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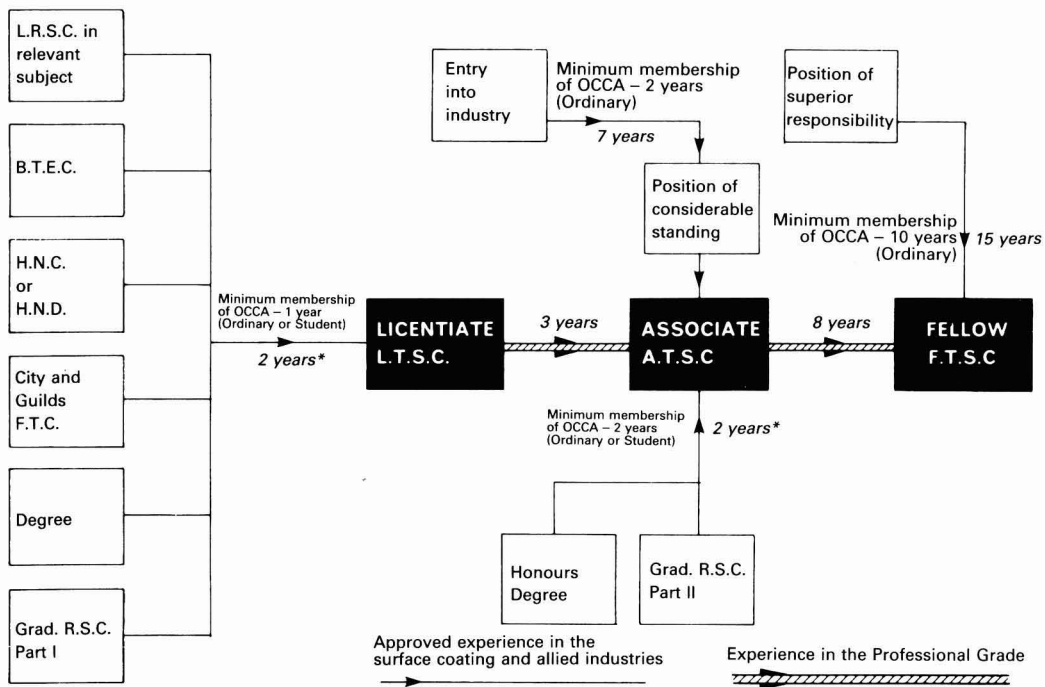


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Atomization: A new concept in producing zinc dust for the paint industry

M. Leclercq

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Summary

A new fine-atomization process has been developed to produce zinc dusts (suitable for pigment uses) by blowing from molten metal. Their chemical composition depends directly on the purity of the starting metal, e.g. SHG or electrolytic zinc. The physical characteristics of atomized zinc dusts are compared with those of three usual grades of material commonly produced by distillation having the same particle size distribution.

A theoretical treatment of physical parameters, such as oil absorption, apparent density, etc., whose values are modified as a result of elongation in their particle shape, leads to a decrease in zinc loading of organic zinc-rich paints prepared from atomized zinc dusts. This is achieved to the benefit of higher mechanical and adhesive performances of paint films, without losing electrical contacts between the particles and the resulting cathodic protection of the coated steel.

Atomization also permits alloyed zinc dusts to be produced, with a possible addition of a few per cent of non-volatile elements, such as aluminium.

Introduction

Zinc dust for zinc-rich paints has been produced for many years now by distillation followed by condensation of the resulting vapour phase; whilst zinc powder is produced by atomization of molten zinc using compressed air.

This historical situation led people to distinguish both products according to their main characteristics, that are themselves dependent on the state of art in the facilities for producing them. As it is extensively described in a paper published in 1963 by J. Vandemaële¹, the product commercially named zinc dust is a powder, whose feature is its very high fineness; its particle size distribution can be controlled in order to comply with the specifications required by its many uses.

While the conventional upper limit of particle size for zinc dust lies at about 75 microns, zinc powder produced by blowing for specific uses, such as for instance alkaline primary batteries, consists of larger particles starting up above that limit of 75 microns. Thus, the classification of zinc powder materials under two definite commercial names is more relevant to the way by which they are manufactured than to the basic properties that are actually needed for their uses; as a consequence of this, attention must be paid to progress now achieved in the metallic powder production, taking into account the possible application of new materials just appearing on the market.

Since the end of the seventies, dramatic improvements have been brought to the concept of atomization devices, which has enabled Vieille-Montagne to produce the so-called zinc dust by blowing; thanks to the products enhanced reactivity in chemical applications, it has found an immediate use as a reducing agent.

