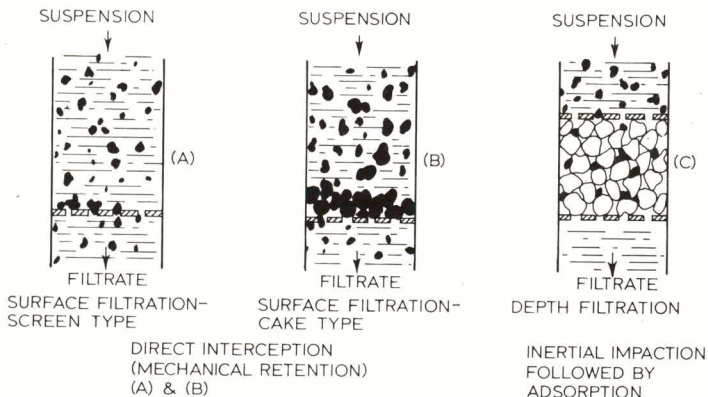




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Filtration of Surface Coatings



Also in this issue

- Measurement of film thickness by colour comparison using primers with low opacity
- Development of wood varnishes from palm fruit fibre hydroxylate (*eheis guineensis*) and red onion skin (*allium cepa*) tannin extract

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SURFACE COATINGS

VOL 2—PAINTS AND THEIR APPLICATIONS

Prepared by **OCCA Australia**

Surface Coatings was first published in 1974. Since then the industry has undergone dramatic and rapid changes. For the second edition the book has been split into two volumes, the first covering raw materials and their usage, the second paints and their applications. Volume 1 was published in the autumn of 1983.

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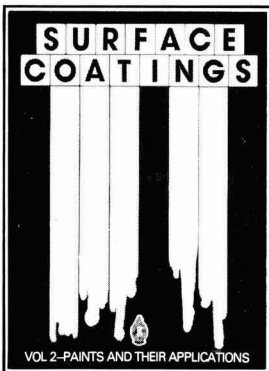
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Analysis of Polymeric Materials
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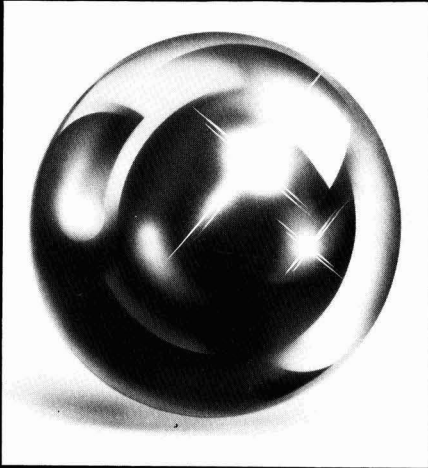
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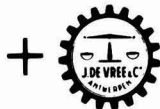
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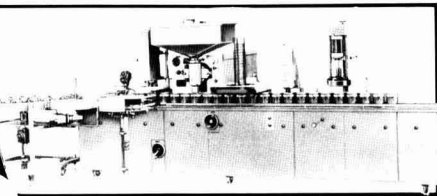
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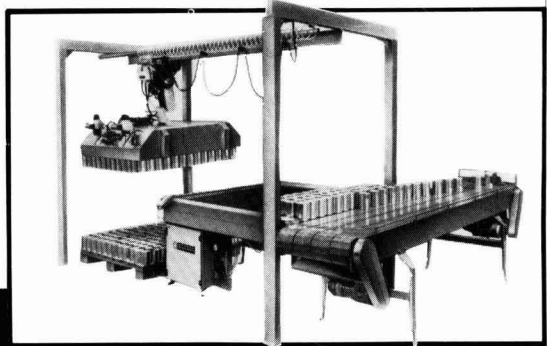
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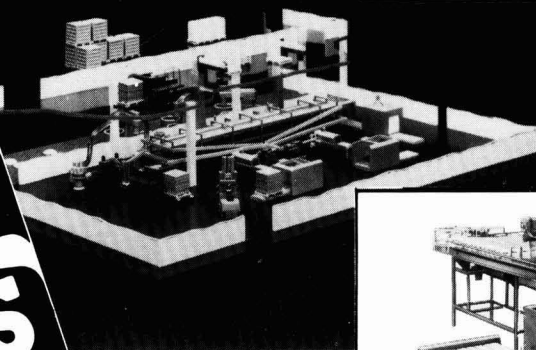
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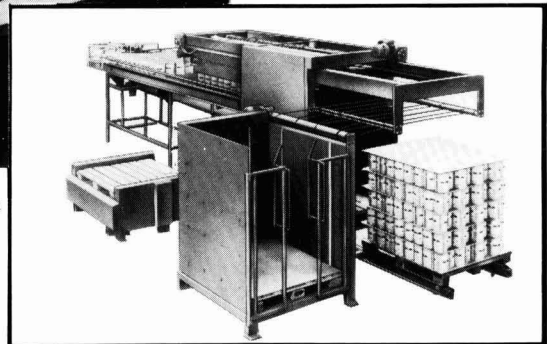


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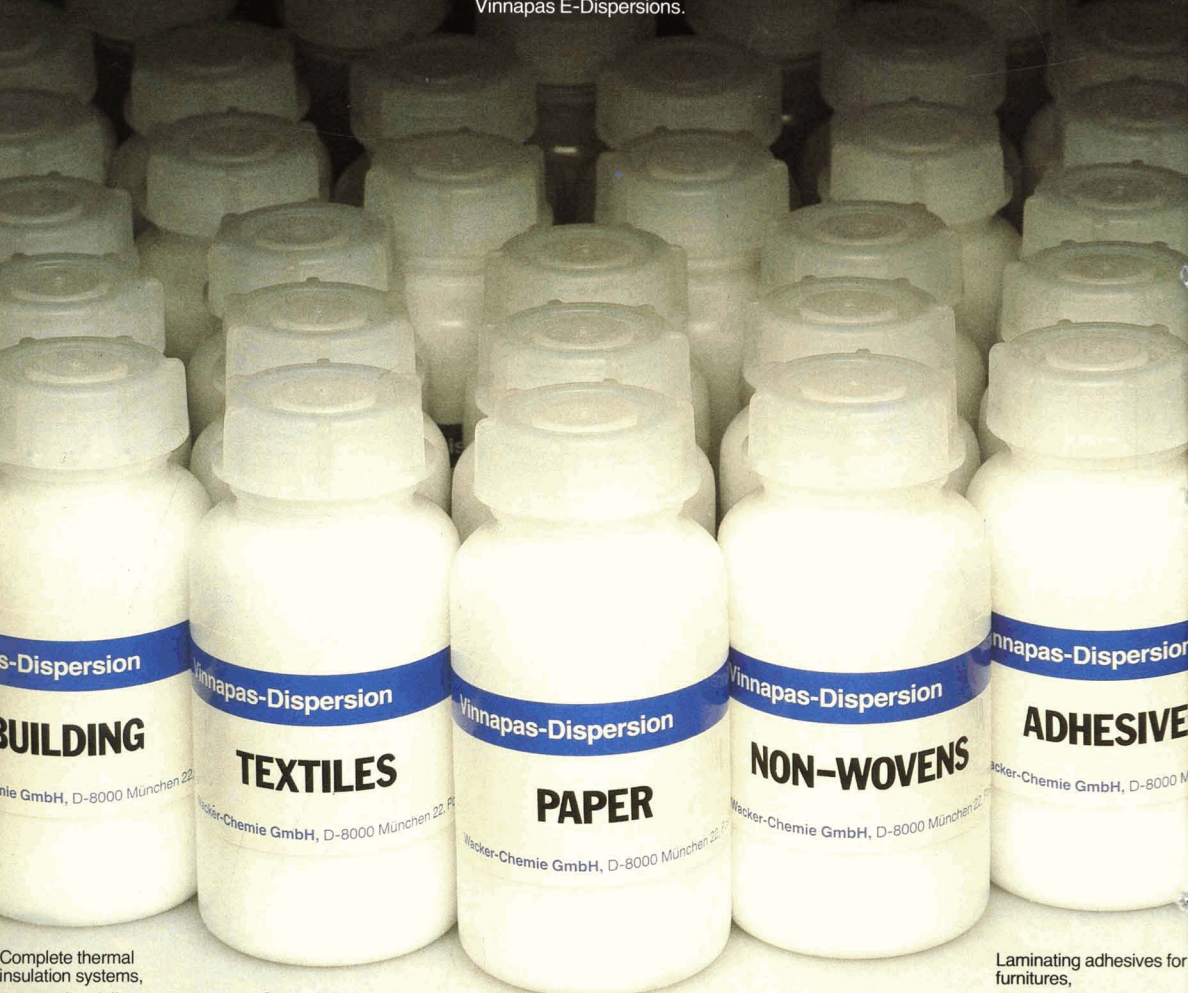
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Filtration of surface coatings

C. G. Roffey

Process Filter Performance Laboratory, Pall Europa Ltd, Europa House, Havant Street, Portsmouth, Hants, PO1 3PD

Summary

An outline is presented of the purpose for filtering surface coatings. The classes of filters used and their filtration mechanisms are described, culminating with some typical examples of filtration applications.

Introduction

Filtration can be defined as the separation of particles from a fluid (in this study liquid) by passage of that fluid through a permeable membrane. The latter is a material containing interconnected pores, which permits the passage of fluids¹.

The purpose of filtration for surface coatings may be two-fold, depending upon whether the coating is pigmented or not. The first is to remove any particles above a certain size from a pigmented ink, paint, or coating and secondly to achieve a high degree of visual clarity in varnishes, which are non-pigmented.

Most surface coatings such as paints and inks, have a similar composition comprising:

- Pigment—provides colour
- Extender—provides body and cheapens product
- Base Resin—Viscosity and film properties
- Solvent Diluent—Viscosity/tack reducer
- Additives—Driers, flow agents, etc.

Organic coatings generally contain contaminants derived during their production or from their raw materials. These interfere with their application e.g. printing or when the end product is being used e.g. magnetic tape. Interference is due both to their size and quantity. Three major groups of contaminants may be defined², which may be hard or deformable particulates or viscous gels, and these may arise from different sources viz:

1. Foreign Bodies. These may be diverse materials such as metal swarf, sand, fabric fibres, dust, carbon, etc., which gain access to the product from the environment.
2. Particulates Arising from Raw Material Preparation. These include:
 - Catalyst residue from resin or base polymer preparation.
 - Degraded organic material, e.g. polymers.
 - Pigment agglomerates.
3. Gel Particles. These are derived from the polymer or resin as a result of localised cross linkage. This occurs because of different residence times, mixing conditions and temperature differences.

Perhaps the major source of gel particles is found in polymer solutions, where the polymer has not completely dissolved.

All the contaminants described above may vary in particle size from the micron level or less to a few millimetres.

For the ever increasing sophistication of integrated and printed circuits with their associated photoresist coatings, sub micron filtration is becoming popular.

Filtration for surface coatings is not necessarily confined to the end product (the ink or paint) and can begin with the raw components. For example, filtration of the resin raw materials prior to their formation by polymerization is often advantageous as less energy is expended in pumping low viscosity materials. The users of filtration for coatings are illustrated schematically in Figure 1.

Solid separation has often been effected by simple decantation while centrifugation is also used when the particulate material has a density greater than that of the liquid phase. Traditional methods of filtration have been used in the surface coatings industry over many years³. These include: simple sieving, bag filters, edge filtration and plate and frame filters with or without the addition of filter aids. All of these are non-absolute forms of filtration which may not provide the level of control of process fluid cleanliness required in the modern industry.

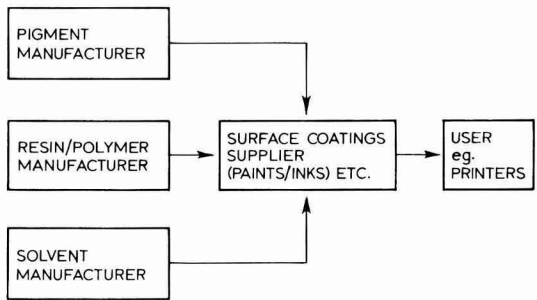


Figure 1

Before discussing the application of filtration to the coatings industry the difference between absolute and nominal (non-absolute) filtration needs to be examined in terms of filtration mechanism.

Filtration Mechanisms

Filtration of liquid is generally regarded in terms of two main separating mechanisms. These are:

Depth Filtration

This is essentially inertial impaction followed by adsorption. The particles are predominantly trapped within the filters' internal structure.

Surface Filtration

This is by direct interception that is essentially mechanical retention. This may be further subdivided into screen and cake type.

Figure 2 outlines the principles for these and Figure 3 shows their difference in terms of particle retention for "diffuse" (variable pore size), and "sharp" (consistent pore sizes) cut off.

In real situations, however, both mechanisms tend to operate to some degree.

For this reason, it is more appropriate to classify filters in terms of whether they are absolute in function or not.

