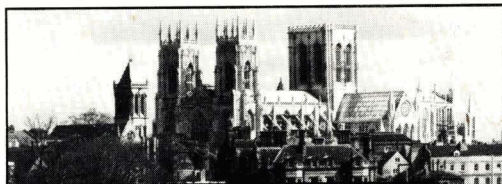


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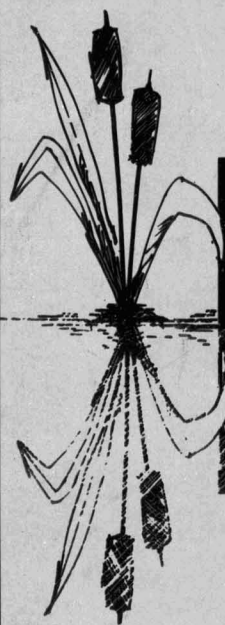
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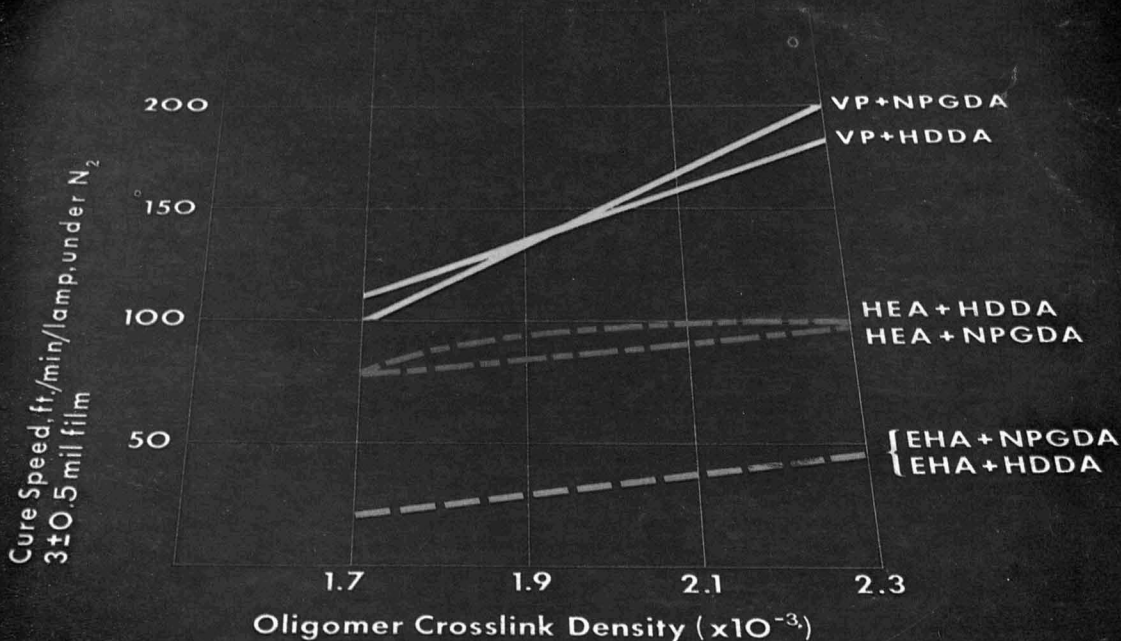
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The surface finishing of exterior plywood

T. B. Dearling and G. A. Smith

Building Research Establishment, Princes Risborough Laboratory, Princes Risborough, Aylesbury, Buckinghamshire HP17 9PX, United Kingdom

Summary

The finishes used to protect plywood in exterior situations have often had short lives and so research has been carried out at the Princes Risborough Laboratory to see how performance is influenced by pretreatment of the surface. Five different finishes were applied to a range of plywoods: untreated, impregnated with water-repellent wood preservative solutions, or paper-overlaid. The finished panels were then exposed either to natural conditions or artificial weathering in an accelerated weathering machine. Coatings performed much better on the overlaid boards than on the untreated and impregnated plywoods. There was reasonable agreement between the natural and the artificial weathering when performance was either poor or good, but not when it fell between the two extremes. Water vapour transmission rates, adhesion values and extensibility of the coatings were determined, but there was no clear connection between these values and performance of the coating in service.

Introduction

During the 1970s plywood became widely accepted for use as cladding, particularly for infill panels below the windows of houses. In order to give a harmonious appearance to the building, architects have often specified a textured surface coating, of the type used successfully on masonry. Unfortunately these finishes have often proved to have an unacceptably short life on plywood. The reasons for this have been described elsewhere¹⁻⁴. Briefly, the surface veneer of plywood develops splits or checks on exposure to fluctuating humidity, putting a strain upon the coating, which usually leads to a poor performance in service. This paper describes work aimed at defining a plywood/finish combination which should achieve a better performance.

Experimental

Materials

All of the materials were commercially available and are described in tables 1, 2 and 3.

In Table 1 the term "weather and boil-proof" (WBP) is as specified⁵ in BS 1203:1963 and relates only to the quality of the glue bond. Quality of the face veneer (i.e. the number and size of plugs, splits, knots or patches) can be specified and is summarised⁶ in BS 3493:1962. Two HMSO publications - "Handbook of Hardwoods"⁷ and "Handbook of Softwoods"⁸ - give information on the durability ratings of many timbers, and the former also gives information on the splitting characteristics of various plywoods.

An overlaid plywood has both sides, or sometimes only the face, covered with a sheet of resin-impregnated paper which is bonded to the surface during manufacture. Special types are available intended for over-painting which enable primers to be omitted.

Preparation of panels

Each plywood sheet, 2440 mm × 1220 mm, was cut to yield six panels, 695 mm × 603 mm, which were equilibrated at 25°C and 65 per cent relative humidity, and weighed. The panels within each board type were randomised and divided into groups to provide four replicates of each combination of plywood, finish and preservative treatment. The relevant boards were then impregnated with preservatives (Table 2) and the average percentage uptake of preservative recorded. Mahogany did not receive treatments B (dip) and C (double vacuum with alkylid resin additive).

After open stacking for at least 14 days, both untreated and impregnated boards received two coats of aluminium primer on backs and edges and were then painted with the range of finishes described in Table 3. Finishes 2 and 4 were factory applied by the supplier, and the remainder applied by brush at Princes Risborough Laboratory; the primer was omitted on the overlays. Table 4 summarises the boards prepared, and Table 3 gives the average coating weights achieved. Finishes 1 and 4 were not applied to Douglas fir and birch pretreated with system C.

After painting, three of the duplicate panels were used for natural vertical exposure and the fourth was cut into smaller panels (200 × 150 mm) for further testing. The edges of the smaller panels received two coats of pitch-epoxy sealer.

Natural exposure testing

The exposure site at Princes Risborough is inland and rural, 105 metres above sea-level, with annual averages of 645 mm rainfall, 1,525 hours bright sunshine and 65,600 mW h cm⁻² radiation dose on a south facing, vertical surface.

The large panels were mounted vertically in racks facing south, with the backs protected by boarding and a 100 mm air gap between the back of the panels and the protective boarding. The smaller panels were exposed at 45° and 0° (horizontal).

Artificial weathering

Two small panels of each combination received up to ten cycles of artificial weathering.

Each cycle consisted of:

- (i) Exposure for 250 hours in an accelerated weathering machine operating⁹ according to BS 3900:Part F3.
- (ii) Soaking in water at ambient temperature for eight hours.
- (iii) Drying by infrared radiation¹⁰ for 16 hours.

Table 1
Composition and properties of plywoods used

Board type	Veneer composition	Durability of veneers (if heartwood*)	Checking grade of face veneer	Designation in tables 2-8
Douglas fir 12.5 mm thick Face quality good one side WBP adhesive	Face – Douglas fir Core – 2 veneers spruce 1 veneer Douglas fir	moderately durable non-durable moderately durable	II	D. fir
Birch 12 mm thick Face quality BB WBP adhesive	Face – birch Core – 3 veneers spruce 4 veneers birch	perishable non-durable perishable	II	birch
Mahogany (Ghanaian) 12 mm thick WBP adhesive	African mahogany throughout	moderately durable	I	mahogany
Medium density overlay (Canadian) 12.5 mm thick WBP adhesive	Spruce throughout	non-durable	not relevant	MDO
Painting grade overlay (Finnish) 12 mm thick WBP adhesive	5 veneers – birch 4 veneers – spruce	perishable non-durable	not relevant	PGO
Sealface PG overlay (British) 12.5 mm thick WBP adhesive	Faces – gedu nohor Core – 2 veneers agba 2 veneers gedu nohor	moderately durable durable moderately durable	not relevant	sealface

*All sapwood is perishable

Table 2
Impregnation materials, techniques and uptake

Code	Treatment	Uptake of liquid preservative* (%)	
A	Double vacuum technique using schedule suitable for spruce with organic solvent, water-repellent wood preservative, based on bistri-n-butyltin (IV) oxide (TnBTO) and pentachlorophenol, with petroleum resin water repellent.	D. fir	30
		birch	38
		mahogany	6
B	Three minute dip in the same preservative as A.	D. fir	2
		birch	1
C	As technique A except that the water repellent was an alkyl resin additive.	D. fir	7
		birch	10

*Expressed as wt/wt

- (iv) Soaking as (ii) above.
- (v) Freezing at approximately -18°C for 24 hours.
- (vi) Drying as (iii) above.

The panels were examined at the end of each cycle.

Adhesion testing

Mild steel studs, 25 mm square, were bonded to the centre of 65×45 mm unweathered test samples using a two-part epoxy resin adhesive. The area to be tested was defined by cutting, with a hacksaw, down the four sides of the stud, through the excess glue and the finish, to the surface of the substrate. Six samples of each type were conditioned to 25°C and 65 per cent relative humidity and separated on

a Hounsfield Tensometer. The force in N mm^{-2} required to break the samples, together with the type of failure, was recorded.

Measurement of water vapour transmission rates

The procedure used was a dry-cup technique based on ISO recommendation R1195 (1970) "Determination of the water vapour transmission rate of plastics films and thin sheets"¹⁰. Measurements were made on four of the five coatings which had been painted on to hardboard discs approximately 1 mm thick. Finish 4 was factory applied and sample material was not available to test the finish in this way.

The initial water vapour transmission rates of all five

Table 3
Surface finishes used and coating weights achieved

Code	Finish	Colour	Average coating weight (g m ⁻²)
1	Vinyl copolymer emulsion, textured with polystyrene beads over solvent-thinned primer.	pale brown	552
2	Oleo-resinous paint, textured with silica over aluminium primer.	green	911
3	Acrylic emulsion, textured with silica and mica over acrylic emulsion primer.	green	975
4	Pigmented emulsion resin base, externally textured with coloured mineral aggregate, particle size ≈ 1.6 mm. No primer.	green	1941
5	Conventional alkyd primer, undercoat and gloss.	green	221

Table 4
Summary of boards prepared

Substrates	Pretreatments	Finishes applied
D. fir, birch, mahogany	none or A	finishes 1-5, as full systems
MDO, PGO, sealface	none	finishes 1-5, primer omitted
D. fir, birch	B	finishes 1-5, as full systems
D. fir, birch	C	finishes 2, 3, 5 as full systems

coatings on Douglas fir and of the uncoated plywood and of different substrate types with one coating (the vinyl copolymer textured emulsion) were measured. At least four replicates of each type were exposed in conditions of 90 per cent relative humidity and 25°C.

Extensibility

The extensibility of four of the coatings was determined by the method of Whiteley and Rothwell¹¹. The coating was applied to specially prepared highly ductile aluminium sheets. After a period of artificial weathering the panels were cut into strips 10 mm wide and stretched on a tensile testing machine until the film was cracked in a fairly regular manner.

Results

Natural weathering

During natural weathering, all the panels showed some change in appearance. These changes varied with the different finishes used and did not always constitute failure. In order to determine whether failure had occurred, a number of observations were made about the appearance of the panels, as described below. Such a method of assessment, particularly criteria 2 and 3, depends to some extent upon an observers judgement, but a reasonable indication of performance has been obtained.

Failure was considered to have occurred if one of the following applied:

1. Loss of coating, leaving bare areas of board.

2. Cracking of the finish, easily visible. (A few small isolated cracks would not constitute failure.)
3. Disfigurement, usually by mould or algal growth. (An even colour change would not necessarily mean that a finish had failed.)

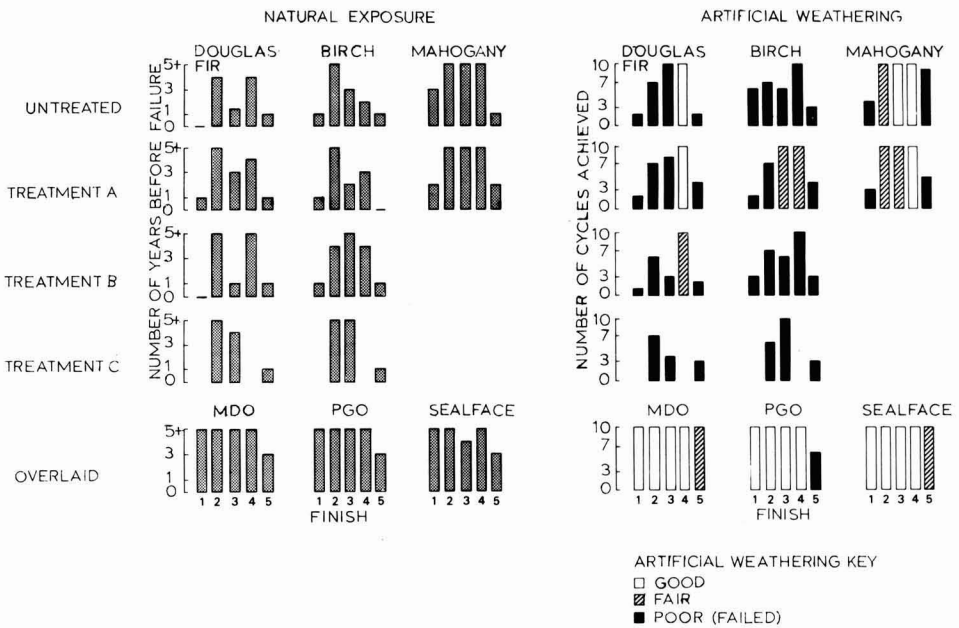
Figure 1 gives the results of five years natural weathering, taking all the factors described into account and indicating the number of complete years of exposure before failure occurred.

Finish 1 crazed all over on all substrates, but this was not classified as failure because the crazing did not penetrate the whole thickness of the coating and did not detract from the appearance. Failure occurred when cracks penetrated the whole thickness of the finish; the cracking always followed the grain of the veneer and was usually followed by loss of the coating.

Finish 2 weathered by erosion, leaving white sand particles distributed evenly over the surface and causing a change in appearance. The appearance was still acceptable, and the finish did not fail until cracks appeared.

Finish 3 changed colour, particularly when viewed in direct sunlight. Weathering eroded the film, exposing mica particles which gave the surface a rather shiny appearance. This change in appearance was not counted as failure, which occurred mostly by cracking and slight losses of coating.