Their particle size distribution, as controlled by acting

upon the parameters of atomization, is quite similar to that of zinc dusts which are commonly obtained through distillation; their chemical analysis is directly related to the composition of the starting molten bath, which allows pure zinc as well as alloyed zinc dusts to be produced.

Finally, a classifier can be fed with such a primary zinc dust in order to provide the paint industry with suitable fine grades. This possibility was at first investigated on a pilot scale; in this way, very good results have been obtained and this was also shown from the standpoint of the feasibility of zinc-rich paint formulations and of their corrosion resistance after several years field testing.

A research work, sponsored by IRSIA and technically supported by CORI in Belgium, was completed in 1981 with the collaboration of a major paint maker; the final report concluded that the behaviour of atomized zinc dusts favoured their use in zinc-rich paints².

Later on in 1983 the regular production of commercial zinc dust pigments started, the purpose of the present paper is to describe their characteristics, peculiarities and potentialities.

1 Chemical and physical characteristics of atomized zinc dust

1.1 Chemical characteristics

The chemical analysis of the zinc dust practically corresponds to the analysis of the zinc which is selected as a raw material; by starting from high-grade electrolytic zinc, a very pure zinc dust is produced, whose content of impurities lies far below the upper limits specified (mainly for toxic elements) in the many national and international standards³. An usual specification for such a grade of zinc dust is as follows:

lead	0.0050% maxi
iron	0.0030% maxi
cadmium	0.0005% maxi
chloride	0.0010% maxi

The limits of content for the lead and cadmium are respectively, 40 and 400 times less than the one considered in ISO 3549, which is a warrant for the health and safety when working structural parts of coated steel, such as for instance by welding.

Atomized zinc dust is also characterized by a rather high content of metallic zinc, which very favourably compares with its content in the highest grades of distilled materials; typical analyses usually lie within the range of 97 to 98 per cent of metal, even though the specification allows a slightly reduced minimal content for the finest grades (f.i. ultrafine particles in zinc dusts having their cut-off point at 10 microns).

As it is commonly observed with any type of fine zinc dust, its sensitivity to oxidation when it comes in contact with moist air is likely to reduce its initial content of metal during its shelf-life; this oxidation being likely to provoke some agglomeration of particles in the bulk, a resulting shift in other parameters, such as the particle size distribution, may also be observed. It is for this reason why care must be taken to prevent as completely as possible the reaction of zinc with moist air, especially when a long duration of storage under severe conditions is expected.

1.2 Physical characteristics

The definition of the physical characteristics of a zinc dust, which is intended to be used as a pigment in paints, is based upon considerations of the shape and size of its constituent particles. Zinc dusts as obtained through distillation mainly consist of spheroidal particles; suitable size distributions with respect to the application and nature of the vehicle are achieved by passing an appropriate primary zinc dust through a classifier.

Primary zinc dusts as obtained by blowing may be processed in a quite similar way in order to obtain the several grades that are required for any usual application of zinc-rich paints; the only difference in the physical characteristics occurs at the level of the shape. Owing to the decrease in surface tension resulting from oxidation, the liquid droplets, whose shape is still disturbed under the effect of blowing, are quickly cooled and do not have time enough to regain the usual spherical shape before they become frozen.

As shown in the SEM-micrograph of Figure 1, the resulting solid particles are more or less elongated, the larger the particle, the greater its deformation; the very tiny particles of a few microns in diameter are still spheroidal in shape, the irregular shape of the biggest particles remain as far as possible from looking like needles or flakes.

This variation in shape has been proved to have no detrimental effect on the manufacture of zinc-rich paints, even though it is responsible for slight differences in other physical properties with respect to distilled materials; Table 1 summarizes the results of analyses carried out on samples

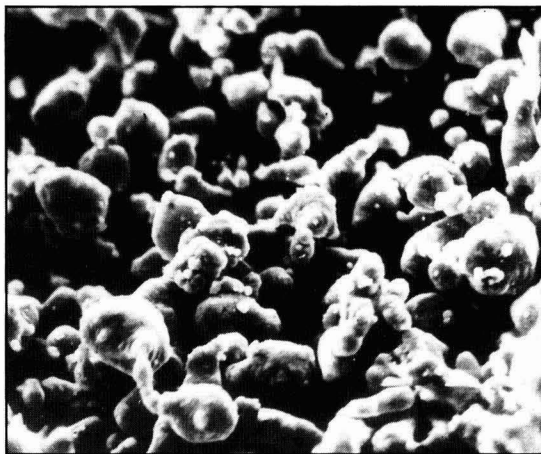


Figure 1. SEM micrograph showing the shape of particles in atomized zinc dust (magn. $\times 950$).

of zinc dusts comparable in particle size distribution, obtained by both processes.