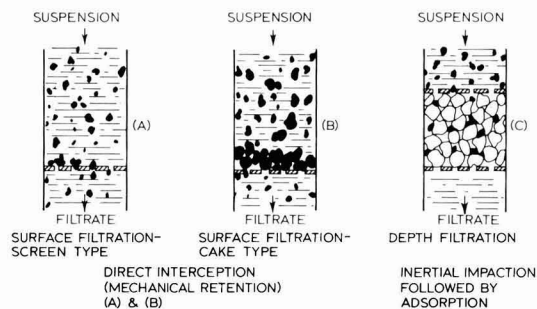


Figure 2

Non-absolute filters

These possess a relatively open structure with loosely bound media and a less controlled pore size distribution than absolute types. Many are made of superimposed turns of cord around a core: the so-called wound cartridge. They rely upon a random adsorptive mechanism of particle capture, based on the inertia of the particle traversing through the tortuous path of the filter medium. These are therefore dependent upon flow and other factors. Three main problems tend to occur with these filter types. These are, unloading of particulates, channelling of flow and release of particles and fibres from the filter material itself (media migration).

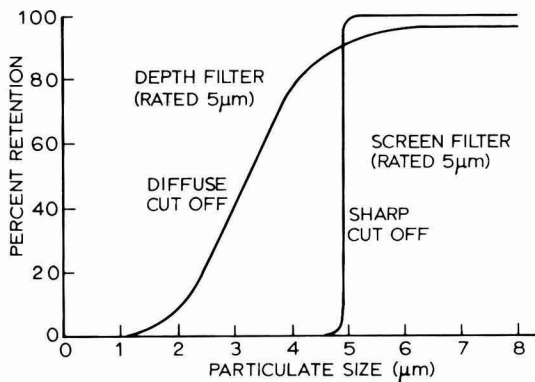


Figure 3

Although such filters may be quite efficient at the beginning of filtration, unloading of particulates always occurs at some point. Generally this happens when there is an increase in differential pressure across the filter as contamination begins to accumulate. Particulates will move progressively through the filtration medium, ultimately gaining access to the downstream side. This effect is exacerbated by fluctuations in system pressure or flow.

Channelling, that is the tendency of fluid to flow preferentially through the larger pores or between non-bonded medium and solid parts of filter (i.e. flow follows path of least resistance) may also occur.

Media migration can occur either as a consequence of unbonded fibres being washed from the filter, or from the medium eroding or being chemically destabilised.

All of these render it difficult to define accurately the removal efficiencies of non-absolute filters.

For non-absolute filters, a 'nominal' removal rating is assigned by its manufacturer. This is an arbitrary micron rating based on a gravimetric removal efficiency.

The advantages of traditional depth filters are in their apparent cheapness. While they may perform well, under some circumstances they do suffer from a number of severe disadvantages which render them unsuitable for today's industry.

For example, labour costs can be high with a plate and frame filter, while there is always a degree of uncertainty about their performance.

Absolute Filters

An absolute filter operates principally by the direct interception mechanism. Retention of the particle is by a pore of smaller diameter, either on the surface or within the filter medium matrix. Once captured, the particles are firmly retained by the stable pore structure and attractive forces. This retention occurs even when subject to changes in flow rate or applied pressure.

The absolute rating of a filter is defined as the diameter of the largest hard spherical particle that will pass through a

filter under specified test conditions. This rating method has the advantage of being dependent on the measurement of a particle diameter. It is therefore reproducible when applied to an absolute filter and not arbitrary as in the nominal rating system. As a rating method it is not fully comprehensive in so far as two filters may have the same absolute rating, but a different mean pore size and hence different performance (life, pressure drop, etc.)

Filter removal rating is described in terms of the Beta Ratio⁴. This is related to filtration removal efficiencies using a mixed particulate challenge. The curve of this Beta Ratio provides the information that the filter has the ability to remove particles that are smaller than a specified absolute rating. Additionally, it can also show that there is more than one filter medium available for a specified removal efficiency.

$$\text{Beta Ratio} = (B)_N = \frac{\text{No of particles of given size } N \text{ and larger in inlet}}{\text{No of particles of given size } N \text{ and larger in outlet}}$$

$$\text{Per cent removal} = (1 - 1/(B)_N) \times 100$$

The method is limited by the fact that the Beta Ratio depends to some extent on the particle size distribution larger than size N . This could obviously vary in practice.

Modern filtration is represented by cartridge filters. These are either surface or depth types. Absolute filters are predominantly of the surface kind and may be divided into two classes. These are disposable pleated cartridges and recleanable porous stainless steel cartridges.

Disposable pleated surface cartridges may be made of polymeric materials, such as cellulose, polypropylene, nylon, polytetrafluorethylene etc., and also made from glass micro-fibres.

Apart from absolute particle size removal there are other advantages to be looked for in cartridge filters: product clarity, higher flow rate, lower pressure differential, long life etc., and general economic benefit in relation to the degree of filtration that is required.

Typical applications of absolute rated filters for the surface coatings industry

The filtration required will be dependent upon whether the coating is pigmented or not. The rheological parameters will, for example, be governed by pigmentation and hence any non-Newtonian behaviour such as thixotropy, dilatancy, etc.

Unpigmented materials

These range from varnishes, coatings, lacquers, resins, polymers, oligomers, monomers and solvents, etc. They are all used for paper and board, metal decorating, plastics and wood coatings applications. A prime objective of filtration is to provide these types of materials with a high degree of clarity. For resins, such as alkyds, polyesters, phenolics, epoxies, etc., removal of gels is readily feasible at ambient or elevated temperature (as produced) by modern disposable absolute rated cartridge filtration, or absolute rated recleanable metal filters.

Mabrey and Surber⁶ have reviewed the use of radiation conversion coatings for fibre optics in the electronics industry. It is necessary to preserve optical characteristics and fibre strength. This is achieved by protecting them from mechanical damage and moisture. Radiation curing acrylates fulfil this function for both primary and secondary coatings for fibre optics. It is essential that the primary inner coating is free from impurities. They report filtration conducted in the micron region. This is likely to become even finer bearing in mind the large telecommunications market and variety of applications fibre optics have.

Pigmented materials

Inorganic and organic pigments are prepared synthetically often by precipitation processes. They are crystalline, e.g. titanium dioxide, and usually separated from water by a final filtration process⁷. They are then dried and dry ground to give powders which are ready to incorporate into ink or paint vehicles. Pigments are usually very fine in particle size and the smallest particle is an individual crystal under $1 \mu\text{m}$ and often as small as $0.25 \mu\text{m}$, representing a narrow particle size distribution.

The pigment is isolated by filtration and expensively by drying. The crystals flocculate and aggregate together on drying so that despite the dry grinding process the pigment powder consists of aggregates of varying sizes up to about $50 \mu\text{m}$ or even higher. For this reason the pigments are generally dispersed with a triple roll mill into an ink or by a ball mill into a paint vehicle (medium), where the pigment/air interface is replaced by the pigment/vehicle interface. This is to wet the pigment particles in order to obtain better dispersion properties.

The removal by filtration of any metallic particles ingressed into a system is particularly recommended for the newer technology systems such as those used for radiation curing. Photopolymerizable materials⁵ for example, contain thermally sensitive monomers for which trace metal ions such as those of iron, possibly obtained during their preparation are known to reduce 'pot life' stability by catalytic action. Clarity of product should also improve 'through cure' (i.e. removal of high light absorbing contaminating carbon particles ingressed from the environment).

'Flushing' is often used alternatively to prepare a relatively inexpensive dispersion for pigment ink bases, from a concentrated aqueous slurry of the pigment generally via a filter press. In this process 'wetting' of the pigment by the oily medium is by replacement of the pigment/water interface (from the aqueous slurry) by the pigment/vehicle interface.

Control of these processes by absolute rated filtration has obvious economic benefit.

Apart from the pigments themselves, the end products requiring filtration are predominantly paints, inks, powder coatings, roller coatings, photo-resists and magnetic coated products. The choice of suitable filters for use after dispersion by e.g. for paint, ball milling, depends upon a number of factors. These include: batch size, number of mills, length of time permissible to retain a mill out of action, degree of refining required, volatility of the coating to be filtered and the cost of the plant and the operation.

Control over particle size in a given formulation is often critical. For each type of pigmented coating there is an acceptable degree of dispersion beyond which an increase results in some properties being improved and others suffer in the final film. Improvements are obtained in colour strength, brightness, gloss and transparency. Adverse effects are upon opacity, lightfastness, weathering and flow properties. For this reason filtration of the raw materials prior to formulation is essential, as the final coating is limited by the above to the level at which it may be filtered. A mean particle diameter below 1 μm is required for adequate colour development in the film.

A. Magnetic coated products

Magnetic materials are usually crystals of iron or chromium oxides (depending upon performance required) dispersed in a resin medium and their rheology controlled by solvents and additives. The oxide is normally acicular (needle like) gamma Fe_2O_3 and CrO_2 particles which are approximately 0.2 μm to 1 μm in diameter and 0.5 to 3 μm long.

These products are used for many applications⁸ the largest being magnetic recording tape in the following areas:

1. Video and high performance data storage tape.
2. Computer tape, floppy disc, hard disc, for information storage.
3. Audio tape.

Other uses of magnetic coatings include magnetic cards, programme cards, magnetic transportation cards, audio cards and sheets for education.

Filtration requirements include the removal of agglomerates, gels and oversized particles, and environmental control to ensure no foreign matter or dust can gain access to the surface of the magnetic film. The latter should be as clean as possible and have no application defects. Failure to remove contamination of this nature can lead to product faults such as signal dropouts, with their respective consequent picture, data storage capacity and sound losses. Proper selection of filtration improves product quality and yield.

It is important that the particle size of the magnetic particles should be uniform and the degree of dispersion should be as high as possible for improved signal to noise ratio. This is because the information signals to be recorded are stored in the magnetic pigment as a continuous series of small magnetic domains magnetized by recording heads.

These filtration requirements may be outlined by considering the general method of production of these high solids coatings.

Three main stages may be discerned for production. These are:

1. Vehicle (binder) preparation—comprising resin and solvent solutions.
2. Paste or slurry preparation—magnetic oxide dispersion within the binder.

3. Final coating—activator may be added to permit hardening of the film.

The components representing these stages in terms of filtration are described below:

Preparation of resins

The resins employed may be typically epoxy based, urethans or vinyl resins. These are mixed with solvents such as cyclohexanone, methyl ethyl ketone, tetrahydrofuran or toluene.

Solvents

Impurity levels are normally low and high flow rates with small area pleated membrane cartridges can be used. Absolute filtration to 3 μm is acceptable for most, although in some cases sub micron filtration may be required.

Resin/solvent mixture

The resin/solvent mix, which can have a viscosity of the order 3,000-10,000 centipoise requires filtration to at least 5 μm absolute (Audio products are less demanding, 40 μm absolute filtration may be quite adequate). It is desirable during filtration to maintain a low pressure differential (ΔP) across the filter unit. In the case of a high ΔP of the order 2-2½ bar, there is the likelihood of extrusion of some of the soft deformable gel particles through the filter.

The importance of satisfactory filtration at this stage is considerable since it may not be possible to filter the oxide-resin mixture at a later stage through a sufficiently fine porosity filter to remove the particles and gels of concern. Significant improvements in dropout (fault) frequency in the finished product can be obtained by attention to filtration at this stage.

Milling of oxide

Simultaneously, with the resin preparation, the required oxide is wetted with solvent and wetting agents. Recirculation is effected through the generally used sand mills of either horizontal or vertical type, in order to arrive at a homogenous oxide mix. Filtration may at this stage be to about 70 μm absolute, in particular to remove mill debris.

Milling of oxide/resin

The resin and oxides are mixed in high shear mixing tanks and are further milled to obtain a fine dispersion. One or several passes may be employed through the mills and filtration is usually employed at these stages. Oversized particles of oxide and agglomerates need to be removed. Filtration may be employed at each milling stage or after completion of all milling operations, to a level of about 40 μm absolute.

Let down

At this stage the dispersion is usually tested for solids loading, resin content, viscosity, etc. and the dispersion 'let down' with additional resin/solvent to obtain correct specification.

Recirculation through filters is recommended at this stage to remove agglomerates, gels, beads from mills, etc.

Final filtration

The dispersion (essentially a paint) is then passed towards the coating machine which is most commonly a gravure roller coater. This is filtered to provide the desired quality of product prior to coating on a clean plastic base such as polyester.

At this stage the dispersion may or may not have activator added for curing (another source of gels). Filtering the activator prior to addition to about 5 μm absolute is recommended here.

The above description is meant for guideline only, owing to the many variable factors. These include:

1. *Dispersion*

This will vary as a result of differences in: mill techniques, resin binder, oxide quality and dimensions, formulation (solids loading, additives, etc.).

2. *Production technique variation*

- Flow rates (generally of the order 20 gallon/h per filter module).
- Coating technique.
- Hardener.

3. *Required filtrate quality*

Post coating processes for smoothing (which is necessary for higher density recording and improved frequency response) such as calendering and polishing and quality of base film will all affect the desired quality of dispersion necessary to provide an acceptable product.

There would appear to be a trend towards thinner magnetic coatings and consequent finer filtration. Some advantages of absolute rated filter cartridges for this area include:

- Smaller Filter Units.
- Longer service life, less filter change outs (and therefore less stops for coating operations).
- Lower product cost.
- Easier handling and cleaning.
- Filters may be operated to high ΔP without unloading risk.
- Large range of possible media.

In principle, for other types of coatings, production sequences are to some extent similar. For comparable reasons to those described these would also benefit from absolute rated filtration. The level of filtration required however will vary. Some general points concerning the advantages of this kind of filtration are therefore outlined in the following typical examples from the surface coatings industry.