Finish 4 proved to be the most difficult to assess. This finish consisted of aggregate applied over a binder coat. The aggregate hid small cracks in the resin, and it was not until they became unsightly that cracking could be said to



COMPARISON OF PERFORMANCE DURING ARTIFICIAL WEATHERING AND NATURAL EXPOSURE

Figure 1. Comparison of performance during artificial weathering and natural exposure

Table 5
Adhesion values and type of failure

Board type	Adhesion (Nmm ⁻²)					Type of failure				
	1	2	3	4	5	1	2	3	4	5
Untreated										
D. fir	1.80	1.31	1.05	1.25	1.31	S	I	S	S	S
Birch	2.14	1.69	1.82	2.03	2.26	F	I	I	R	I
Mahogany	2.77	1.25	1.95	1.84	2.26	S	I	I	R	S
Treatment A										
D. fir			1.32	1.54	1.14			I	S	S
Birch	1.40	1.49	1.50	1.25	1.14	F	I	I	R	I
Mahogany	2.46	1.92	1.32	1.91	1.47	S	I	I	R	I
Treatment B										
D. fir	0.18	1.27	1.14	1.31	1.34	S	I	I	F	S
Birch	2.75	1.64	2.06	2.07	2.21	S	I	I	R	S
Treatment C										
D. fir		0.96	1.71		0.55		I	I		S
Birch		2.09	2.14		2.04		I	I		S
Overlaid										
MDO	0.62	1.28	0.81	0.72	0.48	S	S	S	S	S
PGO	1.26	1.70	1.31	0.71	1.19	S	F	F	F	S
Sealface	1.86	1.65	1.40	0.86	1.01	F	F	I	F	F

S = failure within substrate, F = failure between finish and substrate, I = inter-coat adhesion failure, and R = failure between aggregate and resin

constitute failure. Also, there was a gradual loss of aggregate, and the point at which failure occurred was a matter of judgement. Failure was taken to occur when the binder coat could be seen clearly because of loss of

aggregate. The colour change from green to blue-green did not contribute towards failure.

Finish 5 failed through cracking and flaking of the film

Table 6
The water vapour transmission rates (WVTR) and their coefficients of variation (C of V) of various substrate/finish systems

	Finish					Uncoated
	1	2	3	4	5	
Thin hardboard						
WVTR (g m ⁻² day ⁻¹)	45.8	4.5	63.1	not tested	8.6	421.8
C of V (%)	2.4	8.7	16.6		12.1	16.7
D. fir plywood						
WVTR (g m ⁻² day ⁻¹)	24.1	2.7	16.1	28.7	4.5	26.9
C of V (%)	10.5	10.8	12.4	11.3	13.0	9.8

on both treated and untreated plywood. The overlaid boards did not show any cracking but only failed by flaking.

Artificial weathering

Figure 1 shows the results of artificial weathering in comparison with natural exposure. It indicates the number of complete cycles carried out prior to failure, or the performance rating of the panel at the end of ten cycles:

1. Good performance with very little, if any, cracking and no loss of adhesion (unshaded in the figure).
2. Fair performance with the presence of some cracks although not enough to constitute failure (light shading).
3. Failure (heavy shading).

Adhesion tests

The adhesion test yields two results, i.e. the numerical value of the force to break the specimen and the type of failure. Frequently a single sample would show more than one type of failure and Table 5 only gives the results of the one which contributed most to failure in the whole batch.

Water vapour transmission rates

The results, along with their coefficients of variation, are given in tables 6 and 7.

Extensibility

Table 8 gives the results of the extensibility tests on the coatings. The results for textured finishes are less clear-cut than those for smooth finishes, such as gloss paints, for several reasons. Textured coatings have irregular surfaces and some have pinholes, particularly after weathering, which do not penetrate the whole thickness of the coating. Also, on stretching the samples, a number of short cracks may appear before ultimate failure but the film rarely cracks completely across the 10 mm width of the sample and in a regular way along the whole length. There is therefore more error in interpretation of these extensibility data than for smooth finishes. The method does, however, give a guide to a coating's extensibility, which could not be achieved using a free film.

Finish 1 already had a number of cracks in it after weathering, and extension widened the cracks and gradually introduced more.

Finish 2 cracked in a fairly regular way and it was possible to determine a consistent failure point.

Table 7
The water vapour transmission rates (WVTR) and their coefficients of variation (C of V) of Finish 1 on various substrates

Substrate	Pretreatment	WVTR (g m ⁻² day ⁻¹)	C of V (%)
D. fir	none	24.1	10.5
Birch	none	14.5	14.5
Mahogany	none	30.0	4.9
D. fir	A	15.3	3.4
Birch	A	13.3	3.8
Mahogany	A	23.2	6.0
D. fir	B	18.7	7.8
Birch	B	23.6	2.1
MDO	none	18.8	3.4
PGO	none	8.5	7.1
Sealface	none	18.1	4.4

Table 8
Percentage extensibility of coatings on aluminium before and after artificial weathering

Finish	Before weathering	After 500 h weathering
1	10	0
2	10	4
3	23+	23+
5 (undercoat)	14	5
5 (gloss)	30+	30

Finish 3 was more difficult to assess because the pinholes stretched without breaking the film and clear breaks were rare.

Finish 5 was tested as a full three coat system of primer, undercoat and gloss. Before artificial weathering the gloss coat showed no cracking at over 30 per cent extension, even though the undercoat beneath it cracked at 14 per cent extension. After 500 hours weathering the gloss coat still had an extension of over 30 per cent, whilst the extensibility of the undercoat had fallen to 6 per cent.

Finish 4 was not tested, as the original coating had been applied in the supplier's factory.

The ductile aluminium tended to break at lower extensions when coated with a textured finish than when coated with a gloss paint. This was because the cutting of the aluminium panels into strips pushed the aggregate into the metal and caused weak points along the edges.

Table 9
Number of substrate/finish systems which survived separately the number of years and number of cycles shown

Cycles to failure on artificial weathering	Years to failure on natural exposure		
	0-2	3-4	More than 5
0-3	13	0	0
4-6	3	2	0
6-10	4	6	8
More than 10	1	4	20

Discussion

The natural and artificial weathering both showed the same clear result: the textured finishes tested all performed much better on the overlaid plywoods than on any other plywood, whether impregnated or not. Considering vertical exposure, all the textured finishes were in good condition after five years on the overlays, and the gloss paint lasted three years. However, amongst the boards without overlay, only the mahogany consistently approached this performance. Coatings on the 45° and horizontally exposed overlays behaved generally almost as well as the vertically exposed overlays, but on the other plywoods had usually failed before five years.

The coatings on birch and Douglas fir plywood showed more cracking than on mahogany, in agreement with the splitting characteristics of the plywoods previously reported^{7,12}. In no case did water repellents significantly reduce splitting and improve coating performance. In certain instances water repellents had a transient detrimental effect, caused by blooming.

Whilst the overlays considerably enhanced the performance of the textured finishes, in one case extending it from failure within a year to beyond five years, such a marked improvement did not occur with the gloss paint. Because an overlay was present no primer was used and it may be that the undercoat did not bond well to the surface.

Comparison of the periods of natural exposure with the number of cycles of artificial weathering before failure is shown in Figure 1 and summarised in Table 9. Of the 61 systems tested 13 failed in less than two years outside and in less than 3 cycles, and 20 survived more than five years outside and also more than 10 artificial weathering cycles. Table 9 shows that artificial weathering can be used to screen out a high proportion of unsatisfactory systems, but also demonstrates that natural weathering is necessary to determine ultimate service life.

Comparison of natural weathering at three orientations showed that generally the 45° and horizontal panels deteriorated faster than the vertical panels. One serious disadvantage of textured panels mounted flat is dirt retention, often associated with algal growth. Whilst this can be ignored during assessment, it does make visual judgement of other types of deterioration harder.

Comparisons of the weathering performance with the water vapour transmission rates, adhesion results and extensibility do not show that they can be used con-

firmly, either alone or together, to predict service life. Finish 1 (textured vinyl copolymer emulsion) showed a very rapid decrease in extensibility and also performed badly during weathering. However Finish 2 (textured, solvent-thinned paint) also became brittle quickly, but performed better than Finish 3 (textured acrylic emulsion) which embrittled more slowly. Finish 5 (highly extensible gloss paint) failed rapidly and consistently in service on plywood.

The adhesion values reflect the variability of the plywood substrates. Often the site of failure was within the wood, and as some of these substrate failures were among the lowest adhesion values recorded, and failure within the substrate is rarely found in service, it must be concluded that initial adhesion values need not be high. Indeed the reverse may be argued because with Finishes 1 and 5, which gave the worst performances on exposure, the bond between the finish and the substrate was often stronger than the internal strength of the plywood. Initial adhesion values therefore give no guide to ultimate service life.

Table 6 shows that the coatings transmit water vapour at very different rates, but in practice those at the extreme ends of the range succeed equally well. Study of Table 7 shows that a water repellent slows the rate of moisture movement through the board, but this is not reflected in improved performance of the coating.

Clearly, none of the coating properties examined here had an overriding effect on coating performance on plywood. However by changing the characteristics of the substrate a much better service life has been achieved: a factory applied overlay presents a surface which is resistant to splitting, and the demands placed on the surface finish are therefore less severe. This observation is supported by the evidence from exposure of coatings on plywood and fibre building board; splitting frequently occurs on the former but not on the latter.

Conclusions

In order to achieve maximum life from textured coatings on plywood it is necessary to use a board overlaid with a resin-impregnated paper designed for over-painting. However, with certain finishes, mahogany plywood, which has less tendency to surface splitting than birch or Douglas fir, was equalling the overlays after five years vertical exposure; the inclined and horizontal tests showed that ultimate life would be longer on the overlays. Although performance of the gloss paints improved on overlays compared with normal boards, it was still unsatisfactory, indicating the scope for more work to realise the potential for improvement with this type of finish.

Impregnation of plywoods with water-repellent preservatives did not enhance performance and even had a transient detrimental effect caused by blooming.

The artificial weathering results showed that these tests could be used to reject the high proportion of systems which would not perform well in service, and also it would help to select those likely to be satisfactory. However, those systems which did moderately well in this test, i.e. failure between 4 and 10 cycles, showed a scatter of results on natural weathering. Ultimate life can only be proved by testing under service conditions.

The surface coatings studied do not show any clear correlation between the physical properties determined and the acceptability of the coating as a finish for non-

overlaid plywood. The influence of the plywood dominates all the other factors and the conclusion seems inescapable that an overlay paper is essential in order to obtain a reasonable life for finishes on exterior plywood. Knight and Doman¹³ reached a similar conclusion.

Acknowledgement

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References

1. Smith, G. A., Building Research Establishment Information Sheet IS 21/75, 1975.
2. Smith, G. A., *Build. Trades J.*, 1977, **174**, 5227, 37-38, 40.
3. Sparkes, A. J., *FIRA Bull.*, 1973, **41**, 13.

4. Frühwald, A., *Holz und Kunststoffverarbeitung*, 1976, **8**, 500.
5. "Synthetic resin adhesives (phenolic and amino plastic) for plywood", *British Standards Institution*, British Standard BS 1203:1963, London, 1963.
6. "Information about plywood", *British Standards Institution*, British Standard BS 3493:1962, London 1962.
7. "Handbook of hardwoods", *HMSO*, London, 1972 (reprinted 1974).
8. "Handbook of softwoods", *HMSO*, London, 1957 (reprinted 1977).
9. "Methods of test for paints", *British Standards Institution*, British Standard BS 3900:1965, Part F3:1966, London, 1966.
10. "Determination of the water vapour transmission rate of plastics films and thin sheets", *International Organization for Standardization*, ISO Recommendation R 1195:1970.
11. Whiteley, P. and Rothwell, G. W., *JOCCA*, 1969, **52**, 736.
12. Knight, R. A. G. and Doman, L. S., *J. Inst. Wood Sci.*, 1962, **10**, 66.
13. Knight, R. A. G. and Doman, L. S., *Wood*, 1967, **32**, 31.

Fractional precipitation of lac. Part 1: integral fractionation

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Summary

The present paper concerns the fractionation of lac at room temperature with the aid of an electrolyte solution acting as a non-solvent and a flocculent. It has been observed that the yield, which is mainly dependent on the solution/non-solvent ratio, is also affected by the concentration and valency of ions.

Introduction

Lac is a versatile resin but it is not free from drawbacks, such as slow thermo-hardening and poor water resistance¹. The need to fractionate lac into its various components in order to examine their physical and chemical properties has long been recognised.

The fractionation of lac was first carried out by Tschirch and Farnar² using ether as a solvent. They isolated two fractions – one soluble in ether called soft resin, the other insoluble in ether called hard or pure resin. Later, Schaeffer, Weinberger and Gardner³ isolated soft resin, hard resin and wax using a series of solvents in succession. A careful examination of the products revealed that the ether-soluble portion or soft resin is responsible for undesirable properties. Therefore attempts were concentrated on the isolation of the soft resin.

Verman and Bhattacharya⁴ separated soft resin by an extractive method making use of a large number of solvents such as toluene, trichloroethylene, benzol and solvent naphtha.

Palit⁵ employed a mixture of ethyl acetate and benzene for this purpose whereas Sen *et al.*⁶ attempted separation by reacting lac with urea in acetone. A more recent approach is the separation of pure resin by the progressive precipitation of the urea complexes of lac⁷. Recently Seshadri *et al.*⁸ have isolated hard resin I, hard resin II and

soft resin from lac by taking advantage of the insolubility of hard resin in ether.

The greatest disadvantage of all these methods is that the unbaked films of pure resin become brittle on ageing due to the removal of a major portion of the plasticiser (soft resin).

Although the extraction with dilute alkali salts such as ammonium hydrogen phosphate, sodium carbonate and borax removes only about three per cent of the soft resin^{9,10}, the materials produced are not suitable for practical uses. It should be pointed out that there are no general rules established for the selection of suitable solvent systems for the isolation of these organic compounds. Therefore the chemical methods of fractionation are just empirical¹¹. The physical methods of fractionation which are most common in the field of high polymers can be enumerated as (i) fractionation by the addition of a non-solvent to the dilute polymer solution, and (ii) fractionation by cooling the polymer solution. The latter technique has been adopted by Sankernarayanan *et al.*¹² for the fractionation of lac and the process has been termed temperature-phase separation method. As can be seen, no report is available on the fractional precipitation of lac.

Therefore an attempt was made to fractionate lac from its solution by the addition of an electrolyte solution acting both as a non-solvent and a flocculent. The present paper reports the results of this investigations in some detail.

Experimental

In view of solubility, ease of filtration, yield etc., a ten per cent solution of seed lac in methylated spirits was used for this investigation.

Table 1
Fractionation data

Ratio of solution to non-solvent	$W_x(\%)$	Appearance	$100/100+V$	$\text{Log}_{10}W_x$
100:30	37.08	light brown, brittle	0.77	1.57
100:40	64.59	light brown, brittle	0.71	1.81
100:50	66.98	light brown, brittle	0.67	1.83
100:75	84.93	deep shade, light brown, brittle	0.57	1.93
100:100	84.93	deep shade, light brown, brittle	0.50	1.93
100:200	94.50	light dark brown, brittle	0.33	1.97
100:300	94.50	light dark brown, lumps	0.25	1.97

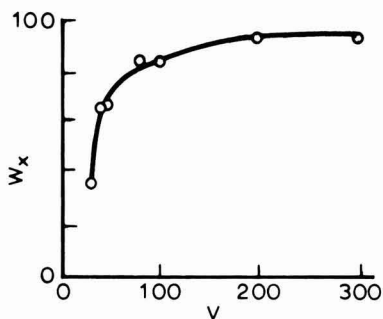


Figure 1.

