

A new water jet/spray gun is now available from Spray Systems.

Equipped with a squeeze grip hand lever, wide angle fine spray to coarse spray or jet can be produced and held by a locking device if required.

The insulated body of the gun is said to allow comfortable operation with hot or cold liquids, whilst a range of adaptors can be fitted to provide extension lances, interchangeable jets or chemical pick-up etc.

The gun is said to have found ready acceptance in industry wherever water is used in processes or for cleaning.

Reader Enquiry Service No. 42

Antifoam for cooling systems

Houseman (Burnham) Ltd has developed two chemical treatments, Antifoam AFC.42 and Antifoam AFC.43, to specifically reduce foam formation in recirculating cooling water systems.

Reader Enquiry Service No. 43

literature

SSPC publications

The Steel Structures Painting Council (SSPC) has published a study entitled "Survey of Existing and Promising New Methods of Surface Preparation", sponsored by the Maritime Administration in co-operation with Avondale shipyards.

Taking into account the need for efficiency, productivity and the restrictions imposed by government regulations, the SSPC study first reviews the state of the art of surface preparation methods presently used throughout the world, and then describes new approaches to surface preparation such as laser and xenon lamps, plasma hot gas, cavitation, ultrasonic cleaning, zinc shot blasting and many others.

The study identifies new methods that warrant further investigation and suggests means by which such investigations can be carried out.

Also from SSPC is a study entitled "Evaluation of Low-Solvent Maintenance Coatings for Structural Steel", sponsored by the Federal Highway administration.

This SSPC study makes recommendations about the timing of regulations restricting the use of organic solvents in coating formulations for structural steel, and describes the adaptations that industry and government must face in procurement, costs, application, and exposure zones, should the use of volatile organic compounds be more widely restricted.

The report reviews the state of the art for water-based coatings, zinc-rich paints, alternative solvents, high solids coatings, non-silica blast media, and non-lead, non-chromate inhibitive pigments.

Both publications are available at US\$40 each from the SSPC, 4400 Fifth Avenue, Pittsburgh, PA, 15213, USA.

Reader Enquiry Service No. 44

Quality circles

BNA Communications Inc. has made available a video cassette of its "Implementing Quality Circles".

A special edition of the programme exists covering non-manufacturing organisations.

Reader Enquiry Service No. 45

Production line electrophoretic priming

Electrophoretic priming of industrial components, vehicles, domestic appliances, earthmoving equipment and any items to be painted on a production line is explained in a new brochure from Hayden Drysys Ltd.

After background on electropriming and a description of its benefits, the brochure sketches the development of the process - particularly Haden Drysys' own Electro-dip systems.

Reader Enquiry Service No. 46

Immersion coil leaflet

A new leaflet has been issued by W. Canning Jigs Ltd on its range of coils for heating, cooling and agitation. These are manufactured in mild, galvanised, lead covered and stainless steels, as well as solid lead, titanium, zirconium and incoloy 825.

Canning Jigs operate a special emergency repair service in which they undertake to give a 24 hour turnaround of all standard types of immersion coil.

Reader Enquiry Service No. 47

people

Mr H. Smith has been appointed technical director of Fishburn Printing Ink Co. Ltd, where he was previously chief chemist.

Ken Hough, 38, has been appointed to the main board of Ellis & Everard and has become managing director of the company's fine chemicals division. He was previously deputy managing director of the division.

Mr David Walsh, Ellis & Everard group managing director and previously also managing director of the fine chemicals division, remains chairman of the division.

OCCA CONFERENCE 1983



The Viking Hotel

York, England

15-18 June 1983

**FURTHER DETAILS
OVERLEAF**

The efficient use of surface coatings

As already announced in the *Journal*, the next Biennial Conference of the Association will take place at the Viking Hotel, York from Wednesday 15 to Saturday 18 June 1983. The title of the Conference will be "The efficient use of surface coatings". Summaries of most of the papers and biographies of the lecturers will appear in the January 1983 issue. The programme for the technical sessions is as follows:

Session I "Formulation including manufacture"

Thursday 16 June 9.15 a.m.-12 noon

Chairman: Mr J. R. Taylor (Hon. Research & Development Officer)

Keynote address

By Mr R. A. Fidler (International Paint PLC)

Surface coatings in relation to external insulation

By Dr M. Wilkinson (Blundell Permoglaze Ltd)

The need for speed and accuracy in the formulation and production of efficient surface coatings

By Mr R. J. McCausland (Bayswell Consultants)

Automated paint manufacture

By Mr W. Ollett (Crown Decorative Products)

Linear polymonosulphide and polysulphide polymers - general survey recent developments and applications (paper presented on behalf of FATIPEC)

By Prof. Brossas (University of Louis Pasteur)

Session II "The use of computers and other advanced techniques in surface coatings"

2.00 p.m.-4.30 p.m.