B. Powder coatings

Metal surfaces can be sprayed electrostatically with polymer powders or epoxy resins and then stoved to yield a continuous, uniform finish at a lower cost and with a lower fire or health risk than solvent based paints⁹. Control of particle size of the polymer powders is critical to produce:

1. A quality finish after stoving.
2. An appropriate electrostatic charge.
3. A uniform and efficient powder deposit without excessive overspray to reduce powder losses in recovery system.
4. Improved filtering and recovery of powder, post application.

These systems are generally composed of a carrier such as powdered polyvinyl chloride or polythene, and a filler such as carbon black or a coloured pigment.

C. Inks

For finished pigmented surface coatings such as inks, it is advisable to ensure that there are no large particles of matter in the ink which could present problems. These may cause damage on the printing machine, or to printing plates and/or affect print product quality. It may be necessary to remove iron particles resulting from wear and tear on steel milling balls or lining, or even from the pigment itself (magnetic separators have been used traditionally).

Reclamation of used ink¹⁰ has often been attempted by filtering through muslin or cheese cloth into a clear container. Filtering efficiently by using absolute rated cartridge filters will remove cellulosic fibres, specks of coating and any dried ink that may have accumulated during the run.

Inks present a diverse range of filtration application. They may be divided into two main types: paste inks and liquid inks.

1. Paste inks

These tend to be relatively high in viscosity compared to liquid inks and may be lithographic, letterpress or web offset inks. Filtration may often be performed at elevated temperature owing to heat generated during the milling process. The viscosity is therefore often lower permitting greater throughput.

2. Liquid inks

These tend to be of three main types: gravure, flexographic, or silk screen. Filtration is in general more suited to liquid inks/paints and coatings of low viscosity than paste inks. Gravure inks in particular if poor in respect to particulate contamination can benefit from filtration. This arises because the "cells" on the gravure roller do not transfer inks correctly if contaminated and poor quality printing results.

News inks are held on storage in large vats and require filtration prior to use.

Ink-jet printing is a rapidly developing technology. Ink-jet printing is used where imaging of variable information, such as product and packaging coding or marking is required. It has three prime application areas: colour hard copy, office and data printers, and industrial printers. Although spraying ink directly onto paper¹¹ is not a new idea, the ink-jet principle is being applied today for printing out computer results. This is in a modified form known as the DOD (drop on demand) principle, whereby droplets are directly impelled at the paper on the receipt of control signals. Careful control of particle size and contamination by filtration are advisable for satisfactory application. This is because the ink is ejected through a fine aperture, and particulate matter must not be allowed to clog the printer's nozzle.

D. Paints

The whole sequence of car finishing¹² would benefit from filtration. The basic sequence for most European car companies involves four main stages. Initially, there is a clean and spray with zinc phosphate. Cathodic electro-deposition of primer then follows. Next, surface sealing ensues principally with resins of the alkyd/amino and oil free polyester amino types with some epoxy ester usage. The final step is to top coat, where filtration is extremely important, especially with the use of automatic spraying equipment. Top coats are generally based on thermosetting acrylic enamels or alkyd/amino resins for solid colours although novel polyester/amino systems are currently being developed.

Absolute rated cartridge filtration would benefit the automobile industry, where in production bag filters have been traditionally used. Modern filters would remedy problems found with top coats and their methods of applications. These include removal of paint agglomerates and fibres which cause top coat blemishes in newly painted automobiles. Often, these cause a percentage return of cars to the spray sequence. Any reduction is therefore an economic bonus. This is reflected when considering the parameters of a paint batch. Filtration would be needed for

a typical batch which could be of the order of 5,000 gallons at a flow rate of 25-35 gallons per minute at about 35°C. The paint viscosity would be of the order of 45-60 centipoise. Typical absolute filtration would be in the region of 70 μ with a disposable or recleanable filter.

Both the new trends of high solids paints carried in conventional organic solvents and water borne paints containing a small amount of coupling solvents need filtration to improve performance. Filters carrying charge (zeta potential) would find application under the polar conditions of the latter.

The purpose and necessity of absolute rated filtration may, therefore, be interpreted for the surface coatings industry from the aforementioned applications and requirements.

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Measurement of film thickness by colour comparison using primers with low opacity

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Summary

Low opacity primers have been formulated to give significant colour changes with varying film thickness. Assessment of thickness using colour standards by many observers was found to be in very good agreement with magnetic measurements on smooth steel panels. On grit blasted panels differences in applied thickness could be readily observed but accuracy could not be determined. Larger scale application has shown that better control over applied film thicknesses can be obtained by using non-hiding primers.

Introduction

The problem of a meaningful measurement of paint film thickness over grit blasted surfaces becomes insurmountable¹ at thicknesses less than about 60 μ m. This means that there is little control over the first two coats of paint applied to a grit blasted surface. There is the possibility, however, that the thickness applied could be assessed by the use of low opacity primers based on zinc

*Now with Vinyl Products Ltd

phosphate and designed to show a range of shades dependent on thickness.

The feasibility of determining the thickness of applied paint films by visual appearance over smooth steel panels has been examined by comparison with colour standards of known thickness. A red iron oxide coloured etch primer was first applied to aluminium or steel substrates followed by a green paint of low opacity; over this was applied a non-hiding orange paint. Several grit-blasted panels coated with similar paints were also examined.

Experimental

Formulation of a green paint

The anticorrosive pigment used in the formulation was zinc phosphate which is almost transparent when dispersed in a resin. The other two pigments were a rutile titanium dioxide and a phthalocyanine green, and the concentrations of these two pigments determined the colour differences obtained between different film thicknesses over a red oxide coloured background. To gain some idea of these differences and to search over various concentrations of white and green a theoretical approach using the Kubelka-Munk equation was tried.

A number of steel panels were coated with a red iron oxide etch primer and onto these, two white and four green tinted paints were dip coated to dry film thicknesses between 25 and 60 μm . The green paints contained two concentrations of white and two concentrations of green pigment. From the reflectance values of the white paints over the red iron oxide primer obtained on an ACS spectrophotometer, and the reflectance of the primer, the scattering coefficients of the white paints were calculated (see Appendix).

As the scattering and absorption coefficients are dependant on wavelength, each calculation was carried out over the range between and including 400 to 700 nm.

From the reflectance values of very thick hiding films of the green paints (using the scattering coefficients of the white paints) the absorption coefficient of the green pigment was calculated.

The importance of using this approach was that the effect of other concentrations of white and green pigments on colour difference could be calculated without preparing a large series of panels. To calculate the reflectance of the colourant layer containing different amounts of pigments new K/S values were needed. These were obtained from the additive rule used in colour theory.

To test the above mentioned method, reflectance values of a third concentration of pigments in the paint were measured and compared to the predicted reflectances. The true reflectance values compared very well and are shown in Table 1 over several wavelengths.

Reflectances were then predicted at film thicknesses of 5 μm intervals between 25 and 60 μm for a range of tinter concentrations. The predicted ΔE (colour change) values were plotted against mean film thickness and are shown in Figure 1 for two concentrations of white pigment. All the colour differences between the 5 μm interval were well above the value of 0.5NBS units considered visually detectable.

Table 1
Comparison of measured and predicted reflectance values for a green tinted paint

Wavelength (nm)	Measured R%	Predicted R%
400	17.25	17.55
460	28.07	28.61
520	31.49	32.00
580	23.81	24.46
640	15.37	15.10
700	19.24	19.27

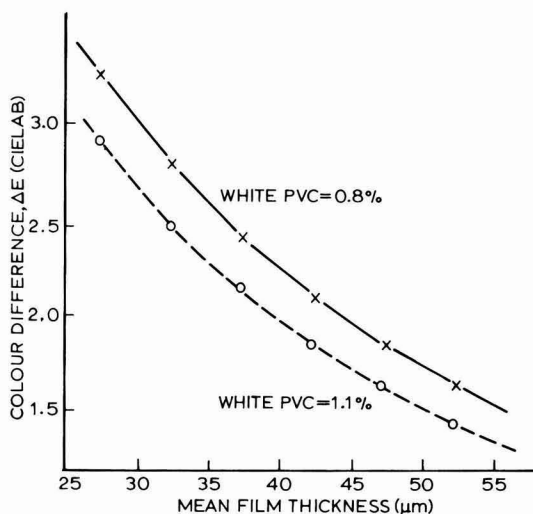


Figure 1. The change in colour difference with increasing film thickness for two green-tinted paints

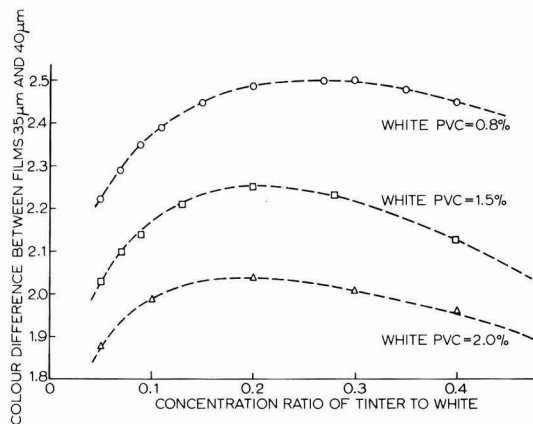


Figure 2. The effect of increasing tinter and white concentrations of ΔE

The effect of various green and white pigment concentrations on the values of ΔE were calculated for a film thickness interval between 35 and 40 μm . The results are plotted in Figure 2, and show that ΔE reaches a maximum

Table 2
Film thickness assessment from colour standards by a
group of observers

Panel Thickness* of Green Film	Observer Assessed Thickness										
	1	2	3	4	5	6	7	8	9	10	11
21	21	21/22	22	21	21/22	22	21	21	21	21	21
26	26	26	26	26	26	26	21/26	26	26	26	26
28	26	26/33	26	26/33	26	26	26	26	26	26	26
30	N33	33/37	N33	26/33	26	N33	33/37	N37	N33	N33	32
40	41	37/42	42	37/42	37	42	37/42	37/42	37/42	42	41
44	42	42	42	42	42	42	42	42	42	42	42
46	N42	N42	N42	N42	N42	N42	N42	N42	N42	N42	46

Standards Used: 21, 26, 33, 37, 42 and 54 μm .

- 42/54 indicates that the observer said the thickness fell between these standards.
- 33, indicates that the observer thought it was exactly 33 μm ; N means it was near to the standard; and a non-standard quote, 46 for example, means an observer estimate.

*Thickness measured by magnetic gauge from the total average thickness less primer average thickness.

at a particular green/white ratio but this ratio varies with the pigment volume concentration of the white pigment. The effect on the colour difference of the green concentration, however, at the low levels examined is very small compared to the effect of the white pigment.

From these results it should be possible to determine the thickness of applied paint films by their visual appearance.

Thickness assessments using colour standards

A green paint, formulated from the results obtained above, contained 1 per cent pigment volume concentration of titanium dioxide, 35 per cent of total pigment mainly zinc phosphate and a weight ratio of white to phthalocyanine green of 13.37:1. This was sprayed onto smooth 6" \times 3" steel panels previously coated with a one pack red iron oxide etch primer to give a range of thicknesses between 20 and 60 μm for the green coating. From the range of panels prepared, standards were chosen at approximately equal colour difference apart and the remaining panels were used for testing. The standard panels were placed in increasing order of thickness on an upright board and observers were asked to judge the thickness of the test panels by comparison with the colour of the standards. Both technical and non-technical people took part in the tests and the results are shown in Table 2.

Out of the eleven people tested only three failed to place one of the panels between the correct colour standards. The remainder all judged the panel thickness very accurately. The thicker films proved more difficult to estimate because the change in hue from red to green was not so great. Even so, people seemed to have no real trouble with the tests, and most of the observers found judging easy once their eyes became adjusted to the colours. Obviously, people with red-green deficiencies would not be able to use this system.

The results of this work showed that people with normal colour vision could easily and quickly assess the thickness of

the green coats by colour comparisons with standards of known thickness.

Formulation of an orange paint

To bring the total film thickness up to a value measurable by magnetic gauges a second paint was needed that could be applied over the green paint and where the thickness could also be determined from colour measurements. It was decided that an orange colour would be the most useful as the eye is particularly sensitive to this colour. The same procedure was followed in formulating this paint as for the green. A paint was made containing 1.25 per cent PVC of white pigment and tinted with a red and a yellow pigment. This paint was sprayed at varying thicknesses over the green and assessments of thicknesses by various observers showed again that film thickness assessment by visual appearance, i.e. colour difference, was feasible.

Assessment of film thickness over grit blasted panels

A number of grit blasted panels, G12 and G24, were etch primed with a red iron oxide coloured primer and then coated with a low opacity green paint to produce several different thicknesses. Assessments of thickness were made against colour standards on smooth panels and the films were also measured using an Elcometer 350: first on the grit blasted surface after calibrating on a smooth panel, then on the etch primed surface and finally on the green coated panel. Table 3 shows in detail the various total thicknesses of a typical panel. Colour differences between the panels of different thicknesses could easily be discerned but because of the problem associated with measuring a thin film thickness over a grit blasted surface true comparisons of thickness could not be made. The results of the assessment are shown in Table 4.