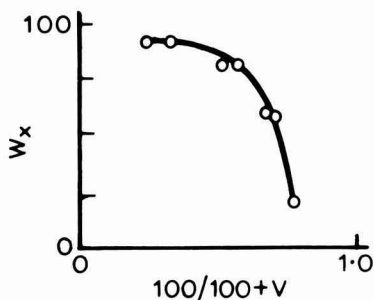


Figure 2.

Preparation of ten per cent (w/w) seed lac solution

Two hundred and fifty grams of seed lac was admixed with 1,800 grams of methylated spirit (b.p.76°C) with constant shaking for two hours and then filtered. The concentration was adjusted to ten per cent (w/w) by dilution.

Isolation of fractions

The fractionation was carried out at room temperature by transferring 100 ml of ten per cent (w/w) seed lac solution to a Jena or Pyrex beaker and adding (with slow stirring) a known amount of one per cent sodium chloride solution. After the addition of the non-solvent, the stirring was continued for half an hour to facilitate settling. After allowing the beaker containing the precipitate to stand overnight inside a bell jar saturated with solvent vapour, the supernatant liquid was poured off. Afterwards, the jelly like precipitate was triturated with water, filtered under vacuum and dried in a tared container to constant weight.

In this fashion, several fractions were collected. The precipitation data are included in Table 1. The effect of concentration was examined by adding 5 ml of the electrolyte solutions of varying concentrations to 10 ml of the seed lac solution. The effects of the valencies of the ions were examined likewise.

Results and discussion

The fractionation of the polymers can be recognised as a phase separation process as it involves the separation of the solid phase from a homogeneous solution¹³. The development of a new phase as a crystal within a liquid involves two processes: nucleation and growth. The fundamentals of the crystal growth have been discussed in some detail elsewhere¹⁴. However, it deserves mention that the transformation from liquid to crystal in the case of the polymers is rarely, if ever, complete¹⁵.

From Table 1 it is obvious that the precipitation is not complete even after the addition of 100–300 per cent electrolyte solution. The maximal yield, however, amounts to 94.5 per cent. This suggests that a part of the solute remains soluble in the non-solvent phase, which is in

agreement with the theory of crystal growth. In differential fractionation¹⁶ also, the difference between the weight of sample taken for the fractionation and the sum of the weights of all fractions is usually of the order of five per cent. Explanations are to be sought for these fractionation losses.

Dependence of W_x on V

An inspection of Figure 1 reveals that W_x is a complex function of V , the volume (expressed as a percentage) of the non-solvent added. In order to verify the relationship¹⁴

$$W_x = A - B/100 + V$$

W_x was plotted against $100/100 + V$ as shown in Figure 2. The plot does not conform to linearity. This may be attributed to large differences in ΔV values.

It may be recalled that when dV is small, $C^1/C = 10^{dV/K}$

If dV is not small, as in the present instance, then

$$C^1 = 10(V + dV)/K \times 10^{-f'(M)/K}$$

Therefore,

$$C^1/C = 10^{dV/K} \times 10^{-\frac{f'(M) + f(M)}{K}}$$

Since $f(M) > f'(M)$, then $C^1/C = 10^{dV/K} \times 10^{d f(M)/K}$

Taking the logarithm, we have

$$\text{Log}_{10}C^1/C = \frac{dV + df(M)}{K}$$

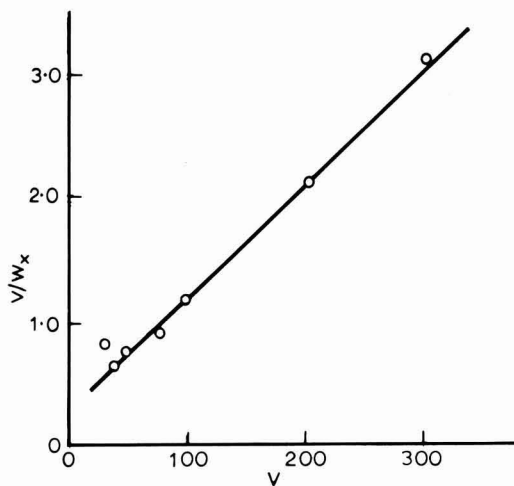


Figure 3.

Table 2
Data on precipitation point

C_o	V	C	C_o/C	$\text{Log}_{10}C$
0.88	34.2	0.66	1.33	-0.18
1.86	27.9	1.45	1.28	0.16
2.84	25.8	2.26	1.26	0.35
3.80	25.4	3.03	1.25	0.48
4.77	25.0	3.82	1.25	0.58
5.74	24.6	4.61	1.24	0.66
6.72	24.2	5.41	1.24	0.73
7.62	23.7	6.16	1.24	0.79

or

$$\text{Log}_{10}C^1 - \text{Log}_{10}C = \frac{dV + df(M)}{K}$$

$$\text{Since } C^1 < C, \text{ then } -d\text{Log}_{10}C = \frac{dV + df(M)}{K}$$

Since $df(M)$ is not known, the validity of the above relationship cannot be tested. However, an inspection of the experimental data has revealed that

$$\frac{V}{W_x} = A + BV$$

The linear plot of V/W_x against V is shown in Figure 3.

Dilution dependence of precipitation point

From Burton's law it is known that if hydrophobic sols are flocculated with univalent ions, the flocculation value increases with increase in dilution. If, however, coagulation is carried out with polyvalent ions, the flocculation value decreases with increase in dilution¹⁷. To examine this effect the precipitation points were determined for seed lac solutions of different concentrations. The experimental data (Table 2) show that the volume of the precipitant necessary to cause the appearance of turbidity, V , is a function of the initial concentration of the resin solution,

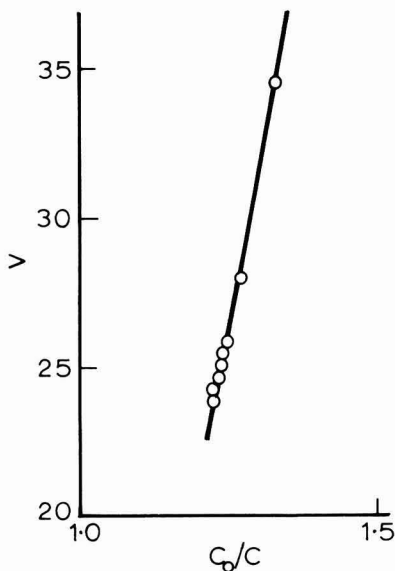


Figure 4.

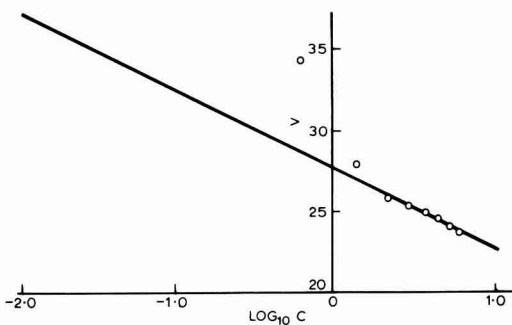


Figure 5.

C_o . Let C represent the concentration at incipient precipitation and V_o be the initial volume of the solution taken. Then, $C = V_o C_o / V_o + V$ or $1 + V/V_o = C_o/C$ or $V/V_o = C_o/C - 1$. Now, if V_o is constant, then a plot of C_o/C against V should be a straight line. Such a plot of the experimental data is shown in Figure 4. The perfect linearity seems to support the above relationship. However, according to Schulz, V is related to C in the following manner:

$$V = \text{Log}_{10}C + f(M)$$

The equation has been found to be true in most cases with the limitation that the solution under study must be dilute. The plot of V against $\text{Log}_{10}C$ (computed from the experimental data) is shown in Figure 5. The plot is linear except for the point that corresponds to 0.88 per cent concentration.

Again, from Table 2 it is evident that as the concentration of the resin solution increases, the value of V decreases. This is one of the reasons why 10 per cent (w/w) concentration was chosen for the investigation.

It is a well-known fact that the precipitation value is

Table 3
Yield at different electrolyte concentrations

C	Y(g)	Y/C	Log ₁₀ Y/C
1.0	2.8	2.8	0.45
2.0	3.0	1.5	0.18
3.0	3.6	1.2	0.08
4.0	2.9	0.725	-0.14
5.0	2.3	0.46	-0.34

Y = yield

greater when the electrolyte solution is added dropwise over a long period of time than when it is added all at once¹⁸. This phenomenon is known as acclimatisation. Therefore a great deal of care was taken to regulate the dropwise addition of the non-solvent.

Mechanism of coagulation

The electric charge on the particles is the main stabilising factor of colloids¹⁹, this is because the repulsive forces prevent the close approach of the similarly charged particles.

The aggregation of colloidal particles under the influence of an added electrolyte is known as coagulation. In fact, the added electrolyte discharges the colloidal particles. The evidence in favour of this is the decrease in mobility and zeta potential of the sols upon the addition of an electrolyte. The mechanism of discharge is still not very clear. In a number of instances the discharge has been explained as an ionic reaction between the ions of the particles and those of the added electrolyte. It has been also suggested that the added electrolyte decreases the thickness of the diffuse layer of ions around the particles and facilitates coalescence. According to another approach, the coagulation has been shown to occur at a certain value of the coagulating ion, independent of the type of electrolyte used.

After neutralisation, the uncharged particles attract each other as a consequence of their surface tension. In other words they possess a sphere of attraction around them¹⁹. In the case of partially discharged particles, the remaining electric charge decreases the probability of adhesion, as a result of this the coagulation rate becomes slow.

In lyophobic systems, coagulation is effected by the removal of an existing solvated shell rather than the electric charge²⁰, and the ion causing coagulation is adsorbed at the interface. As a rule, the lyophilic colloids require more electrolyte for flocculation than that needed for the lyophobic colloids²¹.

Lastly, it may be added that the mechanism of coagulation is ruled by the probability of collision of the particles and the probability of adhesion after collision. At sufficiently high electrolyte concentration, when each collision results in aggregation, the coagulation is said to be fast. At low electrolyte concentration, each collision does not produce aggregation and the coagulation is said to be slow.

Effect of electrolyte concentration

Coagulation takes place due to the ions of the electrolyte which carry a charge opposite to that on the dispersed

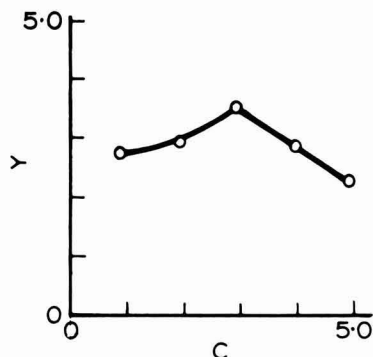


Figure 6.

phase. Further, only a minimum concentration of electrolyte is required to bring coagulation about²².

The rate of coagulation, which increases with increasing concentration of electrolyte, becomes constant at higher concentrations²³. Thus, it can be inferred that the process of coagulation is efficient only at a fixed electrolyte concentration. To verify this the effects of concentration on yield were thoroughly examined. The results are presented in Table 3 and Figure 6.

Table 3 shows that yield increases with increase in electrolyte concentration and attains a maximum value at a particular electrolyte concentration. Thereafter there is a decrease in yield with increase in electrolyte concentration.

The plot of yield against concentration is somewhat hyperbolic (Figure 6). Therefore the ratio of yield and concentration (Y/C) was plotted against C, as shown in Figure 7. The graph suggested that Y/C is an exponential function of C. Therefore Log₁₀Y/C was plotted against C, as shown in Figure 8. The plot is a perfect straight line. Therefore, the relation between Y and C can be expressed as

$$\text{Log}_{10} Y/C = A + BC$$

or

$$\text{Log}_{10} Y - \text{Log}_{10} C = A + BC$$

or

$$\text{Log}_e Y = 2.303A + 2.303BC + \text{Log}_e C$$

Differentiating with respect to C, we have $1/Y \times dY/dC = 2.303B + 1/C$, or $dY/dC = 2.303 BY + Y/C$. For maxima or minima, $dY/dC = 0$. Therefore $2.303 BY + Y/C = 0$, or $Y(2.303 B + 1/C) = 0$. But $y \neq 0$, therefore $2.303 B + 1/C = 0$. From the graph, $B = -0.2$. Therefore $1/C = 0.4606$ or $C = 2.2$, consequently the maxima should occur at an electrolyte concentration of 2.2 per cent. From Table 3 it is obvious that the maximal point lies in the vicinity of 3 per cent. Thus the values compare well within the limits of experimental error. To keep production costs low, a one per cent electrolyte solution only was used instead of the maximum concentration.

Effects of valency of ions

According to the Schulz-Hardy rule, the flocculating power of bivalent ions is about 20 to 80 times greater than

Table 4
Yield (g) in relation to the valency of anions

Electrolyte	Valency of anion	Yield (g)
NaCl (mol. wt. 58.5)	1	0.56
Na ₂ SO ₄ (mol. wt. 142.0)	2	0.70
Na ₃ PO ₄ (mol. wt. 164.0)	3	0.90

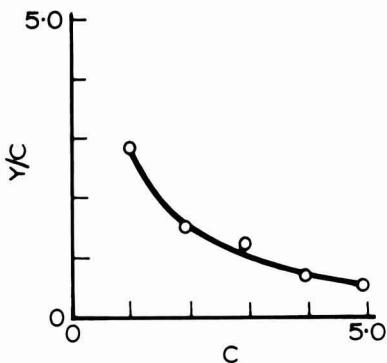


Figure 7.

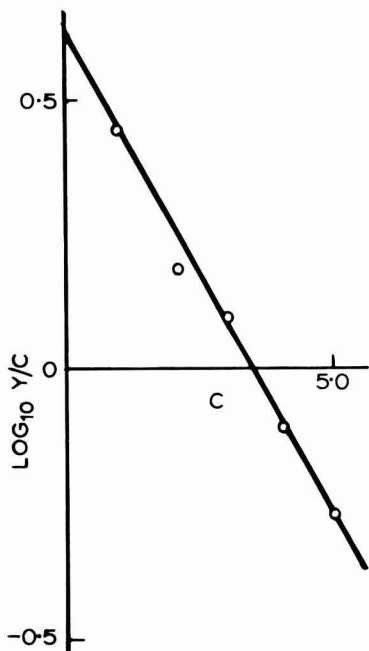


Figure 8.

Table 5
Yield (g) in relation to the valency of cations

Electrolyte	Valency of cation	Yield (g)
NaCl (mol. wt. 58.5)	1	0.56
BaCl ₂ (mol. wt. 208.4)	2	1.30
FeCl ₃ (mol. wt. 162.3)	3	1.00

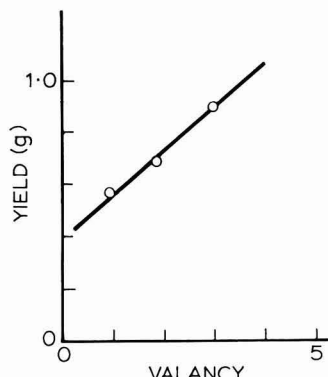


Figure 9.