Chairman: to be announced

Introduction to computer technology

By Mr G. T. Eady (Ault & Wiborg Paints Ltd)

Solving paint problems with computers

By Mr H. J. van der Stoep (Sikkens Ltd)

Introduction of microprocessors in surface coatings

By Dr A. Carrick (Kratos Ltd)

The use of NMR in the characterisation of polymers used in surface coatings

By Dr M. Marshall (MQAD)

Efficiency and change in metal decoration

By Dr A. Gamble (J & C Ink Co. Ltd)

Session III "Maintenance of quality and prediction of performance"

Friday 17 June 9.15 a.m.-12 noon

Chairman: Mr T. Graham

Quality control and standardisation in the titanium pigment industry

By Mr R. Blakey (BTP Ti oxide Ltd)

Prediction of performance of exterior wood coatings

By Dr E. R. Miller (Building Research Station)

Prediction of salt spray results from formulation parameters (paper presented on behalf of FSCT)

By Dr F. L. Floyd (Glidden Inc.)

Acoustic emission - further unpublished results of the new technique for the study of paint performance during environmental exposure tests

By Mr T. A. Strivens (ICI Paints Ltd)

Wood protection - the interaction between substrate and product and the influence on durability (paper presented on behalf of SLF)

By Mr K. Kleive (A/S Jotungruppen)

Session IV "The efficient use of coatings application"

2.15 p.m.-4.15 p.m.

Chairman: Mr F. H. Palmer

Quality control of application of coatings and technical developments which have occurred

By Mr D. Bayliss (ITI Ltd)

The use of modern application equipment and its efficiency

By Mr M. Eaton (Kremlin Spray Painting Equipment Ltd)

Paint finishing in the car industry

By Mr Quick (Talbot)

Fire retardancy of coatings systems and application techniques

By Dr F. G. R. Zobel and Mr D. Bishop (British Railways)

In keeping with earlier Conferences the 19 papers are of a very high standard, 9 of which will be presented by lecturers from paint and printing ink companies.

York Conference 1983

Conference preprints

Preprints of the papers will shortly be prepared and it is expected that these, together with details of accommodation, badges, programmes etc, will be sent to those who have registered early in June 1983. It is a feature of the Association's Conferences that preprints are sent well in advance of the function, in order to enable delegates to read them before the Conference, at which the lecturers illustrate their topics but do not read the papers in their entirety. This allows for a much longer discussion period than at many other conferences and has proved of immense value to those attending previous Association Conferences.

Registration fees

Forms of registration are enclosed in this issue for all members of the Association attached to the UK, Irish and General Overseas sections. For the benefit of non-members, registration forms can be obtained by circling No. 199 on the Reader Enquiry Service form at the back of the *Journal* and returning it to the Association's offices.

In order to encourage as large an attendance as possible, section chairmen have agreed to explore the possibility of running special daily coach parties to the Conference. Those wishing to participate in this activity should enter the word COACH in the appropriate box on page 8 of the brochure when forwarding their application form for daily registration, together with the appropriate remittance, direct to the Association's offices. These

names will then be passed to the Hon. Secretary of the relevant section.

In addition, Council has decided to keep the registration fees to the same level as for the 1981 Conference for both members and their ladies: £80.00 (plus Value Added Tax at the standard rate) for members, £110.00 (plus VAT) for non-members and £25.00 (plus VAT) for wives. The daily registration fee for members of the Association of £45.00 (plus VAT) and of £25.00 (plus VAT) for Registered Students of the Association will also remain the same.

Non-members wishing to avail themselves of the preferential Conference fee for members should request application forms from the Association's offices and these should accompany registration forms.

Next year's Conference in York will take place from Wednesday 15 to Saturday 18 June at the Viking Hotel. The title of the Conference is "The efficient use of surface coatings". Summaries of the papers and biographies of the lecturers will appear in the January 1983 issue of *JOCCA*. In keeping with earlier conferences the papers are of a very high standard and of 19 papers, 9 will be presented by lecturers from paint and printing ink companies.