With both grit sizes, the observer assessed the film thickness of coated grit blasted panels from colour comparisons significantly higher than that measured using a

Table 3
Thickness measurements on grit blasted steel (G12)

Steel Surface (micrometres)	Primed Surface (micrometres)	Green Coated Surface (micrometres)	
28.4	24.8	62.1	
18.7	23.9	58.7	
17.9	10.0	57.5	
13.9	21.5	63.9	
19.4	25.2	62.3	
14.3	14.2	63.5	
20.3	20.1	52.0	
16.1	22.9	65.1	
30.3	23.6	67.9	
26.0	28.7	63.2	
19.8	18.6	58.1	
3.8	24.0	60.5	
9.9	32.2	59.4	
23.8	19.1	56.3	
20.6	28.5	53.4	
Mean	18.9	22.5	60.3
Standard Deviation	6.9	5.6	4.4
Mean Thickness of the green coat =	$60.3 - 22.5 = 37.8 \mu\text{m}$.		

magnetic gauge. Nevertheless a reasonable correlation was obtained and distinction between films of ten micrometres was easily seen. Of course, the accuracy of the measured film thickness is unascertainable, but the assessment of film thickness from the colour standards was reproducible with satisfactory precision.

Larger scale application

Practical trials over larger areas, illuminated certain problems, the main one being that a non-hiding paint showed clearly the unevenness of airless spraying. These paints had been formulated to show thin or over-thick areas of application as well as their measurement by colour. As a result large areas applied with these paints appeared blotchy. This appearance was found to cause a sprayer to continue applying paint until a near hiding thickness, or at least, an apparently even colour was obtained which to him was visibly more satisfactory. Therefore, although the idea of measuring the exact film thickness was an attractive one, it was more practical to formulate the paint so that it hid just above the desired thickness. This simply involved the addition of more white pigment which was the opacity controlling element in the paint.

In one trial it was found that increasing the white pigment from one to two per cent PVC caused the sprayers to apply only about 50 μm instead of nearer 70 μm . In a factory trial on grit blasted and primed I beams the sprayer was asked to apply the green paint in his normal way and without prior instructions. Again the spray pattern was uneven so that more than one pass of the gun had to be made to produce a satisfactory appearance which, unfortunately, resulted in too great a thickness being applied. This time the 1 per cent PVC gave a dry film thickness between 120 and 170 μm and the 2 per cent between 70 and 100 μm . These figures were obtained from small smooth panels attached to the I beams.

These trials have shown that the film thickness applied is

Table 4
Film thickness assessment of coated grit blasted panels by colour comparison

Grit Size	Panel No.	Measured Thickness	
		of Green Film* (micrometres)	Observed Assessed (micrometres)
12	1	91	110
12	2	38	50
12	3	27	45
12	4	29	45
12	5	25	35
12	6	22	31
24	7	68	70-100
24	8	35	50
24	9	32	45
24	10	29	45
24	11	16	31

Smooth Standards Used: 31, 35, 45, 50, 70, 110 and 128 micrometres.

*Difference between total thickness and thickness over primer.

very operator dependant, but with one operator (and it could be extended to one manner of operation) a required film thickness could be achieved by using a paint of a particular opacity. Standard panels of the specified thickness limits could be used to check for areas with too much or too little paint applied, the remaining areas being satisfactory. Film defects such as sagging and particularly run-away from edges were very obvious with these paints as were thin or over thick areas.

Advantages and Disadvantages

The disadvantages associated with low opacity paints is that standards have to be made comprising the colour and the film thickness. For a more opaque paint that is formulated to almost hide the underlying colour at a particular thickness, this range of standard thicknesses would not be necessary. Areas of lower thickness, but not of greater thickness, could easily be observed from one standard only. The colour of the green and orange paints was not affected too much by a variation in the hue of the background paint provided the upper film was not too thin, i.e. greater than 30 μm . Psychological resistance by the applicator occurs because of the difficulty of producing an even coating that is also non-hiding. Lighting conditions can make assessment of thickness difficult, especially when areas are in shadow. Colour blindness is a bar for inspectors.

These disadvantages are outweighed as low opacity paints would be extremely useful not only for easy and accurate measurement of film thickness on smooth steel and a reproducible assessment of film thickness on grit blasted steel, but also as a rapid indication of poor area of the paint film, particularly the assessment of the thickness on edges which cannot be measured easily by magnetic gauges.²

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Appendix

Theoretical reflectance equations

The Kubelka-Munk expression for the reflectance R, of any colorant layer of thickness X laid down on a background of any reflectance R_g is:

$$R = [1 - R_g(a - b \operatorname{Coth} bSX)] / (a - R_g + \operatorname{Coth} bSX) \dots\dots(1)$$

where $a = 1 + K S_\infty$
 $b = (a^2 - 1)^{1/2}$

K/S_∞ = The ratio of absorption coefficient to scattering coefficient of the colorant at hiding thickness.

and S = The scattering coefficient of the colorant.

The K/S value is determined from reflectance measurements of a colorant layer so thick that a further increase in the thickness, however great, does not significantly change its reflectance. The relationship is as follows:

$$K/S_\infty = (1 - R_\infty)^2 / 2R_\infty \dots\dots\dots(2)$$

Where R = the reflectance of the colorant layer at hiding thickness.

The scattering coefficient, S, for a non-hiding film is found using:

$$S = \frac{1}{2bX} \ln \frac{(1/R - R)(R_\infty - R_g)}{(R_\infty - R)(1/R_\infty - R_g)} \dots\dots\dots(3)$$

Therefore, S and K/S can be found from experimental measurements, and using these the reflectance for that particular

colorant can be determined for any film thickness using Equation 1.

As the scattering and absorption coefficients are dependent on wavelength, each calculation must be carried out over the entire range between 400 and 700 nm. This is normally done every 10 or 20 nm if the reflectances are to be used to calculate colour coordinates.

To calculate the reflectances of the colorant layer containing a different amount of tinter a new K/S_∞ must be found. This can be determined from the experimental values at two concentrations using the simple additive rule used in colour theory. The ratio of absorption coefficient to scattering coefficient can be found from:

$$K/S = \frac{K_o C_t}{S_o C_w} + \text{constant}$$

Where K_o = the absolute absorption coefficient of the colour, and is provided by the tinter

S_o = the absolute scattering coefficient, provided by the white

C_c = the concentration of tinter

C_w = the concentration of white.

The constant arises from the large concentration of zinc phosphate present compared to the white and green pigments.

The constant and K_o/S_o ratio in this equation can be evaluated using two tinter concentrations from:

$$K_o/S_o = (K/S_2) / (C_{t2}/C_w - C_{t1}/C_w) = \text{slope} = m$$

$$\text{and constant} = K/S_1 - (K_o/S_o \times C_{t1}/C_w) = F$$

Where K/S₁ is for tinter concentration t, and similarly for K/S₂.

From these the K/S value for any concentration can be determined:

$$K/S_3 = m \frac{C_{t3}}{C_w} + F$$

For a given tinter — white concentration the reflectance, R, was calculated at 5 micrometre intervals using Equation 1 and over a number of wavelengths. These values were fed into a program already existing in the ACS computer which calculated the colour difference (ΔE.CIELAB) between successive film thicknesses (see Figure 1).

Development of wood varnishes from palm fruit fibre hydroxylate (*Eheis guineensis*) and red onion skin (*Allium cepa*) tannin extract

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Summary

Acid hydrolysis of the fibre of palmaria palm (*Eheis guineensis*) was carried out to yield furfural, which was then condensed *in situ* with the tannin extract of the red onion skin (*Allium cepa*) to give a phenol-formaldehyde like resins. Evaluation of the resins as surface coatings for wood gave promising results. The varnishes proved to be extremely resistant to acid, alkali, water and scratch, as well as showing good gloss characteristics. Results obtained point to the potential use of these agricultural wastes as raw materials for the manufacture of surface wood finish.

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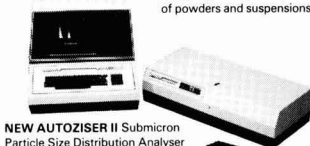
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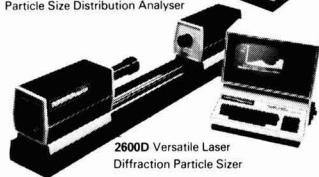
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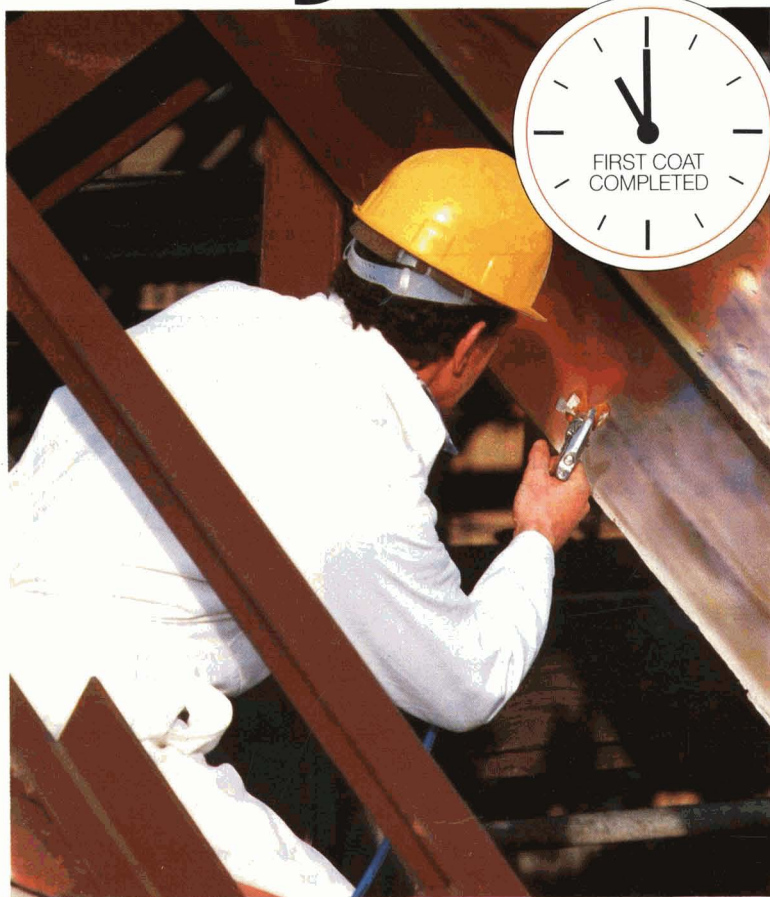
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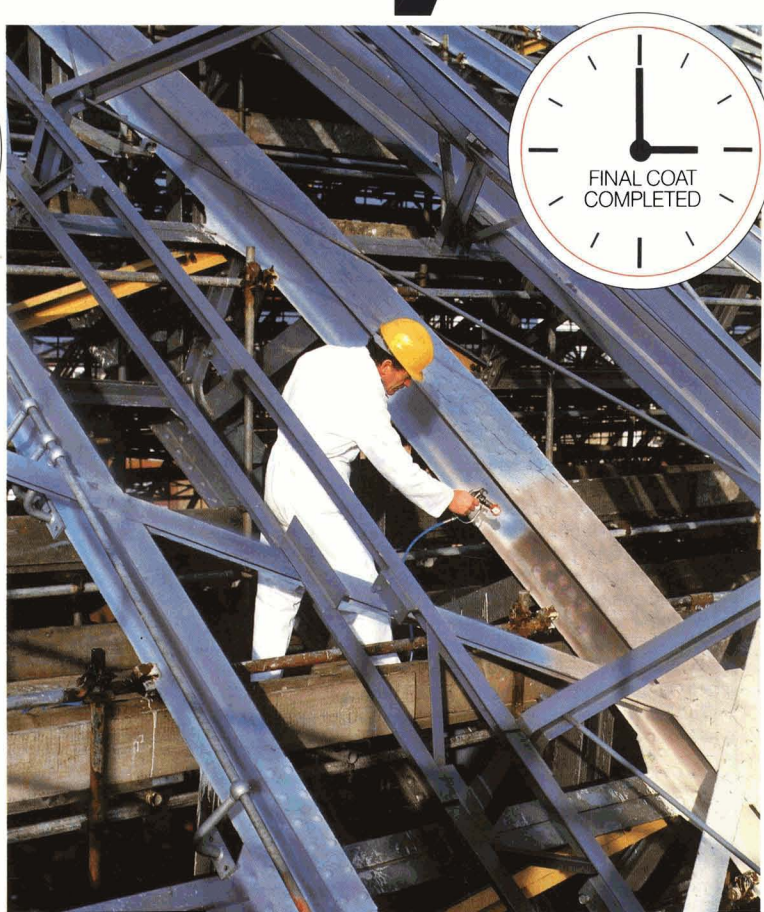
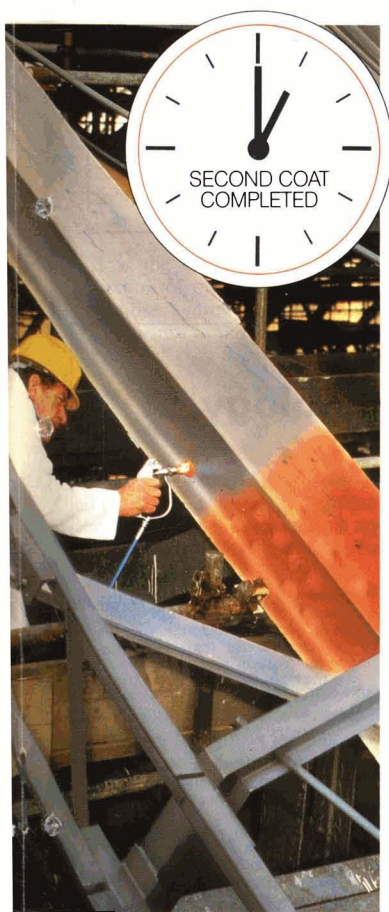
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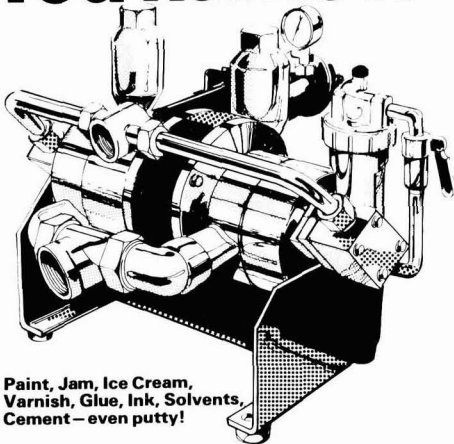
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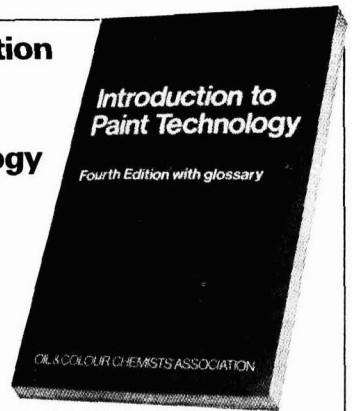
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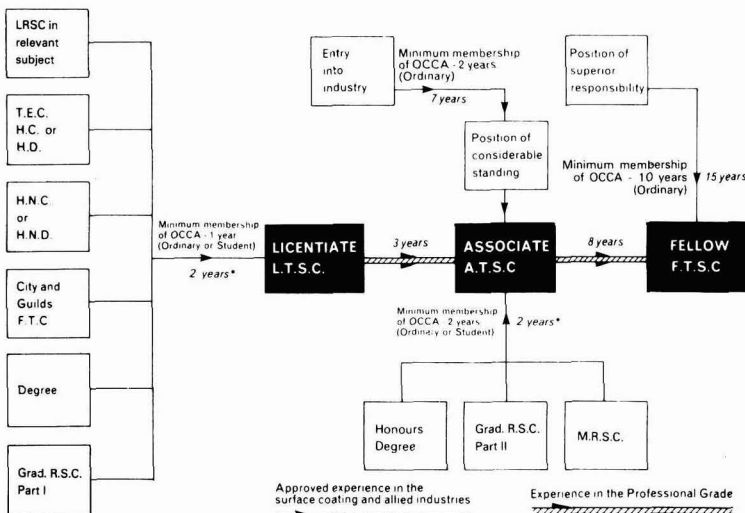
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them have over the years found rewarding industrial outlets, notably in the technology of polymeric resins for coatings and adhesive applications¹⁻³. These topics have recently been reviewed by Pizzi⁴. Similarly, Saad *et al*⁵ have reported the production of wood varnishes from 2-furfuraldehyde obtained from sugar cane bagasse.