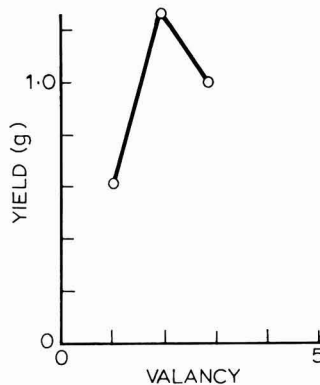


Figure 10.

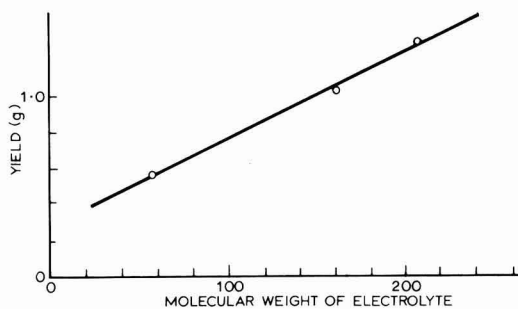


Figure 11.

that of univalent ions, and the flocculating power of trivalent ions is many times greater than that of bivalent ions¹⁷. Besides this, it has been observed that flocculating power increases with increase in atomic weight or ionic radius in the series Li, Na, K, Rb and Cs, and the ions of higher valency have the tendency of being strongly

adsorbed¹⁸. Moreover, the flocculating ion has been detected in the coagulum²².

The effects of the valency of the ions are shown in tables 4 and 5 and in figures 9 to 11. Figure 9 shows that yield is a linear function of the valency of anions such as

Cl⁻, SO₄²⁻ and PO₄³⁻. Thus the greater the valency of an anion the greater the yield. The validity of this rule is to be examined for salts other than those of sodium. Again, Figure 10 indicates that in an electrolyte where the cation effects coagulation, if the anion remains the same, the yield first increases with increasing valency of the cation and then shows a downward trend. In order to find out the best fit, yields were plotted against the molecular weights of the electrolytes. The linear plot is shown in Figure 11. Thus in an electrolyte where the cation effects coagulation, if the anion remains the same, the yield is a linear function of the molecular weight of the electrolyte and is independent of the valency of the cation. The validity of this rule when cation and anion vary is to be examined.

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References

1. Verman, L. C. and Bhattacharya R., *London Shellac Research Bureau*, Technical Paper No. 1, 1934, December, p. 5.
2. Tschirch, A. and Farner, A., *Arch. Pharm.*, 1899, **36**, 237.
3. Schaeffer, B. B., Weinberger, H. and Gardner, W. H., *Ind. Eng. Chem.*, 1938, **30**, 451.
4. Verman, L. C. and Bhattacharya, R., *London Shellac*

- Research Bureau*, Technical Paper No. 5, 1935, August, pp. 1-30.
5. Palit, S. R., *J. Ind. Chem. Soc.*, Ind. News Ed., 1942, **5**, 25.
6. Venugopalan, M. and Sen, H. K., *J. Soc. Chem. Ind.*, 1938, **57**, 371.
7. Sengupta, S. C., *J. Sci. Ind. Res.*, 1959, **18A**, 221.
8. Seshadri, T. R., Madhav, R. and Subramanian, B. V., *Indian J. Chem.*, 1967, May, **5**, pp. 182-4.
9. Bhattacharya, R. and Gidvani, B. S., *London Shellac Research Bureau*, Technical Paper No. 13, May 1938, pp. 3-21.
10. Bhattacharya, R. and Heath, G. D., *London Shellac Research Bureau*, Technical Paper No. 16, 1938, September, pp. 3-15.
11. Berg, E. W., "Physical and chemical methods of separation", *McGraw-Hill Book Company*, New York, 1963, 74.
12. Mani Tripathi, S. K. and Sankarnarayan, Y., *Indian Lac Research Institute*, A.R., 1959-60, p. 23.
13. *Angew. Chem. Internat. Edit.*, 1966, vol. 5, No. 6, 609-10.
14. Kumar, A., *J. App. Poly. Sci.*, 1977, **21**(10), 2695.
15. Mandalkern, L., "Crystallisation of polymers", *McGraw-Hill Book Company*, New York, 1964, 215-290.
16. Chien, Jen Yu an., "Determination of molecular weights of high polymers", *Oldbourne Press*, London, 1963, 23.
17. Jirgensons, B. and Strauman, M. E., "A short textbook of colloid chemistry", *Pergamon Press Ltd*, London, 1954, 300-16.
18. Weiser, H. B., "Colloid chemistry", vol. 1, *The Chemical Catalog Company*, Inc., New York, 1926, 611.
19. Kruyt, H. R., *ibid.*, pp. 306-22.
20. Hartman, R. J., "Colloid chemistry", *Houghton Mifflin Company*, New York, 1939, 255-56.
21. Jirgensons, B., "Organic colloids", *Elsevier Publishing Company*, London, 1958, 229.
22. Hatschek, E., "An introduction to the physics and chemistry of colloids", *J. & A. Churchill*, London, 1925, 55-6.
23. Freundlich, H., "New Conceptions in Colloidal Chemistry", *Methuen & Co. Ltd*, London, 1926, 39.

Instrumental assessment of application properties of latex paints

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Summary

A method is described for using a rotational viscometer to measure rheological properties of latex and other paints. Thixotropic and viscous properties are characterised by a fairly rapid standardised procedure with sheared and unsheared rheological states defined operationally. Results of this technique correlate well with manual brush and roller assessments.

Introduction

Actual brushing or rolling out of latex paints is a sensitive measurement of application properties of these materials. Such assessments are fast and reliable when performed by skilled and experienced personnel. They cannot be made quantitative, however, and it is sometimes difficult to use the conclusions from brushout trials to reformulate efficiently. Instrumental rheological techniques, on the other hand, can be employed to produce quantitative measurements of apparent viscosity as a function of paint composition, shear rate and shearing history. These results can be used conveniently to modify formulations in order to remedy particular deficiencies as well as in quality control. As in all instrumental measurements, however, it

is necessary to ensure that the procedure used produces data which actually reflect the properties the method purports to measure. The Stormer viscometer¹, for example, is an accepted instrument in the coatings industry but it is doubtful that its results can be used efficiently to design paints with improved flow properties.

Many instrumental methods have been suggested for the characterisation of application properties of coatings. This report summarises results of an investigation into procedures for making effective use of a rotational viscometer for this purpose. The experimental method is of course not fundamentally different from those used by other investigators who have employed similar test equipment. It appears to have certain advantages over prior practice, however. These include simplicity and rapidity (about 30 minutes) of experimental method, a clear-cut and standardised procedure and interpretation of data, and good correlation with the results of manual brushout trials. The method reported has been tailored particularly to latex-based paints, although several solvent-based alkyds were used for comparison in the investigation.

Alternative procedures

During the course of this work it was necessary to consider some of the existing rheological methods. Two of the apparently more convenient and promising approaches are mentioned briefly in this section. The authors do not claim to have carried out a systematic survey of alternative procedures, however.

The Casson-Asbeck equation^{2,3} provides a useful framework for organising the rheological data of coatings formulations when experimental results fit the form of this equation⁴. In this case the data are handled in the form

$$\eta^{\ddagger} = \eta_{\infty}^{\ddagger} + \tau_0^{\ddagger} \dot{\gamma}^{-1} \dots \dots \dots (1)$$

where η is the apparent viscosity at shear rate $\dot{\gamma}$, η_{∞} is the limiting viscosity at high shear rates and τ_0 is the yield stress of the material. A plot of η^{\ddagger} versus $\dot{\gamma}^{-1}$ should be a straight line with slope τ_0^{\ddagger} and intercept η_{∞}^{\ddagger} if the data are compatible with this equation. In practice, the limiting high shear rate viscosity is taken to represent the viscosity of the coating under brushing or rolling conditions, while the yield point is related to the resistance of the paint to sagging and peripherally to its levelling ability.

Latex paint rheological data obtained with a Brookfield viscometer conform well to the Casson-Asbeck relation⁴, as do results for some high solids coatings⁵ and high build castor oil-based marine paints⁶. The Brookfield instrument operates over a relatively narrow and low shear rate range, however, and our experience with a cup-and-bob rotational viscometer indicates that the Casson-Asbeck equation does not fit the behaviour of latex paints when measurements are made over a wider shear rate range. Similar conclusions have been reported earlier by others⁷.

Sarkar and Lalk⁷ have described the comparison of rheological and application properties of latex paints using apparatus similar to that employed in the present work. Despite the clear description of experimental procedures provided by these authors, serious problems were encountered in our laboratory in attempts to duplicate their method and to replicate our own data measured by the techniques recommended in the cited article. As a result a more time-efficient and unequivocal procedure was developed in this laboratory for the characterisation of latex paints. This report describes the method and some of its applications.

Measurement policy

A number of variables should be controlled in any quantitative measurement of thixotropic behaviour, such as that which occurs in latex paints. These variables include shear stress or shear rate levels, shear history (shear rate and time under shear), temperature, initial state of the material to be studied and, in some cases also, the rates of change of shear stress or shear rate. Instruments with narrow flow paths are best for such measurements because the shear history of the test liquid is more nearly uniform. Capillary instruments are not as useful as concentric cylinder rheometers because the latter provide more uniform shear histories. Cone-and-plate viscometers are acceptable by this criterion but their geometry allows evaporation of water and drying of the paint and there is some tendency for the test material to climb out of the gap between the cone and the plate at higher shear rates.

The particular sequence of measurements used in the rheological characterisation should be matched so far as possible to the information one wishes to obtain. The

material must be brought first to a defined, reproducible rheological state. One way to do this is to shear out the previous history and measure the rate of recovery of thixotropic structure. As an alternative, one may let the sample rest under specified conditions until a reproducible "equilibrium" state is reached for subsequent measurements of rates of thixotropic breakdown.

Since a spectrum of rheological behaviours can be observed with a given thixotropic material it is also essential that experimental results be determined objectively. Subjective data such as judgements as to when the viscosity of a liquid has fully recovered from the effects of shearing are difficult to employ in a reproducible manner.

The experimental method reported here facilitates characterisation of the thixotropic behaviour of a paint composition by defining "sheared" and "unsheared" rheological states operationally. The measuring procedure is also defined operationally and the data are shown to correlate well with the application properties of the latex paints.

Experimental

Rheological measurements were made with a Contraves Rheomat-30 cup-and-bob viscometer over a shear rate range up to 660 s⁻¹. Sample temperatures were held at 30 ± 0.1°C, for convenience. The particular instrument used in this investigation was limited to a maximum shear rate of 660 s⁻¹. Other measuring systems which permit higher shear rates would be preferable but it is not likely that the differences between materials noted in this work would be altered by this change. The choice of sample temperature is also not critical in the temperature range near normal room conditions.

The procedure was to briskly stir the paint in the can for one minute with a mechanical stirrer or shaker and measure out about 120 ml of stirred paint into the rheometer cup. The bob was immersed in the cup and the cup and bob were attached to the calibrated viscometer. A piece of stretchable polyethylene film was used to seal the cup opening and prevent skinning. The whole assembly was left for 30 minutes to allow for temperature equilibration and recovery of sheared out thixotropic structure.

The majority of users stir paints before use and the procedure outlined above appears to be a realistic approximation of service conditions.

After the half hour resting period the film cover was removed, the bob was given one turn to release any trapped air bubbles, and the viscometer shear rate was automatically varied from 0.1 s⁻¹ to 6.6 s⁻¹ using the programmable shear rate options of the instrument. The shear rate was then increased automatically from 9.0 s⁻¹ to 662 s⁻¹, held at 662 s⁻¹ for five minutes, and then decreased progressively to 9.0 s⁻¹.

This procedure provides the yield value of the unsheared paint and the characteristic thixotropic loop. Note that the unsheared paint is defined operationally as the material which has been rested 30 minutes in the rheometer cup after shearing as described above. Shearing at 662 s⁻¹ for five minutes was sufficient to bring the shear stress to its equilibrium value with all the paints which were examined in this study.

The viscometer was then set to manual control and the paint was sheared again for five minutes at 662 s⁻¹.

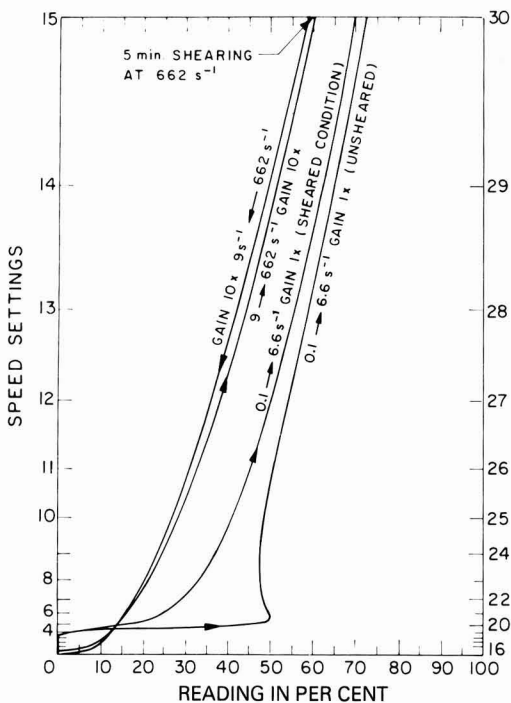


Figure 1. Raw data for a polyvinyl acetate latex paint. With the viscometer used the x axis is proportional to viscosity and the y axis is related to shearing rate

Twenty seconds after cessation of high speed shearing the viscometer control was returned to automatic and the shear rate was increased from 0.1 s^{-1} to 6.6 s^{-1} . This procedure provides the yield value and the low shear rate flow curve of the sheared paint. Here again the "sheared paint" condition is defined operationally.

The 20 second rest time used here after shearing can be modified if desired. This particular interval was chosen because levelling of typical coating films has been estimated to be completed in 10-30 seconds⁸.

Figure 1 shows typical raw data for a polyvinyl acetate latex paint. The abscissa scale is proportional to viscosity with the particular instrument used and the ordinate scale is related to shear rate.

Yield values are estimated by extrapolating rheograms to the x axes. When stress overshoots are observed, the later linear part of the curve is used for the extrapolation.

Results and discussion

The information that can be extracted from the rheogram of the paint as measured by the procedure outlined above consists of the yield value of the sheared and unsheared material, the viscosity of the paint in the sheared and unsheared conditions at low and high shear rates, and the degree of thixotropy of the material as expressed in the thixotropic loop or by comparison of viscosities at a given rate before and after shearing. The total working time is about half an hour after the initial half hour resting time.

The measured yield values of six paint samples are listed in Table 1. The data given are mean values of these

Table 1
Summary of yield values of various paints

Code	Description	Yield stress (Pa)*	
		Unsheared	Sheared
F	PVA latex interior semi-gloss	4.38 ± 0.22	1.37 ± 0.15
G	Acrylic latex interior semi-gloss	6.86 ± 0.36	4.53 ± 0.09
H	PVA latex interior flat (high pigment volume concentration)	4.38 ± 0.57	0.59 ± 0.07
J	PVA latex velvet finish interior (low pigment volume concentration)	12.63 ± 1.09	2.54 ± 0.13
K	Alkyd semi-gloss	12.60 ± 0.40	≈ 0
S	Alkyd semi-gloss with proprietary flow control additive	12.2 ± 0	≈ 0

*Figures recorded are mean values \pm standard deviations.