York is probably the most beautifully preserved historic city in Britain and is expected to prove popular and interesting to delegates. The varied social programme will afford delegates and their ladies an opportunity to visit places of

historical interest including York Minster and the world famous Castle Museum. Coach tours have been arranged to Harewood House, the home of the Earl and Countess of Harewood, and Castle Howard, a magnificent 18th century house designed by Vanbrugh for Charles Howard, third Earl of Carlisle, still occupied by the Howards. This house was recently used for filming the television series *Brideshead Revisited* and the costume galleries house Britain's largest private collection of 18th to 20th century costume.

Following the success of the river trips during the last two Conferences, delegates will this time have an opportunity to travel on the River Ouse, during which coffee and biscuits will be served.

As an alternative to the cruise, subject to adequate response, a party will visit the National Railway Museum, which should be of great interest to railway enthusiasts.

In addition, theatre parties are being arranged on the Wednesday and Thursday evening (programme not yet finalised).

For those wishing to play in the golf tournament (for the OCCA Conference Trophy donated by Mr S. Sharp) facilities will be available at the York Golf Club.

Further information may be obtained from the Director & Secretary at the address on the Contents page of this issue (Tel: 01-908 1086; Telex 922670).

OCCA news

Manchester Section

1982 OCCA National Golf Tournament

This year's event was held on 2 September 1982 at Stockport Golf Club, Offerton, Stockport, Cheshire, and whilst the venue was the same as for the 1981 event, this Manchester Section organised Golf Tournament was supported by a record number of entrants, 64, an increase of 13 on the 1981 figure. In addition to the National Trophy, the Manchester Jubilee Trophy was competed for by Manchester Section members and the two OCCA prizes were augmented by a range of prizes generously donated both by individuals and company competitors. These prizes varied from the ever useful golf balls,

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



On the left Frank Redman (Chairman, Manchester Section) presents Brian Carroll with the two OCCA golf prizes. In the background is the excellent selection of donated prizes with Norman Seymour (Section Treasurer), contemplating his reward for an individual score

bottles of liquor, floor tiles to the longest prize, a reel of garden hose.

Following a very light lunch the Singles Stableford competition commenced at 1.45 p.m. from two tees, accompanied by excellent weather conditions. The fairway was in excellent condition but the greens presented a challenge to all the competitors as they had undergone concentrated maintenance. The weather remained excellent for the full 18 holes and the golf was followed by an excellent three course dinner prepared by Pepe, the resident steward originally from Barcelona.

Frank Redman and Gordon Robson, Chairman and Vice-Chairman, of the Manchester Section, were present to welcome competitors and especially those from other OCCA sections, including London, West Riding and Midlands.

The prize giving ceremony followed, with Frank Redman presenting them as follows:

1982 OCCA National Trophy plus Replica – Brian Carroll
 1982 OCCA Manchester Section Jubilee Trophy plus tankard – Brian Carroll
 Next highest scoring OCCA member – Brian Falder
 Guest with highest score – Ted Crossley

There followed prizes for nearest the hole on the 11th, descending scores and finally he who shall be nameless collected plural prizes for a singular score.

Several interesting points arise from an analysis of the prize giving:

1. Brian Carroll, with 38 points, also won the 1982 Northern Sections Golf Tournament. His score equalled the 1981 total.
2. Manchester Section has completed a double hat-trick by winning both these OCCA trophies for three successive years.



3. Brian "beat his boss" (Ted Crossley) by one point.

4. Brian Falder, a Manchester Section member, is proving so successful in recent golf competitions that the title of Brian (Bandit) Faldo has been suggested!

An excellent golfing day was had by all, hopefully to be repeated at the same venue on 1 September 1983.

F. B. Windsor



Brian Higgins on the left receiving the Visitors Tankard from Brian Gilliam (Chairman) at the London Section's annual golf tournament



Shown at the London Section's annual golf tournament: Brian Gilliam (Chairman) on the left handing Martin Stevens the Members Cup

London Section

Golf tournament

On a warm summers day on 7 July 1982 40 members and guests of the London Section assembled at Canons Brook Golf Club, Harlow, Essex for the annual golf tournament.