The mushrooming demand for chemical feedstock in developing countries makes it imperative to start a search for alternative sources of raw material. A leading factor in achieving this is the industrial utilization of the large amounts of agricultural wastes. Among the numerous agricultural wastes, red onion skin (an inedible portion of the red onion bulb) and palm fruit fibre (a waste material resulting after the extraction of oil from palm fruit) appear to be potential sources of stored chemicals. In this connection, Odozi *et al*⁶ have recently reported that the red onion skin extract consists of tannins in the form of flavonoids. Further, the palm fibre is believed to contain a large quantity of Pentosan⁷, which on acid treatment yields furfuraldehyde. The importance of furfuraldehyde (furfural) and its derivatives has increased and its use has been described for coating applications, such as for the preparation of phenol formaldehyde (PF) type resins for use as wood varnishes⁵.

This investigation is not only aimed at finding out the possibility of using the onion skin tannin component as a substitute for phenols in PF type resins, but also aims to study the opportunities for waste material utilization, as well as to explore new sources of raw materials.

It is the object of the present paper to study the utilization of the onion skin tannin extract and the palm fruit fibre hydroxylate (furfural) for the preparation of resins for use in the production of wood varnishes.

Experimental

Materials

Palm fruit fibre (*Eheis guineensis*) was obtained from local oil extraction centres, and the onion skin from the Port Harcourt main market. All chemicals and solvents used were of technical grade unless otherwise specified.

Methods and Techniques

Tannin Extract

This was obtained by aqueous extraction of air dried onion skin material, which was accomplished by a single contact batch operation where the onion skin to be leached and the water are mixed and the extract solution and raffinate phases separated.

Hydrolysis of Palm Fruit Fibre

First, the fibre was reduced into powder form using a laboratory mill followed by sieving over a 60 mesh screen. The fine powder was then treated with HCl according to the method described by Saad *et al*⁵. This involved the reaction of a known weight of the material with fifty times its weight of 4.5 M HCl for 1 hour. Thereafter, the mixture was cooled, filtered, washed with acid and the filtrate (containing the furfural) stored. It is claimed that up to 11 per cent furfural could be obtained by this method.

Furfural/Phenol/HCHO Condensate (Resin 1)

Phenol, 0.2 mole and 0.1 mole palm fibre hydroxylate (furfural) were placed in a three necked flask equipped with a condenser, mechanical stirrer and thermometer. It was then heated to reflux (80°C) and maintained at that temperature until the development of a coloured product and then cooled; followed with the addition of 2.18 mole formaldehyde (37 per cent w/v) solution. Heating was then resumed until the formation of a brown resinous product.

Furfural/Tannin/HCHO (Resin 2)

About 1.0 mole tannin extract, 0.1 mole palm fibre hydroxylate (furfural) and 0.44 moles formaldehyde solution were charged into a quick-fit flask, heated to reflux (90°C) and maintained there for 3 hours. The resulting brownish crystalline product was dried and stored.

Tannin/Phenol/HCHO (Resin 3)

A mixture of 1.16 mole onion skin tannin extract, 0.44 mole formaldehyde solution and 2 ml commercial defoamer was prepared at room temperature and charged into a three necked flask and refluxed for 2 hours. Thereafter the mixture was cooled and 1.06 mole phenol and 30 ml of 30 per cent NaOH solution were added and refluxed further for 2 hours. Excess water was then removed by atmospheric distillation, giving a dark brown oily product.

Furfural/Tannin/HCHO (Resin 4)

A mixture of onion skin tannin (1.16 mole), furfural (0.1 mole), formaldehyde solution (0.44 mole) and 50 ml of 5 per cent Zn(OAc)₂ solution as catalyst was prepared at room temperature. The mixture was then refluxed at 90°C for 2½ hours until the development of a highly coloured (deep rose pink) resinous product.

Preparation of Air Drying Varnishes

In preparing varnish 1, oil-modified resin varnish was prepared according to the following formulations (parts by weight). Five parts of resin 1 (added over a period of 2 hours in small increments), and 75 parts linseed stand oil were heated at 250°C and continued until homogeneity was achieved, as evidenced by the transparency of a cold drop of the varnish in white spirit on a glass slide. Thereafter, it was thinned down with a mixture of xylene and white spirit (2:1), filtering and finally adding 0.1 per cent of metal driers with respect to the total oil used. Similarly, varnishes 2, 3 and 4 were made using the procedure stated above and in the proportions shown in Table 1.

Evaluation of Resin

The melting point of the resin was measured using Gallenkamp melting point apparatus. Its solubility in oil and solvents were carried out according to the methods described by D'Allelo⁸.

Evaluation of Varnishes

The water, acid and alkali resistance, as well as the scratch hardness (Sheen Scratch Tester) and gloss (Sheen

Table 1
Varnish formation

Resin type	Varnish No.			
	1	2	3	4
Resin 1	5			
2		5		
3			5	
4				5
Linseed Stand Oil	75	75	75	75
% Drier Mix (CO and Pb naphthenate)	0.1	0.1	0.1	0.1
Solvent (Xylene/White Spirit)	100:50	100:25	60:40	75:25

Table 2
Characteristics of the Resins

Resin SI	Resin Type (Condensate)	M.Pt. °C	Solubility in			
			Raw Oil	Linseed Oil	Toluene	Acetone
1	Furfural/phenol/HCHO	260	IS	SS	S	S
2	Furfural/Tannin/HCHO	280	IS	SS	S	S
3	Tannin/phenol/HCHO	48	IS	SS	S	S
4	Furfural/Tannin/HCHO	250	S	IS	S	S

IS=Insoluble, SS=Slightly soluble, S=Soluble.

Table 3
Physico-Chemical Properties of Air Drying Varnishes

Varnish SI	Condition of Film			Viscosity (Fann Viscometer) Poise 30°C	% Solid Content
	After 8 days immersion in H ₂ O	After 16 hours immersion in 20% NaOH Solution	After 6 days immersion in 20% HCl Solution		
1	5	5	4	1.42	27
2	5	5	4	2.42	36.2
3	5	5	4	0.82	22
4	5	2	1	0.97	25

5=Unaffected, 4=Slight loss in gloss, 3=Loss in gloss, 2=Loss in gloss and film partially cracked, 1=Film cracked and partially removed, 0=Film completely removed.

glossmeter) were determined using standard methods wherever possible. The viscosity (Fann Viscometer) and drying characteristics of the varnishes were also obtained by standard methods⁹.

IR Analysis of Resins and Varnishes

The IR Spectrum of resin 4 was taken in nujol, while those of resin 1 and varnishes 1 and 4 were recorded direct by introducing a thin film squeezed between two sodium chloride cells, using a Shimadzu IR-408 Spectrophotometer.

Results and Discussion

Data on the melting ranges of resins and solubility in various media are recorded in Table 2. The physico-chemical characteristics of the varnishes are presented in tables 3 and 4.

Resin Properties

Table 2 summaries the results of the tannin based resins. It will be noticed that the resins were soluble in acetone and slightly soluble in toluene except for resin 4. This is in agreement with findings of Saad *et al*⁵ for bagasse furfuraldehyde/phenol resin. Again it can be seen that resin 4 is insoluble in linseed oil and it indicates the possible difficulty that might be encountered in blending it with drying oils at room temperature. As to the melting point values, there is little difference between resins 1, 2 and 4. In contrast, resin 3 gave a much lower melting point value probably owing to its low level of conversion.

Varnish Properties

All varnish samples prepared above were studied for viscosity, solid contents and the film properties.

Water and Chemical Resistance

From the results listed in Table 3, it is evident that air dried films of the varnishes show good water and alkali resistance after 8 days and 16 hours of immersion respectively. However, the alkali resistance of varnish 4, based on tannin/furfural resin was extremely poor and the films were partially cracked. The acid resistance of most of the varnish films generally showed slight loss in gloss. Again, the acid resistance of varnish 4 films showed exactly the same pattern as observed in the case of alkali resistance. As can be seen in Table 3, low viscosity and per cent solid contents were recorded for varnishes 3 and 4.

Scratch Resistance

Scratch resistance (in grams) of the varnishes is shown in Table 4. Varnish 1 based on resin 1 (furfural/phenol/HCHO), gave the highest scratch hardness value.

Gloss

The gloss values of all coated panels were measured with a Sheen glossmeter at 60° angle referred to a standard gloss value of 100. After 4 days of air drying, varnishes 1 and 3 based on resins 1 and 3, respectively were found to have

Table 4
Film Properties of the Air Drying Varnishes

Varnish SI	Drying time (min)			Gloss at 60°	Scratch Resistance (loads in grams)
	Surface dry	Hard dry	Dust free time		
1	17	121	20	70	600
2	20	123	19	38	400
3	19	123	19	78	400
4	22	124	23	38	

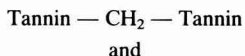
better gloss values, i.e. 70 and 73 as compared to 38 for resins 2 and 4.

Drying Characteristics

The shortest time to surface drying, hard drying and dust free drying occurred with varnish 1 based on resin 1 which contains a phenol/furfural backbone. Varnish 4 took the longest time to dry as shown in Table 4. The reason for this is not clear but it could be attributed to low level of oil bodying.