Table 2
Viscosities at low shear rates (Pa.s)

Code	0.3 s^{-1}	0.6 s^{-1}	1.05 s^{-1}
F	69	57	41
G	169	103	62
H	102	79	58
J	138	107	74
K	70	53	39
S	33	25	21

replicate experiments. The corresponding standard deviations are also recorded, to indicate the good reproducibility of this method. All the unsheared paints have yield values greater than 1 Pa, suggesting that a minimum amount of settling of pigment should occur during storage of the paint⁹. In fact, some slight settling was observed with paint G, but the pigment was easily re-dispersed. This indicates that while the rheological character of the material is a major factor in influencing the rate of pigment settling, other features, like surface forces, may also be significant.

The low shear rate viscosity and yield value of sheared paint are obtained from the curve generated by sweeping through the range of shear rates from 0.1 s^{-1} to 6.62 s^{-1} , beginning this measurement 20 seconds after the cessation of high speed shearing. Other investigators have used different procedures to measure the yield stresses of paints. Our experience is that many of these procedures are time consuming and poorly reproducible.

The operative shear rate experienced by paint during levelling and sagging has been estimated variously to be in the range^{9,12} $0.001 - 0.5 \text{ s}^{-1}$.

Levelling is of course promoted if the coating develops only a low yield stress or no yield stress in the time available for levelling.

Table 2 lists viscosity values for sheared paints at the indicated low shear rates. From these data and the yield values of the sheared paints in Table 1 it can be concluded that paints F and H would exhibit the best levelling

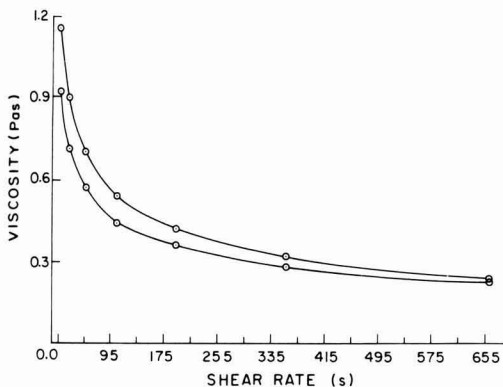


Figure 2. Thixotropic loop for latex paint F

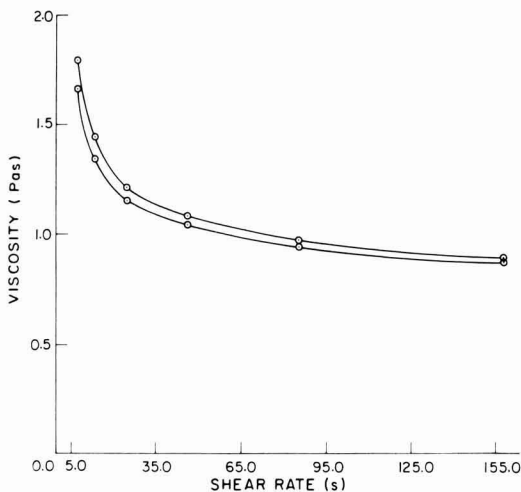


Figure 3. Thixotropic loop for alkyd paint K

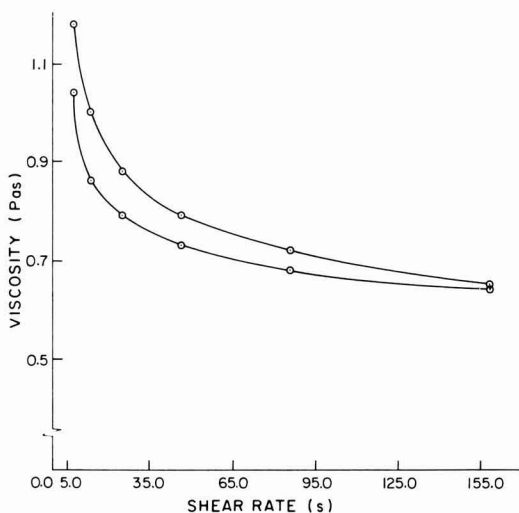


Figure 4. Thixotropic loop for alkyd paint S, with flow modifier

properties of the four latex paints. The two alkyd paints, K and S, would have better levelling properties than any of the latex formulations, with S superior to K in this respect.

Sagging is prevented if the paint exhibits a high viscosity at low shear rates or if a reasonable yield value develops rapidly after shearing has ceased. The exact values which are required for elimination of sagging are not agreed. Patton¹³ suggests a viscosity of several thousand poises while Sarkar and Lalk⁷ postulate a viscosity greater than 250 poises and a yield stress greater than 5 dynes/cm². None of the paints examined had low shear rate viscosities of the order of thousands of poises but all except the two alkyds exhibited a yield stress in the sheared condition. The latex paints which had most sag resistance appear to be G, J, F and H in the order listed. The alkyd paints both had sagging problems with S worse than K.

Figures 2-4 show the thixotropic loops measured for latex paint F and alkyds K and S. All the latex paints had about the same viscosity at higher shear rates, with paints F and G almost identical in behaviour. The two alkyds were more viscous at higher shear rates. They can be expected to exhibit higher brush drag and better hiding since they will not brushout as far as the less viscous latex compositions. Alkyd S contained a flow control additive. It exhibited a bigger thixotropic loop and less brush drag than alkyd K.

The stress overshoot in the right hand curve of Figure 1 has not been considered in this discussion. When thixotropic suspensions are sheared at a constant rate the resulting shear stress builds up quickly with time and then decreases to an equilibrium value. The stress overshoot which is observed reflects the breakdown of entanglement junctions in the fluid. Its exact value depends on the applied shearing rate, however, and accurate measurements of stress overshoots did not appear to be practical with the viscometric technique used here, in which the shearing rate is programmed. In addition, it is not clear how the stress overshoot phenomenon correlates with application properties of latex paints. It may be noted, however, that addition of a conventional hydroxyethyl cellulose thickener to a polymer latex results not only in a pronounced increase in the yield values of the fluid as measured by the method described here, but also in the appearance of strong stress overshoots.

General conclusions

The method described appears to provide reproducible, quantitative rheological data which correlate well with application properties of latex paints. It is convenient and reasonably fast in operation. The rotational viscometer used does not measure elastic effects, however, and the data cannot be expected to correlate well with phenomena such as roll spatter, which appear to reflect elastic as well as viscous properties of paints¹⁴.

Acknowledgment

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References

1. ASTM D562-55.
2. Casson, N., "Rheology of Disperse Systems", Mills, C. C. (ed.), Pergamon Press, New York, 1959, 84.

3. Asbeck, W. K., *Off. Digest*, 1961, **33**, 65.
4. Pierce, P. E., *J. Paint Technol.*, 1971, **43** (557), 35.
5. Schoff, C. K., *Prog. Org. Coat.*, 1976, **4**, 189.
6. Papo, A. and Torriano, G., *JOCCA*, 1980, **63**, 10.
7. Sarkar, N. and Lalk, R. H., *J. Paint Technol.*, 1974, **46** (590), 29.
8. Dodge, J. S., *J. Paint Technol.*, 1972, **44** (564), 72.
9. Munn, R. H. E., *Paint Manufacture*, 1968, **38** (7), 22.
10. Wu, S., "ACS Organic Coatings and Plastics Division Preprints", 1977, **37** (2), 315.
11. Pierce, P. E. and Donegan, V. A., *J. Paint Technol.*, 1966, **38** (492), 1.
12. Patton, T. C., *J. Paint Technol.*, 1966, **38** (502), 656.
13. Patton, T. C., "Paint Flow and Pigment Dispersion", *John Wiley*, New York, 2nd edition, 1979.
14. Glass, J. E., *J. Coatings Technol.*, 1978, **50** (640), 61.

short communications

Adhesion and the gap between theory and practice

W. Funke

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"A paint film peels off because its adhesion is poor." Such a specious explanation of one of the most important practical paint defects may amuse somebody who isn't involved in the case. But what kind of answer would we give? It is certainly known that adhesion may be achieved by various mechanisms. There is the mechanical theory, the adsorption theory, the diffusion theory and the electrostatic theory of adhesion. But how does the paint chemist of a company know which of these theories is relevant in his special case?

In order to make use of these theories in a practical sense, characteristic criteria indicating the various adhesion mechanisms should be available, which isn't the case up to today. A very similar situation exists as far as the bonds responsible for adhesion are concerned. We know, hear and read of in connection with adhesion problems again and again that primary forces and, even more likely, secondary valence forces may play a role. The latter ones, also known as van der Waals forces, are again subdivided into dispersion and dipole forces. In addition, electrostatic forces and, perhaps most important of all, hydrogen bonds are also involved. However the question as to which kind of interactions prevail in a special case, or to what extent various types of bonds contribute to the total adhesion in a specific case is mostly answered in a rather speculative way.

Accordingly the concept has become established that polar groups improve adhesion. However is this idea generally and without exception valid, especially where the protective function of organic coatings is concerned? As favourably as polar groups may influence adhesion in relatively dry environments, they may to the same extent adversely affect adhesion when exposed to humid, corrosive conditions.

Quite apart from the fact that the polar groups of the binder molecules accumulate at the film/substrate interface, they are also distributed throughout the film, rendering it water sensitive, and at high humidity water preferentially enters these regions of polar interactions. It should be borne in mind that surfaces of most generally used metals are covered by relatively hydrophilic oxide layers to which water is firmly bound in the first adsorption layer, making the affinity of these interfaces to more water molecules especially high.

existence of a weak boundary layer is frequently postulated. One explanation of this "weakness" is the depletion of polar groups in the region above the bonding layer. It is difficult to understand, however, why a deficiency of polar groups in the lower part of the film should be responsible for a failure in this area, because this would mean that this kind of polar interaction is essential for the mechanical strength of the whole film, i.e. for its cohesion. Again, for this assumption there is no conclusive and convincing evidence based on unequivocal experimental results.

The experimental determination of the adhesion of organic coatings is still not much less problematic than questions about adhesion mechanisms. Following the call for a physically exact testing method the vertical pull-off or tear-off test has been developed.

Disregarding the considerable fluctuation in measurement data, moderate reproducibility and also problems connected with the attachment of the sample to the pull-off device, the difficulty still remains to interpret the measured force of adhesion if the fracture is neither a purely cohesive nor a purely adhesive one, but both kinds of fracture are found side by side and irregularly distributed over the fractured area.

Moreover, the question of how adhesion is influenced during exposure to water, which is extremely important for the protective function of organic coatings, cannot be answered by the pull-off test. At best one can find whether and to what extent adhesion regenerates after exposure when the coating is again in the dry condition.

Admittedly conclusions drawn from these considerations are somewhat disappointing, especially for those having done a lot of work on elucidating these problems. Nevertheless we cannot afford to rest on the present knowledge.

Today new methods for the investigation of the chemical and structural nature of interfaces are available, of which one would have scarcely dreamed some 15 to 20 years ago. It therefore doesn't seem hopeless to try and bridge the gap between theory and practice in adhesion thus making theories practically useful.

In discussions on adhesive and cohesive failure the

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next month's issue

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

Fractional precipitation of lac. Part 2: characterisation by *A. Kumar*

The adhesive property of shellac on wood to wood surfaces by *P. C. Gupta, M. Islam and R. Prasad*

Programmed environmental testing – a pet theory by *J. L. Scott*

Impedance of detached paint films by *G. A. M. Sussex and J. D. Scantlebury*

Wood preservation and its adjacent partner (short communication) by *E. M. Pearce*

Further information from the publishers of the titles reviewed can be obtained by completing the *Reader Enquiry Service* form at the back of the *Journal*.

Corrosion Testing for Metal Finishing

V. E. Carter

Butterworth Scientific in association with the Institute of Metal Finishing, Exeter House, 48 Holloway Head, Birmingham B1 1NO
ISBN 0408-01994-7, pp. 121 inc index
Price £10

This book is a concise reference volume on corrosion testing. There are 20 chapters, each dealing with a specific aspect of testing and including two on quality control testing of coatings using accelerated corrosion tests, which should be read by all chemists employed in the paint industry. Wherever possible the relevant British Standard, ISO and/or ASTM references are quoted.

A number of the test methods described apply only to plated finishes, but this does not detract from the value of the book, which provides a quick reference to this particular aspect of testing.

Reader Enquiry Service No. 21

D. S. Newton

A Dictionary of Chromotography, 2nd Edition

R. C. Denney

MacMillan Reference Books
London, 1982
pp. XIV + 229
Price £15

Like its companion on spectroscopy (see below) this book gives useful concise definitions, which, as stated in the introduction, are not intended for the expert but for those

Information regarding membership of OCCA is obtainable from the Association's offices, see contents page for address.

Trent Valley Branch

Surface coatings and British Rail

The first technical meeting of the Trent Valley Branch was held on Thursday 28 October 1982 at a new venue, The British Rail School of Engineering, Derby. Mr David Bishop, MSc, an employee of BR and also a member of

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reviews

coming into the field. On one or two aspects it may not be sufficiently up to date. The term, size exclusion chromatography, now being widely used should have merited an entry. More could have been given on the recent advances in gel permeation chromatography (GPC), e.g. high performance GPC and its use for materials of low molecular weight.

Reader Enquiry Service No. 22

L. A. O'Neill

A Dictionary of Spectroscopy, 2nd Edition

R. C. Denney

McMillan Reference Books
London, 1982
pp. XIII + 205
Price £15

Although this book is larger than the first edition of nine years ago it would need to be much more extensive to cope with the rate at which new spectroscopic techniques are developing. However, it deals mainly with the more general terms and gives some useful concise explanations. On particular points, the description of Fourier transform infrared spectroscopy does not make clear the full advantages of this technique, which is becoming important in film studies, and IUPAC has a much wider role than coordinating nomenclature. One can never have too many reference books, and while this one may not provide all the answers it makes a good place to start.

Reader Enquiry Service No. 23

L. A. O'Neill

OCCA meetings

the Trent Valley Branch of OCCA, presented a slide show and talk on "Surface coatings and British Rail".

The early railway companies soon realised the

importance of chemists to the smooth running of the trains, and laboratories were organised between the 1860s and 1890s. The London and North Western Railway was the first company to establish a chemical laboratory in 1864 at Crewe, and the other companies soon followed. The Surface Coatings and Corrosion Unit had its origins at Wolverton in 1921 and was responsible for the quality control of paints for the London and North Western Railway's rolling stock. Following the grouping of the railways in 1923, the laboratory became part of the London, Midland and Scottish Railway Research Department and on nationalisation in 1947 became responsible for the painting and allied problems for the whole of the railway network. Several of the activities that are under current investigation were discussed and will be the subject of further papers in this *Journal*.