Two trophies were being contested, the Members Cup donated by The Valentine Varnish and Lacquer Company Ltd, and the Visitors Tankard donated by Cowan Colours, Blythe Burrell Colours Ltd.

The first group of players away included the President, Mr D. J. Morris. Styles on the first tee varied and it was evident that several players had improved from last year. One player's shot actually reached the ladies tee, another's ended behind him.

During the afternoon, stories of trees crossing the fairway were reaching the

organising committee. Once again the course laid out by Henry Cotton was proving a challenge. As the players returned to the 18th green it was obvious that everybody had enjoyed themselves.

The committee eventually worked out

the scores for the prizes and the presentations were made following a good meal.

The next tournament will take place at the same venue in early July 1983.

B. A. Canterford



Shown above at the South African Division's symposium held on 11-13 October 1982 at Sun City, Bophuthatswana are (from left to right): J. Anneveldt, G. Hughes, H. Villiger, R. G. Humphreys, J. R. Lyon, Dr P. R. Colau, E. Duligal, G. P. Verster, D. J. Morris (President), B. Rouse, C. J. R. Eichhorn, G. Munro, R. Egington, J. van der Klooster, I. Whyley, W. C. Aten. Photo: Warman Publications

Protection of iron and steel – readers' views sought

It is confirmed that the British Standards Institution Technical Sub-Committee BDB/7/1 "Protection of iron and steel structures against corrosion" is the committee responsible for:

- (a) BS 5493: 1977 "Code of practice for protective coatings of iron and steel structures against corrosion" (formerly C.P. 2008).
- (b) DD24: 1973 "Draft for Development. Recommendations for methods of protection against corrosion on light section steel used in building".

The committee is considering the need to revise these documents and wishes to canvass views and comments from as many people as possible. Thus the secretary, Mr J. B. Stubbs, British Standard Institution, 2 Park Street, London W1A 2BS, would welcome the views of all readers.

British Standards

3690: RDB/26
Bitumens for building and civil engineering
3690: Part 2: 1982 Specification for bitumens for industrial purposes 4 page A4 size Gr 3

Requirements for grades of bitumen suitable for use in industrial applications in the UK. No current standard is superseded. (ISBN 0 580 12866 0.)

Amendments

3900: PVC/10
Methods of test for paints

3900: Part B4: 1967 Determination of lead in low-lead paints and similar materials
Amendment No. 3 Gratis AMD 4044

Please give the reference AMD ..., not the B number

3262: 1978 RDB/25
Specification for hot-applied thermoplastic road marking materials
Amendment No. 3 Gratis AMD 4048

6088: 1981 RDB/25
Specification for solid glass beads for use with road marking compounds and for other industrial uses.
Amendment No. 1 Gr 2 AMD 4047

British Standards reviewed and confirmed

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

Proposed for withdrawal

A note of any objection to these withdrawals should be sent to the Director General by 31 December

3900: PVC/10

Methods of test for paints
3900: Part A4: 1966 Notes for guidance on paint application

Obsolete

3900: Part F7: 1973 Determination of resistance to water (water immersion method)

Superseded by BS 3900: Part G5: 1976

Standards withdrawn

AU 148: AUE/-1
Methods of test for motor vehicle paints
AU 148: Part 1: 1969 Visual colour matching
Superseded by BS 3900: Part D1: 1978
AU 148: Part 7: 1969 Hiding power
Superseded by BS 3900: Part D4: 1974
AU 148: Part 8: 1969 Measurement of paint film thickness
Superseded by BS 3900: Part C5: 1975

New work started

Specification for identification of pipelines
Will revise and update BS 1710 MEE/104

3900: PVC/10
Methods of test for paints
3900: Part G4: 1967 Resistance to hot fats

Draft Standards for public comment

Requests for drafts only, quoting the relevant document number, should be sent separately to: General Office, 101 Pentonville Road, London N1 9ND enclosing addressed labels and a remittance of £2.50 including postage for each copy ordered by subscribers (£3.00 including postage to non-subscribers). A higher charge will be made for exceptionally large drafts for public comment and in these cases the prices will be given beneath the title. Comments are welcome but must be received by 31 December 1982 to be considered by the relevant BSI committee. Draft standards may be modified before adoption and issued as British Standards.