IR Spectral Analysis of Resin

Comparison of IR spectra (Figure 1) of resins 1 and 4 revealed the presence of common bands in the region of 3500-3200 cm^{-1} , which correspond to phenolic -OH stretching. However in the spectrum of resin 4 (Figure 1b) a stronger -OH stretching hydrogen bonded absorption, typical of tannin molecules is observed. Bhardwaj *et al*¹⁰ have made similar band assignment for tannins of abrus precatorins. Two bands are significant which are among the most intense in the spectra (Figure 1) of the resins, 2900 cm^{-1} and 1680-1580 cm^{-1} . The first band which in resin 1 is low intensity, is due to -CH stretching vibration. The second intense band is known to correspond to vibration of -CH=CH- of ring compounds, such as tannins. Finally, the broad and diffuse peaks appearing in the region of 1300 to 1050 cm^{-1} are due to C-O stretching. These band assignments suggest that the structural elements of resins 1 and 4 should be:



IR Spectral Analysis of Varnishes

In the spectra (Figure 2) of the varnishes, the absorption band at 3450 cm^{-1} which was earlier attributed to hydroxyl groups (-OH) of the phenolics is retained. This absorption is known to increase since the preparation of the varnish was done in an atmosphere of oxygen. Thus, the possibility of thermal oxidation of the fatty acid double bonds is envisaged. Bands appearing in the region 3050 cm^{-1} and 2940 to 2875 cm^{-1} are largely due to the C-H stretching of -CH₃ and -CH₂- groups of the fatty oil, respectively. Although the aromatic C-H stretching vibration is evident, its contribution is somewhat minimal (Figure 2). The presence of C=O vibration is shown by a strong band

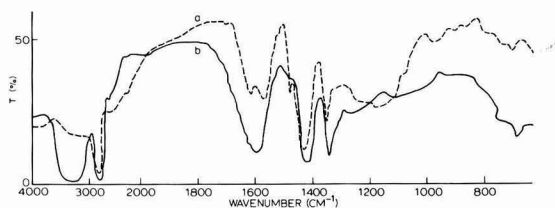


Figure 1. IR Spectra of furfural-phenol-HCHO resin (....., a) and furfural/tannin/HCHO resin (————, b)

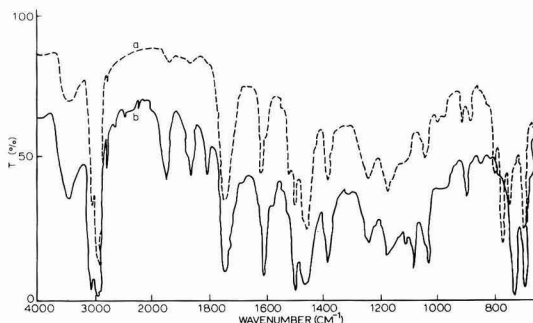


Figure 2. IR Spectra of Varnish 1 (....., a) and Varnish 2 (————, b)

at 1740 cm^{-1} , which is typical of aliphatic carboxylic acid. No such absorption was observed for the resins as can be seen in Figure 1. Strong absorption at 1240 cm^{-1} observed is due to an aromatic ether (Ar-O-C) stretching vibration, attributable to the formation of chromane-like compound. In fact, Williams *et al*¹¹ have indicated chromane formation on the phenolation of drying oils.

[Received 19 February 1985]

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

Instrumental analysis in the coatings industry by *I. L. Davies*

The photochemistry of the peroxodisulphate ion in aqueous alcohol solutions by *C. G. Roffey*

Modification of shellac with some unsaturated acids by *N. Prasad, S. C. Agarwal, P. C. Gupta and A. K. Dasgupta*

occa meetings

London Section

Paint from a user's point of view

At a meeting held on Thursday, 15 November 1984, at the Pearly King, Bromley High Street, Bow E3, a lecture entitled "Paint from a user's point of view" was given by Mr A. D. Sturrock, of the Architect's Department of the GLC.

Mr Sturrock gave a brief summary of his career to date: he had served as an apprenticed Grainer and Marbler over 30 years ago, graduating to management, he had then changed to become a technical representative and adviser for a Paint Manufacturer, and for the past seven years he had held a position in the GLC as a specialist adviser to the Architect's Department.

Mr Sturrock felt he was in a unique position in view of the scientific and technical back-up available to him at the GLC. His work entailed advice on both maintenance and new work problems for all the Greater London areas, and many other local authorities, outside contractors, as well as members of the general public.

He emphasised that the views expressed in the lecture were his own, based on his own experience and not necessarily those of his employers.

The substance of the lecture covered the confusion caused by suppliers' literature in describing products and the processes to be used—particularly to householders doing their own decorating, e.g. the use of terms such as Stoppers, Fillers, Putties, Sealants, and the limitations of the life of these products particularly on exterior work. The use of terms such as "Micro porous films" needed more clarification to describe new products and processes being offered.

The problems of new legislation now becoming effective on low lead and lead-free paints and the effects this was having on both wood and metal primers as now used, was discussed.

Reference was made to problems with Maintenance Work where old paint systems which had used paint with high lead content had to be dealt with, though it was felt that media reports tended to exaggerate problems.

Experiences on painting galvanised iron were discussed and the advantages of using two pot etch primers over the old practice of weathering or the use of mordant solutions were given.

The introduction of new structures such as double glazing, the use of UP/PVC windows and doors with hardwood surrounds and the growth of the use of wood stains followed by clear coatings were referred to.

The various methods of coating masonry were mentioned, which led on to a discussion of painting large surfaces with thicker coatings which should give 15-20 years life—a method used particularly in Germany, Holland and Austria. Attention was drawn to the specialist companies now appearing in England who catered for this work.

Developments and trials relating to water based undercoats and gloss finishes were referred to and concern expressed as to whether these trials would be completed in view of changes in structure of the GLC, now under consideration.

The lecture was followed by a lively question, answer and discussion session which had to be brought to a close after 50 minutes or so.

A vote of thanks was proposed by Dr Tom Banfield who suggested that every DIY enthusiast felt he could make a contribution to this topic, as the evening had shown—the only regret was that the attendance was so low—only 20 members being present. It was felt that many members had missed a very interesting evening.

J. H. Tooth

Inks For Security Printing

The January meeting of the London Section was held on Thursday 17 January 1985, at the increasingly popular venue of the Pearly King at Bow. Despite the arctic-like weather conditions, there was a good turn out to hear Mr David Bisset, technical director of Bradbury Wilkinson) present his paper on "Inks For Security Printing".

Mr Bisset began his talk with the statement that anything that is created by man can be copied by man, which in this day and age has led to an increased demand for security, particularly in the printing of bank-notes, credit cards, legal documents, etc.

A fact not recognised by most people is that like any other commercial organisation, security printers are just as cost conscious and quality has always the constraint of economics. Competition, however, is not limited to other companies in the business as "Forgers" have to be con-

sidered in this way and it is necessary always to keep one step ahead.

Mr Bisset outlined the various forms of printing used, for example, lithographic printing for backgrounds where even computers are used to create certain patterns which would be difficult to copy. The formulator has a difficult task as not only has he to consider the rheology of the inks but also build in resistances such as lightfastness and rubfastness, etc.

Intaglio printing was explained as being the "Blue Riband" of printing methods and the system was demonstrated by drawings and practical examples.

Various 'tricks of the trade' were outlined including holograms and the addition of vitamins, solvents, chemicals, fluorescent pigments, magnetic pigments and even by varying the electrical conductivity of inks. All these "markers" were demonstrated by slides or examples.

A brisk question time was followed by the vote of thanks given by Mr H. Worsdall.

D. Bannington

Hull Section

The philosophy of polish formulation

The third technical lecture of the session was presented by Mr Keith Lawson of Reckitt & Colman (Household and Toilet products), to a small, but attentive audience, on Monday 3 December 1984, at the Duke of Cumberland Hotel, Cottingham.

The evening began with Mr Lawson giving a breakdown of the types of polishes available and the substrates on which they are employed. Consumption of each type was shown to be dependent on national traits, substrate, climatic conditions and finish required.

Waxes, the active components in all polish formulations, were examined with particular attention given to the naturally occurring ones such as carnauba, candelilla, bees wax and paraffin wax. Synthetic polyethylene waxes, which have good solvent retention properties, were also mentioned. A traditional paste polish formulation consisting of a simple wax/solvent mixture was compared to a modern emulsion paste polish.

Polishes of the cream type were described, which generally have a lower wax content and serve to provide a cosmetic type finish.

Finally polishes dispensed by aerosols and water-based self-shine floor finishes were examined. Formulations on these two products tend to be more complex than paste and cream polishes.

The evening closed with a vote of thanks proposed by Mr J. W. Wenham and the audience showing their appreciation in the usual manner.

External wall insulation and associated decorative protective coatings

The fourth technical lecture of the session was presented by Dr Maurice Wilkinson, technical manager of Blundell-Permoglaze Ltd., to an audience of 17 members and guests at the Duke of Cumberland Hotel, Cottingham, on Monday 7 January 1985.

In an uninsulated domestic property, calculations showed that an average of 20 per cent of the total heat consumed for space heating escaped through walls. Consequently, with increasing energy costs, it is prudent to provide some form of wall insulation, either by cavity in-fill, for double skin buildings only, or by an external system.

The three basic types of external wall insulation, i.e. lightweight renders, board system and board system using metal lathing were described, which not only provide thermal insulation but also an attractive decorative finish.

Composition and construction of the board systems was explained with particular attention given to the cement polymer adhesive, stainless steel fixing pins, alkali resistant glass fibre scrim and the necessary expansion joints. An impressive demonstration of impact and fire resistant properties was given by repeatedly striking a board sample with a heavy hammer followed by prolonged exposure to a blow torch flame. In both cases little damage resulted.

Finally, several slides of externally insulated properties were shown which illustrated the decorative aspects of the systems.

The evening closed with a lively question time and a vote of thanks was proposed by Mr John Wenham.

P. A. Bentley

Manchester Section

Industrial hydrocarbon solvents

On Wednesday 21 November 1984, Mr Allan Cumbers of Carless Solvents presented a student lecture entitled "Industrial Hydrocarbon Solvents", to students and senior members of the Manchester Section at the John Dalton Faculty of the Manchester Polytechnic.

Unfortunately, some of Mr Cumbers' slides had not arrived on time but his talk proved to be so interesting that they were not missed.

Mr Cumbers guided us through the range of solvents from the low boiling aliphatics through the various distillates to the aromatics. The properties of each solvent type were discussed in relation to their applications. The effects of the changes in cracking procedure on the cut of the oil barrel available to solvent manufacturers were explained, as was the effect of legislation on usage and labelling of solvents.

The talk was followed by a series of interesting questions and a vote of thanks to Mr Cumbers was proposed by Mike Nixon.

Modern organic pigments with controlled particle size

On Monday 3 December 1984, 130 members and guests of the Manchester Section were present at a lecture entitled "Modern Organic Pigments with Controlled Particle Size". The lecture, at the Pack Horse Hotel, Bolton, was presented by Mr A. Waller and Mr A. Abel, of Hoechst UK Ltd., who also sponsored an excellent buffet which followed the lecture and was enjoyed by all present.

The first part of this most interesting lecture dealt with two methods used for the determination of particle size. The first method involves the use of the transmission electron microscope. Individual particles are measured using an electronic stylus on a graphic tablet; up to 1,000 particles have to be counted to provide a good figure, which is long-winded.

The second method uses the ultra centrifuge and, because of the need for a very dilute dispersion, tends to be restricted to aqueous dispersions. The disk of the ultra centrifuge spins at 52,000 rpm; light, of a wavelength corresponding to the absorption maximum of the pigment, is shone through a transparent window in the disk and measured over a two-second period. Feeding the information on transmission to a micro-computer produces a result by direct print-out in about 20 minutes.

The second part of the lecture dealt with the effect of particle size on pigment properties.

The properties of pigments affected by particle size are: colour strength, colour of the pigment, lightfastness, opacity, rheology, durability, thermal stability and solvent stability.

The manufacturing techniques used to produce controlled particle size pigments are most secret. However, there are various well-known techniques which can be used such as the addition of rosin, alkyl amines and sulphonates, and solvent-soluble pigment derivatives.

The ink industry needs transparent pigments which are relatively easy to produce, usually by rosin additions which produce very small particle sizes.

On the other hand, the paint industry, except for metallic finishes, needs opaque pigments. This opacity depends upon several factors such as the refractive index, pigment content and the scatter factor. Pigment crystals must be grown to a ceiling size which give the maximum scatter.

The Hoechst 70 series of organic pigments have been developed for use in applications where high opacity is needed. They can be very useful to improve opacity of decorative paints and can be used in industrial lead-free paints to replace chrome pigments, but as yet are more expensive than chromes.

The lecture was followed by a lively question-time and a vote of thanks was proposed by Peter Stanton.

R. G. Handley

Scottish Section

Cracking of paint fibres in wood

The initial meeting of the current session took place in the Albany Hotel, Glasgow, on 11 October 1984, when Mr R. Blakey, Assistant Technical Services Manager of Tioxide U.K. Limited, spoke on "The cracking of paint fibres in wood".

Cracking in paint films is a common failure when paints are applied to unstable substrates such as wood which can change in dimension with humidity. A number of woods had been tested for dimensional change in both tangential and radial dimensions, and a considerable difference in a variety of types was found. One of the best, Western Red Cedar, still exhibited changes of up to five per cent on outdoor exposure.

The weathering and cracking of paint film was treated as a fatigue problem by Tioxide who designed and built a machine to simulate cyclical fatigue due to strain.

This machine was used to examine the effect of thermal ageing and artificial weathering on paint films. It was shown that accelerated weathering reduced the fatigue life of a film to a greater extent than thermal ageing.

The effect of pigmentation levels on film life were also studied and confirmed the fact that increase in PVC lead to increased cracking.

Cracking was also influenced by the degree of dispersion of titanium dioxide. Flocculated films cracked more readily than dispersed. The type of titanium dioxide used did not greatly affect the film life, although heavily coated grades led to more brittle films. The type of extender blend used, however, could affect cracking and optimum formulations may be used to reduce cracking.

The cracking behaviour of various systems was also studied: primers, undercoats and topcoats, namely aluminium primers, acrylic primers/undercoats, non-aqueous undercoats, alkyd topcoats and gloss emulsion topcoats. The results indicated that cracking was most likely to occur initially in the undercoat, particularly if this is solvent based.

The water permeability of the film may also have a considerable influence on cracking and is worthy of more detailed investigation.