Micaceous iron oxide has been extensively used as the major pigment in undercoats and finishes for the protection of civil engineering structures. Although micaceous iron oxides have been found in various parts of the world, only two pigments have been approved for use in British Railway's protective systems, namely those from Devon, England (from 1900-1964) and Waldenstein, Austria (from 1964 onwards). In the latter years several alternatives have become commercially available with obvious differences in their physical properties. Extensive research has shown that of the pigments currently available only the Austrian can be classified as micaceous iron oxides; other pigments do not possess the lamellar structure of mica, have Fe_2O_3 contents below the accepted minimum of 85 per cent (w/w), and have inferior corrosion protection to the lamellar pigments.

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

The evaluation of paints for the outside of rolling stock has been assessed by attaching painted "Mylar" sheets to the bodysides, thus subjecting the various paints to the mechanical and chemical conditions associated with a railway environment. The value of this technique is that the sheets can be removed to the laboratory and the paint performance assessed by optical and analytical techniques. Over 40 different types of paint are being assessed and there are strong indications of the type of air drying system most suitable to meet railway requirements. There is also a major project on finding suitable decorative retardant paints to increase the fire protection of wooden materials inside rolling stock. Over 200 paints from all over the world have been evaluated and suitable paints have been subjected to the various British Standard tests, followed by large scale fire tests simulating the conditions

inside a coach compartment; on the basis of these tests recommendations have been given to minimise the fire risk.

After a short buffet interval during which informal discussions took place, the meeting was re-convened and a lively question and answer session period was followed by a vote of thanks from Mr John Burns which was heartily endorsed by all present.

J. C. Ellis

Manchester

Colour perception and measurement

Monday 6 December 1982 will be a day to remember in the Section's diary of events, as innovation and success were the final result. Dr M. P. Pointer of Kodak Ltd, Hertfordshire had motored to the new venue of Bolton Wanderers' Football Supporters Club, Executive Lounge, Burnden Park, Bolton and arrived safely despite a massive pile-up on the fog-bound Manchester Motorway network which included the car of our Vice-Chairman, Gordon Robson.

The 77 individuals who attended this Christmas buffet lecture were entertained to a 70 minute lecture that was notable for the detailed information that Dr Pointer provided, coupled with a formidable array of lecture aids in the form of projectors, prisms and other impressive equipment.

We were told that Kodak has 13 colour laboratories throughout the world and that these supplied information on colour to Dr Pointer.

The lecturer posed the question as to whether individuals see colour differently and then proceeded, with the aid of a Union Jack, to prove that they did. He also claimed that one in seven of the population is defective in relation to colour appreciation and perceptiveness.

The lecture was followed by a discussion period in which questions raised included reference to darkrooms, the Ishihara test, effect of photochromic spectacle lens on colour matching procedures, colour blindness and the interesting effect noted when a black border section is added to a projector screen.

Fred Morpeth gave a vote of thanks to Dr Pointer which was enthusiastically received.

F. B. Windsor

Eastern Branch

Alternative methods of pigmentation

On 1 December 1982, Herr G. Dam, technical service manager of Sachtleben Chemie GmbH, addressed members on the subject of "Alternative methods of pigmentation".

The speaker discussed the benefits of the use of zinc sulphide opacifying pigments and barium sulphate extenders in conjunction with titanium dioxide, putting forward the

case for looking at the concept of pigment surface area concentration as the calculating factor as opposed to pigment volume concentration.

The properties of these products were described offering possible advantages in rheology, dispersibility, absence of flocculation, no absorption in near ultraviolet range and dense film packing. These properties having to be weighed against lower tint reduction than titanium dioxide and higher specific gravity.

Some of the uses of these materials were outlined, particularly in the manufacture of emulsion paints, zinc phosphate/chromate primers, alkyd gloss paints and silk emulsions, and also in ultraviolet curing coatings.

This was a most interesting lecture as can be testified by

occa meetings

the extremely good turnout of members and the number of questions from the floor.

A vote of thanks was given by Mr A. McKendrick on behalf of the Eastern Branch, who greatly appreciated the kind gesture of Sachtleben in providing a most enjoyable buffet supper prior to the lecture.

E. P. Sinclair

Further information on any items mentioned below is obtainable by completing the Reader Enquiry Service form at the back of the Journal.

Interest repayments will inhibit UK adhesive recovery

A recent report from ICC Business Ratios examines the financial performance of 60 leading companies involved in the manufacture of adhesive and adhesive products in the UK over a three year period to March 1982. Key indicators suggest that while the sector's performance is still depressed, it has at least stabilised.

For instance, its average return on capital employed, after plummeting from 14.1 per cent in 1979/80 to 6.0 per cent in 1980/81, has remained at 6.0 per cent in 1981/82.

The industry's average profit margin has followed the same pattern, dropping from 5.7 per cent in 1979/80, through 2.4 per cent in 1980/81, to 2.3 per cent in the final year.

Over the same period, stock turnover has improved from 4.2 times to 4.8 times a year, while credit period has remained static.

However, adhesive manufacturers have been borrowing extensively through the period. In 1981/82, interest repayments to lending institutions took nearly 45 per cent of their pre-interest profits, and while falling bank rates may alleviate this burden, ICC predicts that the industry will be left in a less competitive position in the future. Without money available to invest in new processes, adhesive manufacturers risk leaving parts of their industry open to import competition.

Reader Enquiry Service No. 31

Butyl methacrylate technology licensed

Beatrice Chemical and ICI have concluded an agreement by which Beatrice has licensed ICI's technology for the production of butyl methacrylate, an important raw material used in the manufacture of acrylic polymers.

Beatrice Chemical is a leading producer of acrylic resins in Europe, the USA and South America through its divisions Polyvinyl Chemie (Waalwijk, The Netherlands), Polyvinyl Chemical (Wilmington, Mass., USA) and three other operating units in Spain, Mexico and Venezuela.

ICI is a major supplier of methacrylate monomer raw materials with a long established position in butyl methacrylate technology. ICI's technology is intended for use in a butyl methacrylate plant in Waalwijk, The Netherlands.

Reader Enquiry Service No. 32

Goodlass Wall wins "Fit for Work" award

Goodlass Wall & Co. Ltd, the Liverpool based manufacturer of Valspar Paints, was among the 100 UK companies to receive "Fit for Work" awards in 1982. The commemorative plaques and scrolls were presented by Jack Ashley, MP at a ceremony in Liverpool during February.

The awards, which are restricted to 100 from a candidate list of many thousands of companies throughout the UK, are given to those which have done most for disabled workers in the previous 12 months by implementing constructive employment policies. Among the criteria taken into account by the Manpower Services Commission when selecting Goodlass Wall was the company's record in several areas: having given full and fair consideration to the disabled for all types of vacancy; the retention of newly disabled employees after any necessary rehabilitation or training; and equal opportunities for the disabled in career development and promotion.

Goodlass Wall employs approximately 650 people. Of these 23 are registered as being disabled, although the company's personnel officer, Harry Randall, estimates that a further 30 or 40 employees could qualify for registration if they wished.

Reader Enquiry Service No. 33

news

Solrec still expanding

Solrec Ltd, specialists in solvent recovery, blending and formulation, has announced an expansion of its plant at Heysham, Lancashire. This involved the installation of a new solvent extraction system which separates out the solvent content from thick waste materials such as thixotropic paints, adhesives and tank bottom residues from dirty solvent storage.

These waste materials can be handled by the new plant at contamination levels of up to 60 per cent, which Solrec claims is far in excess of the levels handled by the majority of other solvent recovery systems.

Solrec goes on to say that normally such materials are incinerated, which nowadays is a costly exercise. However, when processed in the new plant, the residues from solvent extraction take the form of dry solids which are easier to dispose of. A further advantage is the elimination of paperwork needed to conform with the requirements for notification of hazardous waste disposal procedures.

Reader Enquiry Service No. 34

EternaBrite specified

A member of the new high performance range of leafing aluminium pigments from Silberline has been incorporated into a specification recently issued by the US Corps of Engineers. EternaBrite 601 is being selected by contractors to pigment a ready-mixed inhibitive finish coat based on silicone resin modified long soya alkyd.

The aluminium borosilicate finish was first used for painting the Sagamore Bridge in Massachusetts and then another bridge in a similar watery

news

environment in Louisiana. The specification, besides calling for a lead- and chromate-free finish, prescribes a leafing content (as measured by ASTM D-480-70) exceeding 90 per cent.

Reader Enquiry Service No. 35

new products

Biocide for in-can and dry film

A fluorinated sulphonamide biocide has recently been developed by Lambson Ltd and has now been released. Known as Microbiocide 125 it is a white virtually odourless free-flowing powder that is insoluble in water. It is a bactericide and a fungicide and is intended for the in-can and dry film protection of emulsion paints.

The advantages of Microbiocide 125 are that it is not phenolic, does not contain heavy metals and is claimed not to cause paint to change colour.

Reader Enquiry Service No. 36

Compact powder gun

Solidspray is a new powder hand gun from Volstatic. It is only 300 mm long overall, weighs only 720 grams, and, says Volstatic, combines exceptional handling with high performance and ease of maintenance.

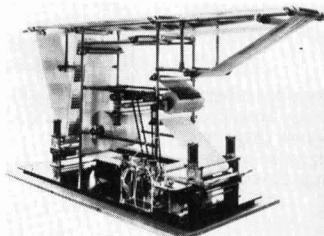


“Solidspray” is recommended for the application of all normal industrial finishing powders

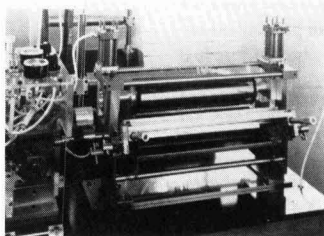
Electrostatic power is supplied to the gun by Volstatic's stand-alone generator via small-bore liquid-filled cables – a safety feature which prevents any short circuit in the event of damage to gun or cable.

To improve the balance and handling of Solidspray, the cable and the air and powder hoses are routed through the handle of the gun.

Reader Enquiry Service No. 37



RK Print-Coat Instruments Ltd's laboratory-scale rotary printing and coating machine



Standard head for gravure

Bench-Top printing and coating

A complete laboratory-scale rotary printing and coating machine which stands on a bench top and is driven by compressed air has been developed by RK Print-Coat Instruments Ltd.

The RK Rotary Koater is made in single-station and double-station versions. There are standard heads for gravure, flexo or gravure-offset printing or coating, also for rotary screen printing, hot-melt coating or extrusion, metering bar or reverse roll coating. Other heads for special applications can be built to order. All heads attach by four screws to the same mounting blocks, allowing interchange in just 5-10 minutes. An additional station for hot or cold laminating is fitted as standard and doubles as a pull-off drive in other applications. Options to assist drying include an extension frame, hot-air tunnel, infrared heaters and heated rollers.

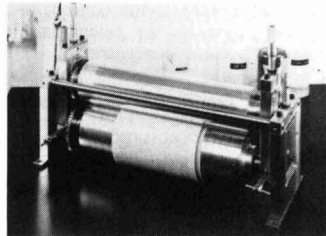
The machine is intended for two main

Three new resins from Polyvinyl Chemie

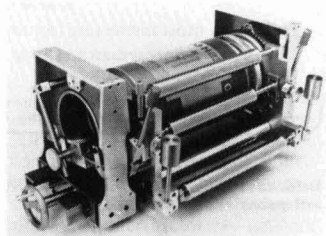
Polyvinyl Chemie recently introduced three new resins to the market.

Between them their uses are intended to cover the following areas: household paints for interior use; plastic, concrete, and wood coatings; concrete curing membranes, concrete sealers and dust binders; top coats and primers for engine enamels, rough metal coatings; also other applications where hardness, gloss and chemical (including petrol) resistance are wanted.

Reader Enquiry Service No. 39



Standard head for flexo



Standard head for rotary screen printing. Other heads are available for various processes and heads for special applications can be built to order

types of application. According to RK Print-Coat, as a multi-purpose research and development instrument it allows manufacturers of inks, coatings, adhesives, papers, films, foils and textiles to test different formulations, substrates and processes on an economic scale under realistic and precisely controllable conditions. As a production aid for printers or converters it enables new methods to be tested or proofs to be taken without interrupting the production machine. With the gravure head fitted, for example, the manufacturer claims it can easily run 12 or 14 different colour proofs in a day under conditions closely resembling the full-scale process.

The two-station machine allows over-coating or two-colour printing techniques to be studied. Alternatively, two different heads – say one gravure and one flexo – can be fitted and the machine used to proof by either method without changing heads.

Reader Enquiry Service No. 38

Wetting and dispersing aid

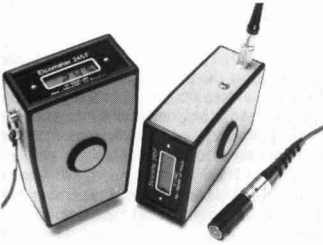
The problems of difficult to disperse oxide pigments and carbon black can now be solved with Disperbyk[®] 130, according to the manufacturer Byk-Mallinckrodt. This cationic wetting and dispersing additive is intended for use in alkyd/melamine systems, hydroxy-acrylics, epoxy/polyamides and thermoplastic acrylics.

Beside increasing gloss, Disperbyk[®] 130 is claimed to prevent hazing as well as flooding and floating and to reduce grinding times by up to 20-30 per cent.

Reader Enquiry Service No. 40

Coating thickness gauges

Elcometer Instruments Ltd claims that its new Elcometer 245F is the world's smallest solid state digital coating thickness gauge. It measures non-ferrous coatings including paints, platings, galvanising, powder coatings, epoxy, plastics and rubber with an accuracy and range of ± 5 per cent and 0-1,000 microns on a ferrous base.



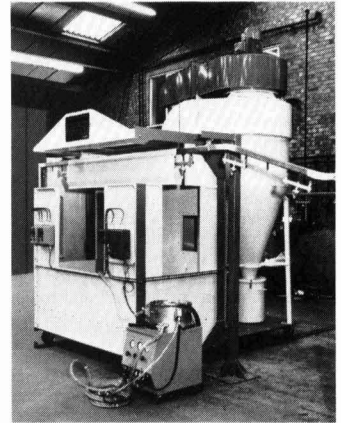
The Elcometer 245F, claimed to be the world's smallest solid state digital coating thickness gauge



The Elcometer 350F, statistical analysis features include automatic highest/lowest reading, mean value, standard deviation from the mean and the number of readings taken in a batch, of which 500 can be stored in the memory

In addition to the 245F, Elcometer has introduced a new microprocessor-based instrument designed for use in the laboratory, the Elcometer 350F Precision Coating Thickness Measuring System. The instrument measures in the range 0-1,000 microns with an accuracy of ± 2 per cent, and incorporates numerous calibration, statistical, programming and output functions.