82/52954 DC Methods of test for finishes for wooden furniture Part 2. Assessment of surface resistance to wet heat (Revision of BS 3962: Part 2) PVC/5

82/52955 DC Methods of test for finishes for wooden furniture Part 3. Assessment of surface resistance to dry heat (Revision of BS 3962: Part 3) PVC/5

*82/54408 DC BS 2782 Methods of testing plastics. Method 150E. Method for the determination of stiffness in torsion of flexible plasticized compounds of vinyl chloride (ISO/DIS 458/2) PLC/42

*82/54755 DC Methods of test for paints. New Part. Preparation of acid extracts from paints (ISO/DIS 6713.2) PVC/10

Comment date – 28 January 1983

82/54896 DC Amendment No. 2 to BS 6044 – Specification for Pavement marking paints

Comment date – 28 February 1983

82/55404 DC Methods of test for paints (BS 3900) – Part A3. Standards panels for paint testing (ISO/DIS 1514)

82/55405 DC Methods of test for paints (BS 3900) – Amendment to Part A 10. Determination of volume of dry coating (ISO 3233/DAM 1)

82/55406 DC Methods of test for paints (BS 3900). New Part. Bead test (Conical mandrel) (ISO/DIS 6860)

82/55407 DC Methods of test for paints (BS 3900). New Part. Determination of water vapour transmission rate of free films (dish method) (ISO/DIS 7783)

International publications

IEC 699: 1981 GEL/16
Test method for the evaluation of bond strength of impregnating varnishes by the wire bundle test 13 page
No corresponding BS

ISO/TR 5657: 1982
Fire tests – Reaction to fire – Ignitability of building products 31 page Q

International new work started

Thickness of wet and dry paint films
Will revise BS 3900: Part C5 and ISO 2808: 1974 to update existing procedures and to include new methods.
ISO/TC 35/SC 9 through PVC/10

At the meeting of the Professional Grade Committee held on 27 October 1982 the Committee authorised the following:

professional grade

Admitted as Associates:

Langdon, Donald Robert (*Ontario*)
Wilcox, David Joseph (*Manchester*)

Admitted as Licentiate:

Stanton, Peter Roy (*Manchester*)

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

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

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

Coventry Technical College, Butts,

Coventry CV1 3GD. Mr B. Bell, Head of Department of Science.

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

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

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

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

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

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

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

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

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

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

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



Professional Grade members

Anyone who has allowed his membership of the Association to lapse and now desires to rejoin the Association is reminded that previous service as an Ordinary Member (or Registered Student) can be counted towards the qualifying period of membership set out in the regulations.

The attention of senior members of the Association is particularly drawn to the Licentiate Grade and they are asked to encourage younger technical personnel to take advantage of this important Association activity. Several colleges are now willing to help suitable candidates with the preparation of dissertations and a list of colleges is given above.

Reprints of the regulations covering the Professional Grade are obtainable from the Association's offices, together with application forms.

List of successful candidates

As laid down in the report of the Working Party on Education, Training and Qualifications which was adopted on the institution of the Professional Grade, a list of those members in the Grade is published in the December issue of the *Journal* each year. The 11th such list appears below and includes the name of members resident in 37 countries.

The section to which the member is attached is given in italics.

The certification fees at present are: Fellows £10.00 + VAT, Associates £6.00 + VAT, and Licentiates £3.00 + VAT. The regulations for admission to each grade are available as a reprint from the Association's offices.

Fellows

Addenbrooke, Brian John (*Midlands*)
Aitken-Smith, Frank Joseph (*Auckland*)
Anneveldt, Jan Johan Willem (*Natal*)
Apperley, Thomas William James (*West Riding*)
Archer, Harold (*Manchester*)
Arnold, Michael Henry Miller (*London*)
Ashworth, Norman (*Manchester*)
Astfalck, Anthony Noel (*Transvaal*)
Atherton, Donald (*Scottish*)
Bailey, John Noel (*Newcastle*)
Banfield, Thomas Arthur (*London*)
Bayliss, Derek Arthur (*London*)
Beachen, John Frederick (*Auckland*)
Bell, Richard Thomas (*General Overseas-Australia*)
Bennett, Norman Arthur (*General Overseas-Malta*)
Bester, Lawrence Percy (*Transvaal*)
Bhumkar, Chidanand Jayram (*General Overseas-India*)