A lively discussion followed the talk and a vote of thanks was proposed by Mr G. T. Flood.

J. H. Coy

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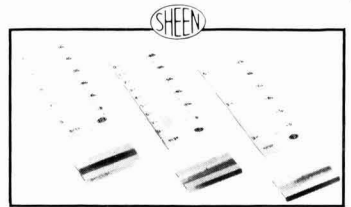
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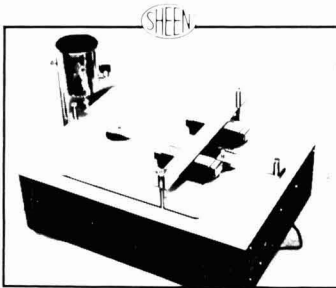
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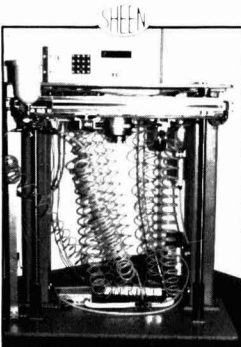
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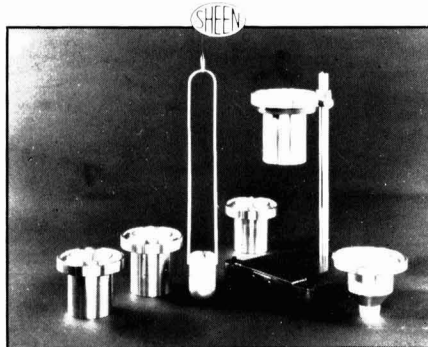
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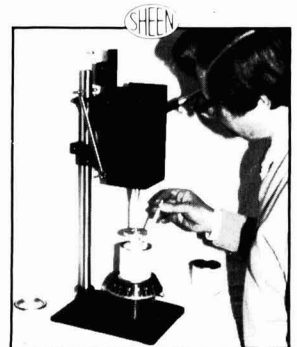
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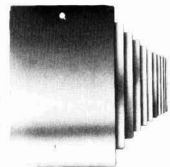
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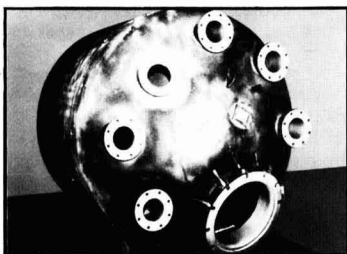
French acquisition

Burmah Speciality Chemicals have purchased Nazdar Europe Sarl, a French speciality printing ink company.

Nazdar manufactures inks, varnishes and allied products for the French screen printing industry and has a well established position in this specialist sector of the French market.

The acquisition will significantly strengthen Burmah Speciality Chemicals existing position in the European screen printing supply industry.

In 1983, it established a printing inks division with the acquisition of Sericol Group. Sericol is a market leader in the UK and has built up a strong position in France, Germany and Switzerland. Well over 50 per cent of Sericol's UK production is exported throughout the world. *Reader Enquiry Service No. 31*



Large reactors with covers of complex shape can be protected against corrosion within the new "Fluoroshield" coating.

Although the coating has only recently become available in Britain, commercial applications in the United States go back more than three years. It is said to have successfully protected valve bodies, agitator blades, impellers, fans, vessels and tanks.

Reader Enquiry Service No. 32

products

New coating protects process equipment from aggressive chemical attack

A new type of protective coating based on Du Pont "Teflon" fluoropolymer is said to extend the service life and cut the maintenance needed for chemical process equipment exposed to strong corrosives and oxidants.

The coating, manufactured in Britain by W. L. Gore & Associates (UK) Ltd under the trade mark "Fluoroshield", is said to offer protection from virtually all aggressive chemicals, and yet remain cost-effective when compared with rubber and other polymers, glass/steel and exotic metal equipment.

The coating is applied by a spray-and-bake process; it can be built up in layers to a thickness of 3 mm. Spray application means complex shapes can be easily and economically protected. Baking fuses the layers together, to produce a bond strength that exceeds the tensile strength of the coating, thus providing a coating that can be used under full vacuum conditions. Maximum continuous use temperature is 260°C.

The Fluoroshield coating has excellent non-stick properties; this helps to reduce wear in moving parts and permits faster clean-up procedures. The inertness of the fluoropolymer ensures that ultra-pure process liquids are not contaminated by leached-out materials. The coating can be repaired in the field.

the introduction of a new addition to its range of resins.

Prince 5180 is said to have excellent solubility and dilutability in ethanol and in propanol; these solutions are compatible with ethyl acetate. The resin is compatible with SS nitrocellulose in all proportions and the solution of such a combination gives excellent ethanol dilutability.

The very high melt point of 180°C is said to give excellent solvent release and the dried film to be very hard and resistant to resoftening under heat. In addition, the low acid value (15 max.) is said to give better product resistance than that achieved by many alcohol soluble resins.

Early laboratory testing has indicated a potential of usage in high quality gravure and flexographic printing inks, nitrocellulose coatings, heat resistant coatings and adhesives.

Reader Enquiry Service No. 34

Gas detection

Sabre Gas Detection Ltd, of Aldershot, Hampshire, have recently been appointed as the UK sole distributors for Komyo-Kitagawa, Japan's leading manufacturer of Gas Detector Tube Systems.

The Komyo-Kitagawa precision gas sampling system is said to provide accurate detection of over 150 toxic gases. The new Model AP1 piston-type, volumetric sampling pump includes an end of sample time indicator to give a positive visual indication for the operator to take the tube reading. The detector tubes have small grain size, sensitive reagent to provide a uniform flowrate and flow distribution through the tube, with a clear line of demarcation for determination of the colour stain length. As the tubes have a controlled inner diameter, the longer stain length produced normally enables the measurement to be taken on a 1 stroke operation, thus eliminating timely analysis, so that many points can be tested quickly and efficiently.

Dapral® GE, a new generation of water-soluble polymers

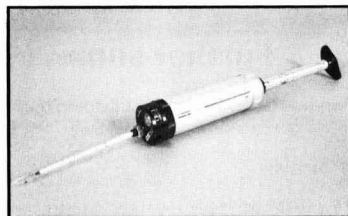
Akzo Chemie has developed a new range of water-soluble polymers. These patented, speciality polymers, combine emulsifying and dispersing qualities with lubricating and anticorrosive properties. This combination results in the use of the polymers in applications such as drilling and cutting oils, emulsion polymerisation, coatings, industrial lubricants, etc.

The polymers which have a molecular weight of approximately 20,000 have a comb-like structure with pendant hydrophobic and hydrophilic chains from a hydrocarbon backbone. This comb structure is said to make the polymers excellent emulsifiers in aqueous systems. The structure also provides lubricity in water systems. Because there are reactive sites on the molecule, the polymer can be combined with amines to provide anticorrosive performance.

These water soluble polymers are marketed under the trade name Depral® GE. At present four products are offered: Dapral® GE 202, the basic polymer with some acid sites available for reaction; GE 204 NA, the sodium salt; and GE 205 DMA and GE 206 DMA, two salts with dimethylethanolamine for protection against corrosion. *Reader Enquiry Service No. 33*

New addition to range of resins

Lawter International Ltd have announced



The Komyo-Kitagawa APS detector tube system

The system is simple and straightforward to operate and no specialist knowledge is required.

Reader Enquiry Service No. 35

meetings

SLF-Congress in Oslo

The Federation of Scandinavian Paint and Varnish Technologists (SLF) will arrange its 11th Congress at SAS Scandinavia Hotel, Oslo, 2-4 September 1985.

Eight papers will be presented in English and six papers in Scandinavian languages with simultaneous interpretation to English. A special section will deal with printing inks.

For further information please fill in the Reader Enquiry Service form.

Reader Enquiry Service No. 36

literature

First corporate brochure

Lankro Chemicals have produced a corporate brochure. "The new Lankro" describes the resources, products and markets of Lankro Chemicals Ltd, which has now completed its first year since the company's restructuring. The first corporate brochure in Lankro's half-century history has text in three languages: English, German and French. Its sixteen pages are said to provide an easy reference guide to the functions and applications of the company's polymer additives, polyurethanes, surfactants and radiation-curing chemicals.

Copies are available by completing the Reader Enquiry Service form.

Reader Enquiry Service No. 37

people

Mr C. T. Richards has been appointed manager, BP Polyolefins (UK).

Colin Richards graduated in chemistry from Manchester University in 1963. He then joined BP at Llandarcy Refinery and held a series of research appointments in the UK, joining BP Chemicals at its formation in 1967, and working at Sunbury, Barry and Grangemouth.

Following the acquisition of Union Carbide's plastics interests in Europe, he was appointed technical manager, BP Chemicals (Suisse) in 1980, and research manager Polyolefins, based in Geneva, in 1982.

OCCA conference

OCCA Conference 1985 – New substrates, new materials, new problems?

As already announced the Association's Biennial Conference will take place in Edinburgh 26-29 June 1985. Twenty-three papers on the theme will be presented in four sessions in the mornings and afternoons of Thursday 27 June and Friday 28 June. Details of both the technical programme and the social programme were given in the registration form, a copy of which was enclosed with each issue of the February *JOCCA*. In addition the technical programme appeared on page 53. Further copies can be obtained from Priory House; photostats of the registration form will be acceptable but all applications must be accompanied by the appropriate remittance.

Regarding accommodation, some may still be available through the Association at the Dragonara Hotel as well as single rooms at the Porlock Halls of Residence. No further single accommodation is available at the Stakis Grosvenor but some double rooms may still be available. Delegates wishing to make their own arrangements may apply for an accommodation booklet (supplied by the Edinburgh Tourist Office) from the Association's offices.

The social programme is a very full one in honour of the 50th Anniversary of the formation of the Scottish Section. It includes a special entertainment by that Section, coach tours to places of interest, a Jacobean banquet, a reception for overseas visitors and the Association Dinner Dance on the Friday evening, together with a golf tournament for the Sam Sharp OCCA Conference and Pearson Panke Golf Trophies.

It is intended to send preprints and maps, etc. in a special folder to delegates about a fortnight before the Conference to allow delegates an opportunity to study the papers in advance.

Further summaries of papers and biographies of authors

Acrylic—and polyurethane dispersions in industrial coatings for plastics

R. Arnoldus

The use of plastics has increased enormously during the recent years. As in many cases these plastics have to be coated for some reason, the technology of plastic

coatings has become more and more important.

Many coating types have been developed, however, mainly based on solvent containing products and often with relative low solids contents.

Environmental and hygienic regulations,

as well as the lower plastic aggressivity of water compared to solvents, has resulted in an increasing interest for waterborne plastic coatings. For this purpose the polyurethane dispersions are very suitable as in many cases only air or forced drying systems can be used.

With help of practical examples from the

automotive and hi-fi industries a discussion on the present and future possibilities for waterbased plastic coatings will be presented.



R. Arnoldus

Biography

Mr R. Arnoldus was educated in chemical technology at the HTS (Amsterdam). He has been working in the resin industry since 1969, both in research & development and technical marketing, mainly for industrial coating applications.

Mr Arnoldus joined Polyvinyl Chemie Holland B.V. in 1979 and went "water-borne" from there. He is presently the application manager responsible for the industrial coatings group.

Plastics as a painting substrate

M. Risberg

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

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

molecular materials may affect the surface with time.

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

Biography

Mikael Risberg was born in 1950. He obtained his BSc at Kungl Tekniska Hogskolan (KTH) in Stockholm in 1975.

Since 1975, Mr Risberg has been working with Becker Industrial Coating at Marsta, Sweden, and is now responsible for the profit centres in automotive and plastic finishing and general industry.

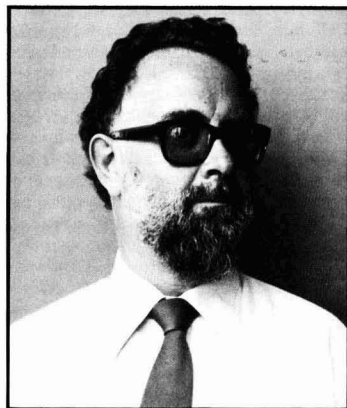
An improved technique for the measurement of adhesion based on a blister method

J. D. Scantlebury and Ali A. Elbasir

This investigation is concerned with the measurement of the adhesion of an unpigmented chlorinated rubber lacquer to mild steel. The technique chosen was the blister method, whereby the coating is forced off by applying pressure hydraulically through a small hole in the substrate. This particular technique differs from other similar blister methods in that the blister is constrained to expand in one direction only. Thus, the growth of the blister may be easily determined. It has been found that the growth rates are largely time independent and it is suggested that the parameter growth rate is related inversely to the adhesive strength. Particular variables which will be reported include the nature of the pressurising fluid, the nature of the pressure application and the film thickness of the coating. Models will be put forward to attempt to explain the experimental observations.

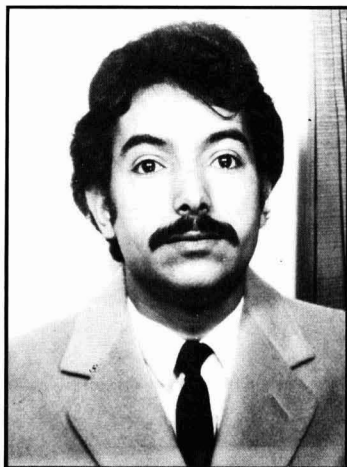
Biographies

Dr J. D. Scantlebury is the International Paint lecturer in Corrosion Science and Engineering in the Corrosion and Protection Centre, University of Manchester Institute of Science and Technology. He leads a research group devoted to the study of organic coatings and corrosion protection. His interest in this area first began when he studied under J. E. O. Mayne in Cambridge for his PhD which was obtained in 1969. He has been at UMIST for ten years and is the author of some fifty



J. D. Scantlebury

publications in the area of corrosion control.