The particle size distributions given in this table were determined by using a CILAS Model 715 laser-granulometer, which is the best instrumental technique just now available for zinc dusts; the results are displayed in the form of a cumulative weight percentage vs. the diameter in microns, and the values of median diameter (K_{50} , diameter at 50% of cumulated weight) and specific surface area (total surface area of 1 gram of zinc spheres having the same size distribution) are simultaneously calculated by the computer.

Determinations of the so-called permeametric surface area were also performed by using Blaine's technique, which gives results very close to those provided by the Fisher technique⁴; results in Table 1 show that, for equivalent particle size distributions, the permeametric surface areas of atomized zinc dusts are higher than the one of distilled materials.

Table 1
Physical characteristics of various types of zinc dust

Type of zinc dust	1A	1D	2A	2D	3A	3D
Particle size dist. cumulative weight						
2 microns, %	14.7	14.7	8.0	7.5	5.7	7.1
4 microns, %	69.4	71.4	48.0	46.6	29.3	31.0
8 microns, %	100.0	100.0	91.5	98.1	70.0	69.5
16 microns, %			100.0	100.0	96.6	98.1
32 microns, %					100.0	100.0
Median diam, mic.	3.2	3.1	4.1	4.2	5.7	5.6
Permeametric surface area, m ² /g	0.329	0.271	0.271	0.211	0.206	0.171
Mean diam, micr.	2.55	3.10	3.10	3.99	4.08	4.90
BET surface area, m ² /g	0.758	0.517	0.582	0.389	0.453	—
Oil absorption, %	8.49	6.88	8.28	6.58	7.62	6.22
Bulk density, g/cm ³	2.27	2.50	2.30	2.70	2.67	2.99
Tamped density, g/cm ³	3.23	3.64	3.33	4.00	3.77	4.26

1 = fine grade, 2 = medium grade, 3 = coarse grade, A = atomized, D = distilled

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Table 2

Packing characteristics for various types of zinc dust in the dry state and in the oil absorption measurement

Type of zinc dust	Packing in dry state		Packing in oil		Mult. coeff. (Void %) dry
	ρ_a	Void %	OA	Void %	(Void %) wet
1A	3.23	54.8	8.49	39.3	1.39
2A	3.33	53.4	8.28	38.7	1.38
3A	3.77	47.2	7.62	36.8	1.28
Atomized					
Mean value		51.8		38.3	1.35
1D	3.64	49.0	6.88	34.4	1.42
2D	4.00	44.0	6.58	33.4	1.32
3D	4.26	40.3	6.22	32.2	1.25
Distilled					
Mean value		44.4		33.3	1.34
Averaged					
Mean value		48.1		35.8	1.34
Calculated pack. fact., χ		0.519		0.642	

1 = fine grade, 2 = medium grade, 3 = coarse grade, A = atomized, D = distilled

As the spherical shape exhibits the lowest possible surface area for a given volume or weight, it is easily concluded that the farther from a sphere is the particle shape, the higher its surface area; as a result, the so-called Fisher mean diameter of atomized zinc dusts, as calculated by the well-known equation

$$\Phi_m \text{ (in microns)}^\dagger = \frac{6 \times 10^4}{7.14 \times s \text{ (in cm}^2\text{/g)}}$$

† 7.14 is specific gravity of Zn metal in g/cm³

will be smaller than the mean diameter of distilled zinc dusts under the same conditions of equivalence in size distribution.

Other physical characteristics of both types of zinc dusts, such as the bulk density, the tamped density, and the oil absorption, are also slightly different. As it will be seen later, the tamped density and oil absorption are reliable parameters to define the structural properties of zinc-rich paints.

The tamped density is the apparent density of the material at closest packing in the dry state; its ratio to the specific gravity of metallic zinc defines the percentage of void between the particles in close contact with each other. The oil absorption (OA) determines the amount of linseed oil which is just necessary to embed the many particles that are contained in a given weight of pigment; it consists of three parts²: the oil required to give a film at least one molecule thickness over the whole external surface of the particles; the oil required to fill any accessible voids in the particle and, the oil required to fill the voids between the oil coated particles when closely packed.