Birrell, Peter (*Ontario*)
Bishop, Eric Harold Abbott (*West Riding*)
Bohringer, Eberhard (*London*)
Boroky, Joseph Stephen
Brown, Arthur Ernest Girdlestone (*London*)
Butcher, George Alfred (*Midlands*)
Butcher, Kenneth William George (*Manchester*)
Butler, Cecil (*West Riding*)
Calder, Robert Malcolm (*Auckland*)
Caldwell, David George (*Wellington*)
Campbell, George Alexander (*Manchester*)
Carr, William (*Manchester*)
Carter, Eric Victor (*London*)
Chatfield, Herbert Walter (*London*)
Chessman, Clifford Reginald (*Transvaal*)
Clarke, Harry James (*Midlands*)
Clement, Donovan Harry (*Midlands*)
Colborn, Douglas Charles (*Thames Valley*)
Cole, Derek (*General Overseas-Australia*)
Cole, Reginald Joseph (*London*)
Collier, Claude William (*Midlands-Trent Valley Branch*)
Collings, Arthur Geoffrey (*London*)
Cook, Harold Gilbert (*London*)
Coupe, Raymond Richard (*London*)
Courtman, Frank (*Manchester*)
Coverdale, Peter Frederick Muir (*Midlands*)
Cutter, John Outram (*London*)

OCCA news

Davidson, John Dixon Wilson
(*Scottish*)
Davidson, Sigismund Leonard
(*General Overseas-USA*)
de Jong, Jan Lauwrens (*Transvaal*)
Dowsing, George Frederick (*London*)
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Association notices

Binding of the Journal

Members will be pleased to know that J. S. Wilson & Son, 14a Union Road, Cambridge CB2 1HE, will undertake the binding of back volumes of the Association's *Journal* sent in by individual members. Quotations will be given on request.

Members wishing to avail themselves of this facility should send the parts, securely wrapped, direct to J. S. Wilson & Son, enclosing the remittance for each volume, and ensuring that notes bearing names and addresses are enclosed with the parcels. It is particularly important that packets are sufficiently wrapped to negate the possibility of damage in the post.

1983 members subscriptions

Members are reminded that the 1983 membership subscriptions to the Association are payable on 1 January 1983. Forms were despatched to members in the autumn.

The Commissioners of Inland Revenue have approved of the Association for the purpose of the 1970 Income and Corporation Taxes Act Section 192, so that a member subject to United Kingdom income tax is entitled to a deduction from the amount of his emoluments assessable to income tax under Schedule E for the whole of the annual subscription to the Association, provided that the subscription is defrayed out of

the emoluments of his office or employment and that the interests covered by the objects of the Association are relevant to such office or employment.

Members resident in the United Kingdom are reminded that if there is any change in the standard rate of Value Added Tax announced before they send in their 1983 subscription, the VAT payable on membership subscriptions is the amount that applies on the date of payment.

1983 library subscriptions

The *Journal* subscription rate to non-members, including libraries, for 1983 will be £50 (US\$110) post free by surface mail, home and abroad. Individual copies can be purchased for £5.00. Remittances should be sent with an order to the Association's offices.

Retired members

Council also wishes it to be known widely that in 1962 it introduced a reduced membership subscription rate for members who have retired from business. This applies to a member who has completed 20 years as an Ordinary or Associate Member and has retired from business and normally has reached the age of 60; he may apply for his name to be retained on the register of members at an annual subscription rate of £6.00 and he will retain the same rights of membership as the class of membership to which he was attached upon retirement.

Members wishing to avail themselves of this concession should write, in confidence, to the Director & Secretary at the address on the contents page, giving the relevant information under the four headings: (a) name, address and section, (b) date of election, (c) date of retirement, (d) age.

Situations wanted

Any member who wishes to place a small advertisement (with box number) in the situations WANTED section of *JOCCA* can do so *without charge* by sending details to the Director & Secretary, marking the envelope "CONFIDENTIAL".

Monographs and student reviews

Council wishes to publish in the *Journal* occasional monographs or student review type articles for the benefit of younger technologists to act as introductions to some specialised fields in the industry. It is intended that such articles would then be reprinted as separate booklets. Council wishes to invite suggestions from members of suitable topics for such a series of articles, *together with the names of persons who would be willing to write the articles.*

Any members who would be willing to write such a monograph, or who can suggest another person who might be willing to do so, should write to the Director & Secretary at the address on the contents page giving full details.

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