A. A. Elbasir

Mr Ali A. Elbasir is a lecturer in the Department of Chemical Engineering, the El Fateh University, Tripoli, Libya. He has recently received an MSc from the University of Manchester for his work in the Corrosion and Protection Centre on adhesion and disbonding.

Infrared spectroscopic studies of adsorption at the solid/liquid interface

C. H. Rochester

This paper is concerned with the characterization of surface groups, adsorbed species and surface-adsorbate

interactions at the solid/liquid interface. Cells have been developed for the infrared spectroscopic investigation of adsorption involving high area solid particles immersed in liquids, liquid mixtures and solutions of solids in liquids. The advantages and disadvantages of the cells will be emphasized.

Examples to be described illustrating the possible usefulness of infrared spectroscopy in the present context will primarily involve silica and rutile as adsorbents, carbon tetrachloride, hydrocarbons and water as the predominant components of the liquid phase, and a variety of organic molecules containing different functional groups as adsorbates. Band shift data give information about strengths of adsorption and the effects of solvent on surface groups and surface-adsorbate interactions. Spectroscopic adsorption isotherms involving specific surface sites can be determined and, in conjunction with uptake data, can be used to measure the number of surface adsorption sites. Adsorption involving two types of site can be distinguished and different types of interaction involving particular adsorption sites can be characterized. Advantages of infrared spectroscopy for studying adsorption from multicomponent liquid mixtures will be emphasized.

Biography

C. H. Rochester, BSc, PhD, DSc, CChem, FRSC, FRSE, is Baxter professor of Chemistry at Dundee University.

Professor Rochester obtained a 1st class



C. H. Rochester

honours degree in Chemistry at London University where he also, in 1962, received his PhD, and later his DSc (1973). He was elected FRSE in 1984.

From 1962 to 1980, Professor Rochester was employed at Nottingham University, first as an assistant lecturer in Physical Chemistry and then, in 1964, as a lecturer; and finally (from 1973-1980), as a reader. In 1980, he moved to his chair at Dundee University, and from 1981 has been Head of Chemistry there.

His publications total ca. 140; split between thermodynamic studies of solvation phenomena and acid-base equilibria, and infrared spectroscopic studies of surface species.

Recent advances in vinylidene chloride copolymers for use in surface coatings

B. Elgood

There has been a recent revival in interest in vinylidene chloride (VdC) copolymers as binders in surface coatings systems. The paper updates some thirty years of development work on vinylidene chloride copolymer emulsions and will explore some of the useful properties conferred by VdC. These include water vapour permeability controllable down to very low levels, fire retardancy and high resistance to hydrolysis. The anomalous T_g: composition relationship in VdC: acrylate copolymers is discussed in relation to its effect on formulation of surface coatings. Potential difficulties with the use of high VdC content copolymers, such as colour development on degradation will also be discussed. Finally, surface coating formulation variables when using VdC copolymers will be considered.

Biography

Brian Elgood is currently general manager, Surface Coatings, Adhesives and Allied Industries at Scott Bader Company Limited, Wollaston, Northamptonshire. He joined Scott Bader in 1964 as a development chemist to work on vinylidene chloride copolymers and was part of the team that gained for Scott Bader the Queen's Award to Industry for technological innovation in water-based gloss paints in 1975. Since 1973 he has been responsible for marketing Scott Bader's emulsion polymers.

occa news

Report of Council Meeting

A meeting of the Council took place at 1.30 p.m. on Wednesday, 20 February 1985, at the Great Northern Hotel, King's Cross, London N1. The President (Mr C. N. Finlay) was in the chair and 18 members were present.

At the commencement of the meeting, the President reported the death of two Council members—Mr David Sharp (Chairman London Section) and Mr Leonard Davidson (a Vice President and former President of FSCT). The Council stood in silent tribute to the memory of their colleagues.

The Council considered and agreed the Annual Report for 1984 and the Agenda

for the Annual General Meeting which will take place on 28 June 1985, at the Dragonara Hotel, Edinburgh at 4.15 p.m. or as soon thereafter as the fourth technical session of the Conference shall have terminated.

Details were given both of the technical and social programmes for the Edinburgh Conference and it was reported that registration brochures would be included in each copy of the February issue of *JOCCA*.

Preliminary arrangements for the Council Reunion Dinner, to follow the October Council meeting, and for the 1986 AGM, to be held in Bristol in June 1986,

following the Council Reunion Luncheon and a lecture or lectures, were given.

A meeting of the Finance Committee would take place in March and the annual accounts would be tabled as usual at the April Council Meeting.

Details of the current position regarding the Open Tech course were given.

The Honorary Editor reported that one offer for a monograph on "Coatings for zinc surfaces" had been received.

It was reported that the Jordan Award for 1983/84 had been made to Mr B. A. Canterford.

Council was informed that the Professional Grade Committee had admitted one member to Fellowship, transferred three Associates to Fellowship and admitted three Associates.

The Exhibition Committee Chairman (Mr F. Morpeth) reported that a Management Committee of himself (Manchester), Mr L. Morpeth (Newcastle) and Mr D. Komrower (West Riding) had been set up. The Director & Secretary and he had visited Harrogate in November and were satisfied that an exhibition, to be known as "SURFEX '86" could be mounted in the hall available in May 1986. This would enable a mixture of shell scheme and free standing space to be offered and further details would appear in the *Journal* in due course.

The FSCT had invited the Association to present a paper at their Annual Meeting and Paint Show in St. Louis from 7-9 October 1985, the theme being "Coatings R & D: Today's Investment in Tomorrow". Any member likely to be attending the FSCT Convention and who would be willing to present a paper there was asked to contact the Director & Secretary.

The President reported on the progress made by study groups and, after thanking members for their attendance, declared the meeting closed at 3.20 p.m.

News of Members

Mr R. King appointed managing director

Former Chairman of the Midlands Section, Mr R. King, has been appointed managing director of MBP Industrial Finishes Ltd, the company set up by Manders Holdings plc after the acquisition of the Industrial Division of Blundell-Permglaze.

Mr King, 46, has more than 25 years' experience of the surface coatings; the last 12 years with Blundell-Permglaze.

His early training as a resin chemist was with the Cray Valley Products company of the Coates Brothers' Group where he worked for ten years. In 1968, he joined the Blundell-Permglaze Industrial Division of Tyseley, becoming chief chemist until 1975 when he took over the sales function. He became general manager at Tyseley in 1979.

In 1982, he moved to London to join the Blundell-Permglaze management at group level.

Married with three sons, Ray King was



R. King

Chairman of OCCA Midlands Section from 1974-1976; he is a member of the Birmingham Paint Varnish & Lacquer Club, he has served on several Paint-makers' Association committees and is a long-serving Council member of the Paint Research Association, recently being elected to PRA Board of Management as vice-president.

J. Lucas joins Lalco Ltd

Mr J. Lucas, a member of OCCA for over 20 years, has recently joined Lalco Ltd as a director. Lalco Ltd is the sole UK distributor for the West German company Buntdruck Aschaffenburg range of top-quality transfers, both open stock and controlled, for the plastics and ceramics industries.



J. Lucas

Mr Lucas' career in surface coatings spans some 35 years. In 1950, he joined ICI Ltd, the old dyestuffs division, and worked in the non-metallic surface coatings development section attached to the engineering department. Subsequently, he was transferred to the application research and technical service department attached to the pigmentations of plastics and rubber section.

He decided to join Bush Beach & Segner Bayley Ltd in 1969. BBSB was the agent for BASF, Wacker and Degussa, marketing their products to the surface coatings industry.

In 1977, Degussa took over BBSB Ltd and Mr Lucas worked for them as product manager before joining Lalco in January 1985.

professional grade

At a meeting of the Professional Grade Committee held on 20 February 1985 the following admissions were made:

Transfer from Associate to Fellow

Caffery, George Francis (*London*)
Johnsen, Svend (*General Overseas-Denmark*)
Weineck, Terrence Graham (*General Overseas-Portugal*)

Admitted as Fellowship

McMillan, Stanley (*Newcastle*)

Admitted as Associates

Akam, Richard Brian (*General Overseas-Hong Kong*)
Arnold, Alan Edward (*Midlands*)
Verma, Ratnakar Prasad (*General Overseas-India*)

new members

The sections to which new members are attached are shown in italics, together with the country where applicable.

Ordinary Members

Bridges, R. B. (*Ontario*)
Chan, G. L. (*General Overseas-Singapore*)
Chana, G. S. (*London*)
Chew, S. K. (*General Overseas-Malaysia*)

Elder, T.A. (*Auckland*)
 Elliot, B. R. (*General Overseas—Malaysia*)
 Furtado, S. E., BSc PhD (*General Overseas—Holland*)
 Gamble, A. A., PhD (*London*)
 Gan, M., BSc (*General Overseas—Malaysia*)
 Gichengo, G.M. (*Manchester*)
 Gillespie, G. D. (*Auckland*)
 Harte, A. (*Ontario*)
 Iddamaloda, P., MSc (*General Overseas—Sri Lanka*)
 Jacques, K., BSc (*Midlands*)
 Kellam, R. I. (*Ontario*)
 Koo, A. M., BSc (*General Overseas—Malaysia*)
 Lee, S. Y. (*General Overseas—Malaysia*)
 Limatibul, S., PhD (*General Overseas—Thailand*)

Mulholland, J. F. (*Manchester*)
 Newton, C., BSc (*Scottish*)
 Patel, R., BSc (*Ontario*)
 Paulin, P. (*Ontario*)
 Peters, J. J. (*Ontario*)
 Plackett, D. V. (*Auckland*)
 Rohde, A. G. (*Auckland*)
 Rouillard, M. M. (*General Overseas—Mauritius*)
 Seow, C. M. (*General Overseas—Singapore*)
 Setton, J., BSc (*London*)
 Simes, H. G. (*Auckland*)
 Stocks, T. (*General Overseas—Zambia*)
 Symes, M., BSc (*General Overseas—Denmark*)
 Toms, H. C. (*London*)
 Wade, D. F., BSc (*London*)
 Winder, B. (*Manchester*)

Associate Members

Cave, P. G. (*Auckland*)
 Day, J. F. (*Thames Valley*)
 Hamilton, S. G. (*London*)
 Knight, P. H. (*West Riding*)
 Whitehead, S. G. (*Manchester*)
 Wilkinson, N. M. (*Scottish*)

Registered Students

Birch, I. M. (*Manchester*)
 Coggins, J. (*Bristol*)

CLASSIFIED ADVERTISEMENTS

APPOINTMENTS

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If interested, please direct your resume, to: Steve Schultz, Chief Chemist, Guertins Bros., Coatings and Sealants Ltd., 270 Assiniboine Avenue, Winnipeg, Manitoba, Canada R3C 0X6.

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 Birmingham B31 3PG.

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Quality Control Manager

To be responsible for ensuring that the quality of all products meet performance requirements. Your expertise will be fully utilised in initiating and carrying through changes in procedures and test methods to meet the needs of a rapidly changing production environment and to respond to demanding standards of customer service.

You will be part of a small quality assurance team instrumental in monitoring and improving production quality levels.

The position demands a high level of man-management skills in addition to technical expertise. You will liaise on a daily basis with a cross-section of personnel covering all disciplines.

In addition to 5 years experience in the paint industry (including 2 years in a formulating laboratory) candidates for both posts should have spent 1 year in a production or production service role and possess an honours degree in Chemistry or Applied Chemistry.

Salaries and benefits are commensurate with a company of our international standing.

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MISCELLANEOUS

FOR SALE: Small technical library comprising many surface coatings and other reference books. Includes bound issues of *JOCCA* from 1932 through to 1972 and a full set of the *OCCA Paint Technology Manuals*. Full list available on receipt of a stamped addressed envelope.—Reply **Box 553**.

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OULU WHO?



A name to remember when you need a stable tackifier.

Finnish is not an easy language, and some people seem to have problems with our name: we've been called Lulu, Zulu and even Honolulu. But one thing is certain: their problems end when they try our products.

Our Oulutac and Oulumer upgraded rosin tackifiers have an enviable reputation for stability. This hasn't happened by chance. There are good reasons.

Firstly, we have perhaps the most advanced and best-equipped quality control and R&D labs in the business. And a staff of experts more than equal to their task.

Secondly, most of our crude tall oil comes from our extensive pulp mills in Northern Finland, right next to our fractionating plant. This means we control our own feedstock, rarely have to go shopping for crude, and eliminate costly transportation.

It also means that our resins are fresh when they reach our customers.

So there are no problems with ageing. All this adds up to stable products, stable supply and... dare we say it... stable prices.

Our present product range includes both polymerised and esterified products for applications including hot melt and pressure-sensitive adhesives, printing inks and coatings.

So next time you want a stable product for use in your formulae, remember... Oulu Oy. From Finland. We've distributors and stocks throughout Europe and will happily supply information and samples.

Oulu Oy

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The resourceful Finns