Reader Enquiry Service No. 41



Mindon's powder recovery spray booth

Binks' robot spray painting system

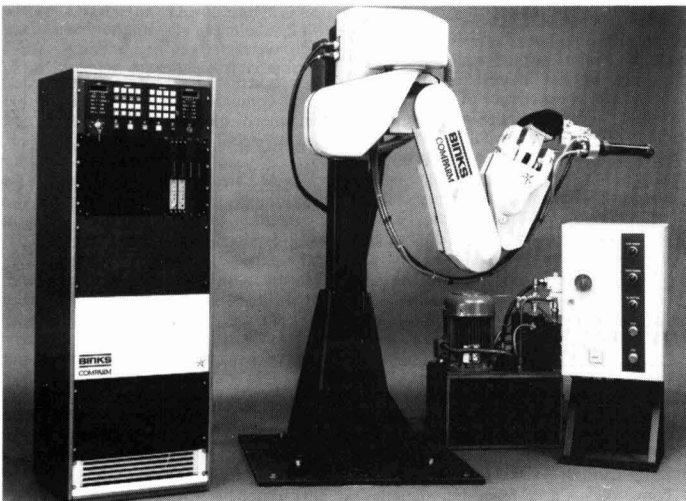
A new robot system has been introduced by Binks-Bullows Ltd. Called the Binks Comparm robot spray painting system, it is based on the Comparm robot designed and developed by GEC Robot Systems Ltd and uses a robot arm which has six degrees of freedom. It includes a jointed elbow and shoulder as well as a fully articulated wrist. Conventional installations have an envelope of movement covering a space 2,080 mm in height, 2,470 mm in width and 1,650 mm in depth.

The robot can be used to spray all

types of material including water-based and oil-based finishes and aggressive liquids. Binks says the unique construction of the arm allows it to be installed in confined spaces and maintain high quality finishes over complex objects. Also that its compact design allows existing plant to be easily automated. It can move up, down, or along a horizontal track to give maximum flexibility.

Binks' Comparm development draws on the expertise developed by the company with the RAMP 4088 robot, which is already widely used in British industry.

Reader Enquiry Service No. 42



Control and movement systems are based upon proven hydraulics and solid-state electronics. The control system provides different painting programs using an online memory capacity ranging from seven minutes to six hours.

Recovery spray booth

Mindon Engineering (Nottm.) Ltd has introduced a new powder recovery booth for the painting of household goods, office equipment, electrical instruments and similar items.

The new Mindon booth is mounted on wheels and is generally intended for use in conjunction with a secondary booth. Where frequent colour changes are required with high volume spraying systems, the secondary booth, when not in use, can be easily pushed on- and off-line for cleaning and colour change.

The booth, which may be used with automatic or semi-automatic powder painting systems, is reckoned to recover a very high proportion of the overspray by means of a cyclone.

Reader Enquiry Service No. 43

Radio frequency/electromagnetic interference shielding

Advanced Coatings & Chemicals of California has introduced what it describes as a super-flexible conductive spray and ink for shielding cables.

This new product is intended for substrates such as Kapton and polyester and is said to show no cracking at film thicknesses of up to 1.5-2.0 thousandths of an inch, even after folding and creasing at 180°F against itself on Kapton surfaces. The high temperature and solvent resistances, flexibility and adhesion, and low outgassing characteristics of this product make it, its manufacturer claims, unique for radio frequency/electromagnetic shielding.

Reader Enquiry Service No. 44

Plastic packaging labelling adhesive

The problem of successfully applying all-weather labels to many types of polypropylene and high density polyethylene bottles, drums and containers is claimed by Fasson to have been solved with FasCal 4900 AP.

FasCal 4900 AP is a combination of the company's premium grade cast vinyl, which is said to offer a seven year life in the most testing climatic conditions, with a new pressure sensitive adhesive, which has been formulated specifically for permanent adhesion to "apolar" and rough surfaces.

According to Fasson, polypropylene and HD polyethylene repel conventional adhesives in much the same way that similar magnetic poles repel each other, hence the tag apolar. Yet both plastics are widely used for packaging products, such as chemicals and oils, which are shipped, stored and used out of doors, and which must be identifiable throughout their life. The new adhesive is said to meet this demand.

Fasson states that the ultimate adhesion ratings are 12 Newtons per 25 mm on HDPE, LDPE, polypropylene and polyurethane, which is well above the threshold of permanence, and 15 Newtons on ABS, acrylic paint, nylon, aluminium and stainless steel; its flow characteristics making it ideal for rough or blistered surfaces, its resistance to temperature making it able to withstand -50 - +110°C.

Reader Enquiry Service No. 45

Modular electrostatic system

Ransburg's Electrostatic Equipment Division has filled the gap between conventional air spray and the Ransburg No. 2 Process with a new line of modular electrostatic equipment known as Monobell systems. The company says the unique one bell, one power supply approach enables small manufacturers and contract painting job shops to save time, material and manpower while achieving high quality finishes. At the same time, larger companies can easily increase their level of automation or technology by simply adding to existing equipment.

Users of Ransburg's electrostatic finishing process are claimed to achieve up to 95 per cent transfer efficiency and increase their paint mileage dramatically over conventional air spray systems. Fewer rejects, lower energy consumption, and better use of floor space are said to add to the savings.

Reader Enquiry Service No. 46

literature

Hazardous wastes management

In the recently published book "The scientific management of waste", three independent scientists examine the results of recent research and development into the environmental aspects of hazardous wastes management. The book is said to provide an objective assessment of the scientific and practical issues involved and costs £35.

Reader Enquiry Service No. 47

Book of books

Applied Science Publishers has produced a catalogue giving brief details of its publications in the fields covered by the catalogue's title: "Polymers, plastics and rubbers". Publication details include author/s or editor, size, number of pages, contents, list of contributors, and, of course, cost, together with labels indicating new publications.

This catalogue is available free on request by completing the Reader Enquiry Service form at the back of the *Journal*.

Reader Enquiry Service No. 48

meetings, etc.

Video for staff training

The North East London Polytechnic is holding a one-day seminar on 3 June 1983 on "How to use video in staff training". The seminar is to be held in Stratford, London E15 and will be completely self-contained.

According to the organisers the seminar will demonstrate the effectiveness of video as a teaching aid, and is designed for training officers and others in industry, commerce and education who are using, or just interested in using, video. Previous experience of using video equipment is not necessary, but the seminar will also be suitable for those already familiar with the equipment.

For further information contact: Geoff Elliott, SEH Short Course Unit, North East London Polytechnic, Longbridge Road, Dagenham, Essex RM8 2AS.

people

The Birmingham industrial paint specialist Carrs Paints Ltd of West Heath has appointed **Tony Wright**, aged 30, as its Midlands accounts manager.

Tony joins Carrs from International Paint where for the past eight years he has been actively involved in selling a wide variety of paints.

★ ★ ★

Colin Greatrix, 38, has been appointed a director of Manders Paints Ltd.

On leaving Wolverhampton Grammar School he joined the technical department of Manders Paints. In recent years he has served in the branch network prior to taking up his duties as manager of Manders' Heath Town paint factory.

★ ★ ★

Robert G. Purshouse, 38, has been appointed a director of Mander Brothers Ltd, the oldest company in the Manders Group and the one which owns the trading property and employs most of the Group's workforce.

Mr Purshouse will now take over the personnel role previously carried out by Group managing director **Geoffrey Norman**.

A former pupil of Wolverhampton Grammar School, Mr Purshouse read law at Manchester University and was articled to Manby & Steward where he qualified as a solicitor. He joined Manders (Holdings) Ltd, the parent company, in 1976.

★ ★ ★

Barrie Williams has joined Goodlass Wall & Co. Ltd, the Liverpool based manufacturers of Valspar Paints, as purchasing manager.

Mr Williams, 39, is a qualified industrial chemist and has been involved in purchasing management with leading companies in chemical-based industries since 1972.

He replaces **Les Wynn** (see page 128) who retired on 25 February after ten years as purchasing manager for Goodlass Wall.

★ ★ ★

Sherwood Parsons Ltd, one of the oldest paint companies in the industry, has announced the appointment of a new national retail sales manager.

David Lewis, 38, will be responsible for developing the marketing and sales momentum of the Sherwood Parsons retail product offer. This range includes an extensive number of car colour aerosols and the original Repaint, a synthetic brush- or spray-applied DIY product.

★ ★ ★

DH Industries has engaged **Mr Paul Nicholson** as a technical sales engineer for northern England and Scotland.

He will be responsible for the sale of DH machines from Molteni, Vollrath and Ge-Halin and the Jenag automatic backwashing self-cleaning straining machine.

Guide to fire tests

More than 300,000 fires break out every year in the UK alone, causing some 1,000 deaths, many thousands of serious injuries, and damage to property and goods amounting to hundreds of millions of pounds. A wide variety of materials, products, structures and systems is involved, and in recent years there has been growing concern both at home and overseas about the inappropriate and possibly misleading tests that are used to assess the behaviour of materials etc. under fire conditions. Equally alarming has been the use of misleading terminology and misuse of fire tests (particularly small-scale tests) as indicators of low fire risk.

Many fire tests use only a very small specimen or ignition source and thus cannot provide a full assessment of the fire hazard in all situations. Such tests merely compare the behaviour of materials under particular test conditions and some may be of value only for checking quality control during manufacture. Great caution is therefore necessary in applying the results of these tests to assess the potential fire risk in practical terms.

In the interests of public safety, the British Standards Institution has just published an important new standard which it is confidently hoped will reverse the recent trend and significantly reduce fire hazard and all its implications. Entitled BS 6336 "Guide for the development and presentation of fire tests and for their use in hazard assessment", the new standard is based on experience gained from the practical application of an earlier Draft for Development, i.e. DD 64. Written in easily assimilable form it offers guidance to anyone responsible for maintaining acceptable standards of fire safety, or who has to deal with any aspect of fire hazard and fire tests.

The new standard is primarily intended for use by specification writers, regulatory bodies, designers and architects, manufacturers and fabricators, wholesalers and retailers, consumer advice services and educational bodies, and, incidentally, also being issued to BSI committees and staff. But it will undoubtedly assist anyone purchasing, specifying or even using materials or products subject to overheating or burning, merely by its emphasis on the need to consider possible fire risks and the way in which properly designed tests can help in assessing a particular hazard and any special precautions that may be necessary in specific environments.

Copies of BS 6336 may be obtained from the BSI Sales Department (see above), price: £8.70 (£4.35 to BSI subscribing members).

British Standards

The publications listed below are new and revised British Standards. An existing BSI publication bearing a number identical to one announced below is automatically withdrawn. In all other cases of supersession, details are given in the appropriate announcement and a corresponding entry appears in the "Standards withdrawn" section.

3900:- PVC/10
Methods of test for paints
3900: Part A2: 1983 Examination and preparation of samples for tests | = ISO 1513| 6 page A4 size Gr 3
Specifies procedures for the preliminary examination of a paint sample and for preparing test material from a series of samples. Supersedes BS 3900: Part A2: 1970. (ISBN 0 580 13209 9)

Special issues

PD 6482: 1983 OC/34
Preparation of visual aids for lectures 16 page A4 size Gr 7
Provides guidance to help lecturers select suitable visual aids for their lectures and provide the information that a newcomer to the subject needs when preparing slides and transparencies. In addition, contains a checklist for lecturers and grids for use in preparing artwork. Supersedes PD 6482: 1977. (ISBN 0 580 13073 8)

Proposed for withdrawal

3900:- PVC/10
Methods of test for paints
3900: Part C4: 1965 Freedom from residual tack
3900: Part D3 1975 Assessment of sheen
Both obsolete

Standards withdrawn

4690: 1980 PTC/-
Method for the determination of solubility of bitumen binders
Superseded by BS 2000: Part 47: 1983

International new work started

Guide to the application of statistical methods in standardization and specifications (ISO/DP 7874)
Will give guidance to non-statisticians on the selection and use of appropriate basic reference standards on statistical methods such as those contained in ISO Handbook No. 3.
ISO/TC 69/SC 3 through QMS/1

Guide to selection of sampling methods (ISO/DP 7869)
Will classify, for non-statisticians, the

various methods of random and systematic sampling for general use in ISO product standards or methods of test.

ISO/TC 69/SC 3 through QMS/1

Statistical procedures for sampling bulk commodities
Will distinguish between the various statistical methods that can be employed for assessing the quality of large quantities supplied in either discrete item or bulk material form.

ISO/TC 69/SC 3 through QMS/1

General introduction to quality control charts (ISO/DP 7870)

Will provide a general introduction to the various types of quality control charts currently in use or being developed within ISO/TC 69.

ISO/TC 69/SC 4 through QMS/1

Introduction to cumulative sum charts (ISO/DP 7871)

Will give guidance on the construction and application of cusum techniques for both data analysis and quality control, based on BS 703: Parts 1 and 2.

ISO/TC 69/SC 4 through QMS/1

Continuous sampling procedures
Will establish acceptance sampling procedures for the assessment of products manufactured or delivered in a continuing series.

ISO/TC 69/SC 5 through QMS/1

Draft Standards for public comment

*83/50551 DC BS 3900 Methods of test for paints. New part. Determination of resistance to abrasion (ISO/DIS 7784).

New ISO Standards

ISO 787:-
General methods of test for pigments and extenders
ISO 787/1: 1982 Comparison of colour of pigments 2 page B
To be implemented in revising BS 3483: Part A1

ISO 4617:-
Paint and varnishes - List of equivalent terms
ISO 4617/2: 1982 Part 2 3 page C
No equivalent BS

ISO 4618:-
Paints and varnishes - Vocabulary
ISO 4618/1: Addendum 1: 1982 General terms 1 page B
No BS equivalent

Midlands Section

The Midland paint scene

The annual dinner lecture of the Midlands Section was held on 20 January 1983 in the Club Suite of the Birmingham Chamber of Commerce.

After an excellent meal the members and guests heard Mr P. A. J. Sturge chairman of Arthur Holden & Sons plc, speak about "The Midland paint scene".

Between 1770 and 1870 ten firms were started in the Birmingham area. These included, in order of formation: Manders, Thornley & Knight, Masons, Postans, Holdens, Bowaters and Thomas Merry.

Prior to the First World War very little ready mixed paint was produced. Paint manufacturers made what was called colours in oil and these had to be mixed with a varnish to produce a decorative or

household type paint. This mixing was usually done by the decorator on the customer's premises to the customer's specification. Varnish makers were very secretive about their formulations and varnishes were often cooked behind closed doors.

The speaker said that after the First World War ready mixed paints became more widespread, paints were also produced to coat some of the articles made in the Midlands such as Black Japan for tin trunks and paint for iron bedframes.

In 1911 the Midland Association of Paint Manufacturers was formed. This had 17 members among whom were Dockers, Gittings & Hill, Carrs and Thomas Howse.

Mr Sturge concluded his talk by saying that the paint trade was very flexible and unlike the engineering industry required no enormous capital investment to set up.

The evening was brought to a close with a vote of thanks proposed by Mr H. J. Clarke who like many members of the audience has known the speaker for many years. He thanked Mr Sturge both

for his talk and for the service he has given to the Midlands paint industry. This was endorsed by the audience in the usual manner.

B. E. Myatt

News of members

Mr R. Taylor

Robert Taylor recently announced his appointment as director with R. S. Manufacturing Ltd. Based at 8 Hanover Quay, Dublin 2, Eire, R. S. Manufacturing is a new company making a wide range of polyurethane (excluding foam) and epoxy resin products for the construction industry. According to Mr R. Taylor the main strength of the company lies in the production of high quality products for use both in Ireland and the UK.

Valspar purchasing manager retires

Les Wynn retired on 25 February 1983 as purchasing manager of Goodlass Wall & Co. Ltd, the Liverpool based manufacturer of Valspar Paints.

Les (65) has been in the paint industry since leaving the RAF in 1947, during which time he has held senior appointments in the purchasing departments of several leading companies. He joined Goodlass Wall in 1973.

A well known figure in the industry, Les Wynn was a member of OCCA Council in 1966/7.

West Riding Section

Annual dinner and dance

The West Riding Section held its annual dinner and dance at the Crown Hotel, Harrogate on Friday 26 November 1982. The President, Mr Don Morris, was the principal guest and other top table guests were Mrs Anne Gibson, Mr B. Gilliam, Mr J. Taylor, Mr D. Pountain, chairmen of Scottish, London, Hull and Irish

sections, accompanied by their partners, together with Mr Robert Hamblin, Director & Secretary.

Following an excellent dinner the President responded on behalf of the guests to an address of welcome from Mr Ron Chappell, Chairman of West Riding Section. The formalities over, dancing soon got under way to the music of Sounds Familiar, and a very pleasant and successful evening all too soon came to an end.

R. A. C. Chappell



Shown at the West Riding Section's annual dinner and dance are (from left to right) Mr Gibson, Mrs A. McA Gibson (Chairman Scottish Section), Mr R. A. C. Chappell (Chairman West Riding Section), Mrs Chappell, Mr D. J. Morris (President), Mrs Morris, Mr B. F. Gilliam (Chairman London Section), Mrs Gilliam, Mr J. L. Taylor (Chairman Hull Section), Mrs Taylor, Mr D. Pountain (Chairman Irish Section), Mrs Pountain, Mr R. H. Hamblin (Director & Secretary)

new members

The section to which each new member is attached is shown below in italics.

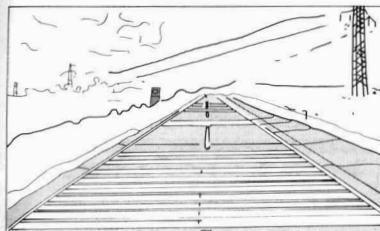
Ordinary Members

- Barclay, A. W. (*Scottish*)
- Brown, R. M., BSc, (*Midlands - Trent Valley*)
- Hughes, D. G. (*Transvaal*)
- Jones, P. B., BSc, PhD (*London*)
- Leaver, D., MA (*Manchester*)
- Mehta, R. M., BSc (*London*)
- O'Connor, J. (*Irish*)
- Paterson, A. W. (*Scottish*)
- Rayner, H. W., BSc (*Transvaal*)
- Reardon, K. (*Transvaal*)
- Richards, J. P., BSc (*Newcastle*)
- Steel, J. A., BSc (*Scottish*)
- Tan, M. L., BSc (*General Overseas - Singapore*)
- Wong, S. K. (*General Overseas - Singapore*)

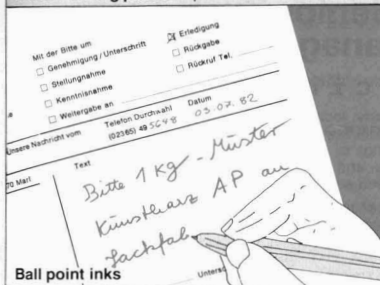
Registered Student

- Jackson, J. (*Manchester*)

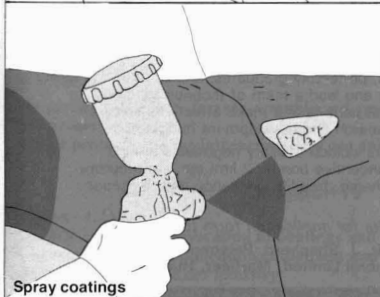
hüls synthetic resins do not leave it at a one-off application.



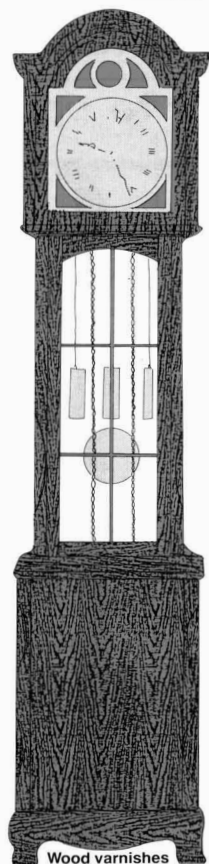
Road marking paints



Ball point inks



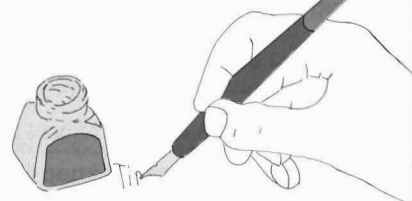
Spray coatings



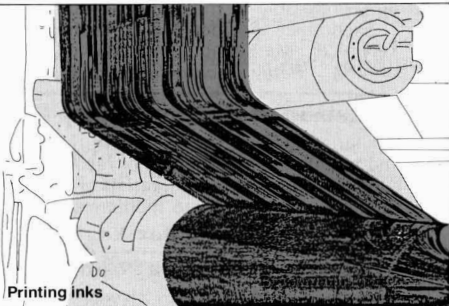
Wood varnishes



Paper varnishes



Inks



Printing inks

Whether it is a 1kg of metal, wood or paper lacquers, whether you make road-marking paints, ball-pen pastes or inks and printing inks, hüls synthetic resins home-in on pin-pointed improvements.

For modified and unmodified ketone formaldehyde resins in lacquer and paint production, hüls is the right partner. Ask about Synthetic Resins AP, SK and

BL 1201 used as supplementary resins for targeted improvements of surface coating properties. These resins are unsaponifiable and neutral, light coloured and fast to light. They enhance the gloss, solids content and yield of lacquer systems.

Send for our new brochure. It gives you comprehensive information on our special-purpose resin range.

hüls (U.K.) Ltd., Cedars House, Farnborough Common, Orpington, Kent BR6 7TE

- Please send me your brochure "Synthetic Resins AP, SK and BL 1201"
 I would appreciate some technical advice on _____

Name _____

Company _____

Address _____

Telephone _____

**CHEMISCHEWERKEHÜLSAG
D-4370 Marl**

hüls

Synthetic resins AP/SK

U.K. Head Office: **hüls (U.K.) Ltd., Cedars House, Farnborough Common, Orpington, Kent BR6 7TE**
 Regional Sales Office: **hüls (U.K.) Ltd., Byrom House, Quay Street, Manchester M3 3HQ**

CLASSIFIED ADVERTISEMENTS

Classified advertisement rates: £6 per single column cm, £70 per quarter page, £125 per half page, £230 per full page. Cost of a box number is £2. Copy date: copy is normally accepted until the 15th of the month preceding publication, though it is usually possible to extend this deadline. *JOCCA* is published EVERY month. Orders and enquiries should be directed to Derrick Buddles, Assistant Editor, OCCA, Priory House, 967 Harrow Road, Wembley, Middlesex HA0 2SF. Tel: 01-908 1086, Telex: 922670 (OCCA G).

MISCELLANEOUS

TRANSLATIONS:

FRENCH/ITALIAN INTO ENGLISH. ADVERTISER WELL EXPERIENCED IN COATINGS. SEND S.A.E. WITH TEXT FOR QUOTE.

STRICTEST CONFIDENCE

Box No. 532

SITUATIONS WANTED

Technical Manager

Member with 16 years experience in the decorative paints industry seeks challenging new position, preferably in the North West.

Experience includes R & D, Technical Service, Technical Marketing, and Works Production Control. *Reply in confidence to Box No. 530*

Position of Responsibility Sought

Industrial chemist (MSc, CChem, MRSC, ATSC) and member seeks position of responsibility with supplier or user of raw materials of Paint, Surface Coatings, Ink and Allied Industries.

Reply in confidence to Box No. 528

Overseas Managerial Position Sought

Paint chemist (ATSC) with 25 years experience in formulation, production etc., seeks overseas managerial position.

Please reply in confidence to Box No. 529

Experienced technical sales representative

seeks work with a raw materials supplier to the paint, surface coatings, ink and allied industries. Preferably north or Midlands.

Please write to Box No. 525

Permanent or Temporary Employment Sought

Due to an early retirement, member with 27 years experience of pigment evaluation is available for temporary or permanent employment.

Replies in confidence to Box No. 527

APPOINTMENTS

HUMBROL

(Consumer Products Division of Borden (UK) Ltd.)

Senior Technical Manager Designate

c £12,500 + Car

The Company, located on Humberside, is a world brand leader in modelling paints and adhesives and includes in its wide range of products model kits, DIY and auto accessories, and industrial paint finishes which are marketed and sold throughout the world.

The above situation has been created in anticipation of the retirement of our long serving and highly regarded Senior Technical Manager and applicants, preferably in the 32-45 age group, should have had considerable experience within the paint industry. The key objective will be to ensure that the Company is kept at the forefront of technical development relating to its manufacturing processes by the provision of research, development and quality control facilities.

Candidates, preferably graduates, should have the ability to organise and lead a team of technologists and laboratory assistants and make effective use of a realistic research and development budget.

The benefits include a salary negotiable around £12,500, incentive bonus, 2 litre car, contributory pension scheme, free life assurance and relocation expenses.

Please write for application form to:-

Mr. J. Shepherd, Personnel Manager,
Humbrol Limited, Marfleet, Hull HU9 5NE.

MISCELLANEOUS

TEMPORARY CONSULTANCY

German expert with up-to-date knowledge on the formulation and manufacture of synthetic resins, emulsion polymers, paints and varnishes offers complete technical service at home and abroad.

Please reply to Box No. 533

OCCA CONFERENCE

15-18 June 1983

The Viking Hotel, York, England



The efficient use of surface coatings

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 Permolglaze 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: R. B. Tennant

Introduction to computer technology

By Mr G. T. Eady (Aul & 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 Tioxide 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 pm

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)



York is probably the most beautifully preserved historic city in Britain and is expected to prove popular and interesting to delegates. The social programme arranged for the Conference will afford delegates an opportunity to visit places of interest including York Minster, the world famous Castle Museum and the National Railway Museum. Coach tours have been arranged to Castle Howard, Harewood House and the City of York, together with a river cruise from the hotel's landing stage.

REGISTRATION FEES

Council has fixed the registration fees payable at the same level as for the 1981 Conference: £80 for members, £25 for partners and £110 for non-members. Council has again made a concession for Retired Members and Registered Students of the Association in fixing a reduced fee of £40, the same rates as in 1981.

DAILY REGISTRATION

Daily registration will be available, again at the same rates as in 1981, to members of the Association at £45 per member per day for Ordinary and Associate Members (£25 for Retired Members and Registered Students of the Association), which will include copies of the preprints, but not facilities for attending the social functions.

ACCOMMODATION

Delegates attending the Conference will be accommodated - providing rooms are available - in the Viking Hotel; the daily rates including VAT, English breakfast, 3 course luncheon and dinner being as follows: single room £48.30, twin bedded room £40.80 per occupant. For children under the age of 14 sharing their parents' room there is no charge for the extra bed; children occupying their own room will be charged at £12.

GENERAL

At the beginning of June 1983, members and non-members who have registered for the Conference will receive preprints of the papers to be given, together with a Conference folder, which will contain a Conference badge, a descriptive leaflet of York, street map, details of allocation of rooms, etc.

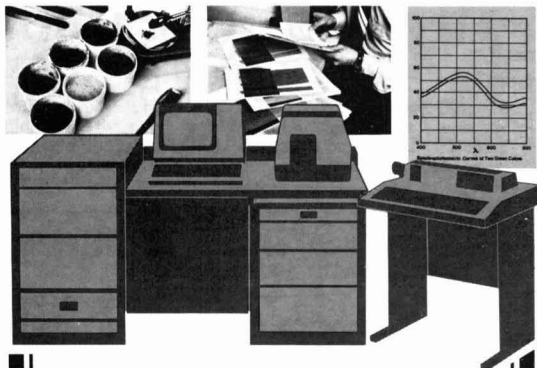
ONLY BRIEF DETAILS ARE SHOWN ABOVE (SEE THE JANUARY ISSUE OF JOCCA FOR SUMMARIES OF PAPERS AND BIOGRAPHIES OF AUTHORS). ANYONE WHO WOULD LIKE A COPY OF THE CONFERENCE BROCHURE CONTAINING FULL DETAILS SHOULD CONTACT:

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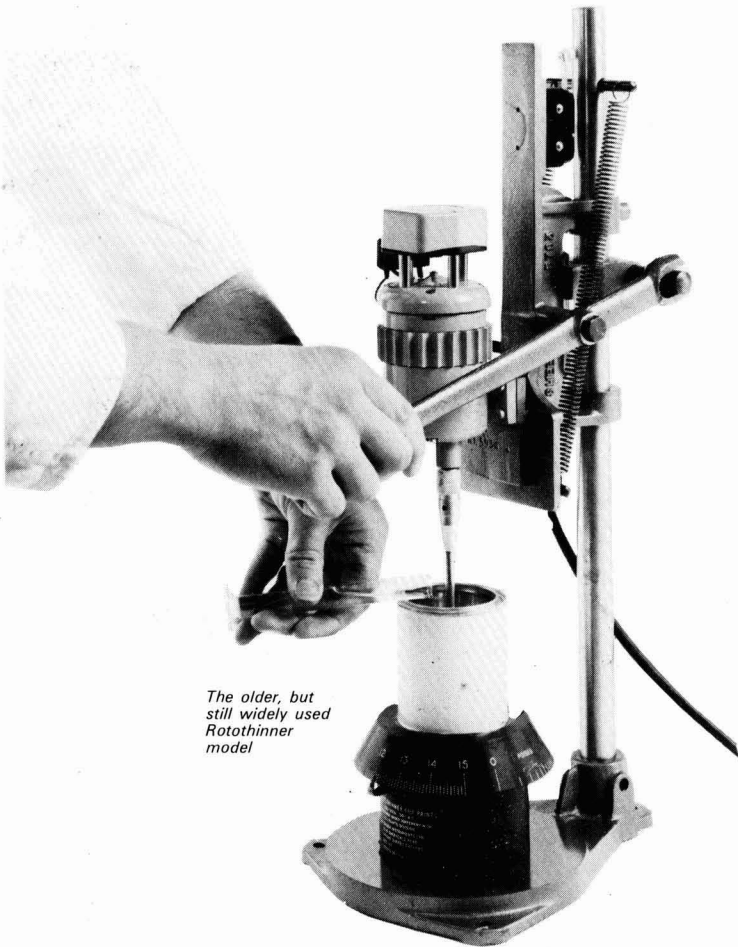
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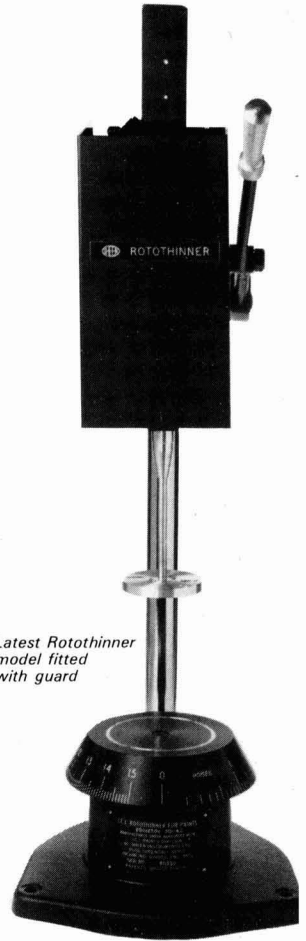
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