Table 2 gives the calculated values of the percentage void on a basis of the apparent density in the dry state and on a basis of the oil absorption. It appears that the void percentage is systematically higher in the dry state than it is

when the particles are wetted by the linseed oil. The averaged mean value of the multiplying factor may be determined as being equal to 1.34 ± 0.07 ; reciprocally, the volume occupied by the zinc under the same conditions permits an averaged packing factor of 0.519 and 0.642 to be calculated, respectively.

At this point, it is useful to compare these values with the one reported for typical configurations likely to occur in a bed consisting of mono-sized spherical particles⁵: the very loose cubical array is characterized by a packing factor $\chi = 0.5236$, while in practice dispersed spherical particles are usually considered to pack randomly in a pattern having a packing factor equal to 0.639.

It is remarkable that these values of packing factor, such as mentioned in the literature, are quite close to the ones that are found for actual zinc dusts, by averaging the results of tamped density and oil absorption measurements, respectively. Thus, it could be concluded that, in the case of more or less spherical particles of zinc dust in the dry state, the array at closest packing takes place according to a pattern which is close to the cubical arrangement; else, under the conditions of oil absorption measurements, a denser packing would be achieved, whose configuration should be similar to the one experienced on dispersed pigments.

The consequence of this will be discussed later when dealing with the behaviour of the zinc dusts once they are formulated in organic zinc-rich paints.

2 The behaviour of atomized zinc dust in zinc-rich paint formulations

2.1 Geometrical characteristics of zinc-rich paints

Zinc-rich paints usually contain more than 90 per cent in weight of zinc dust in the dry film; this very high content of pigment is generally supposed to be necessary to insure electrical contacts between the particles, in order to enable

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the metallic zinc to provide cathodic protection to the coated steel. An extensive discussion about the geometrical parameters to be taken into account in the case of spherical particles has recently been published by C. H. Hare et al⁵; as a guideline satisfying the requirements of the formulator and specifiers, these authors estimate that developing formulations on a basis of the respective volumes of zinc and dry vehicle are more fruitful and accurate than considering weight ratios.

Their conclusions are based upon the definition of the critical pigment volume concentration (CPVC), which is the value of the pigment volume concentration (PVC) where any void available between the particles closely packed in the dry film is filled by the vehicle; since the theoretical arguments are those considered for defining the oil absorption, it is usually admitted that both are related as follows

$$CPVC = \frac{1}{1 + (OA) \rho / 93.5}$$

where OA = oil absorption in grams/100 gram of zinc dust;
 ρ = specific gravity of the pigment = 7.14 g/cm³.

By neglecting the sheath of vehicle that is adsorbed onto the substrate, another definition of the CPVC is obtained from the well-known Steig's equation

$$CPVC = \frac{PV^*}{PV^* + V_a + V_b}$$

where PV* = the volume of pigment at closest packing;

V_a = the sorbed vehicle volume;

V_b = the interstitial binder.

The sorbed vehicle volume corresponds to the total volume of the sheath which builds up on the pigment surface; in the case of organic zinc-rich paints, that sheath at least one molecule thickness will increase the electrical resistance at the contacts between metallic particles. As the contact between adjacent spherical particles is tangential, which corresponds to a very restricted surface area, the highest possible electrical current needed for cathodic protection is likely to be favoured by the highest number of possible contacts.

This is the reason why the cathodic protection ability

reaches a maximum when PVC = CPVC, in which case the number of contacts is at a maximum; a shift in PVC towards looser packing, such as the one in cubical mode, will lead to a decrease in the number of contacts. As a result, the electrical resistance will increase, and could very soon reduce the paint performances⁴.

The point to define is how does atomized zinc dusts behave, as their shape differs significantly from a sphere; it is hoped that the deformation and elongation of the spherical shape should increase the total surface area of contact, to such an extent that equivalent aptitude for cathodic protection could be obtained at reduced values of PVC.

2.2 Formulation of epoxy polyamide zinc-rich paints

The zinc dusts described in Table 1 were formulated according to a typical composition, commonly used for experimenting on epoxy polyamide paints in the laboratory:

Pack 1	Zinc dust	920g
	Epikote 1001-X-75	61g
	Bentone 27	10g
	Xylene	1/3 vol.
Pack 2	MIBK	1/3 vol.
	Ethylglycol	1/3 vol.
	Versamid	41g
	Xylene	1/3 vol.
	MIBK	1/3 vol.
	Ethylglycol	1/3 vol.
		67g

When neglecting the contribution of Bentone 27 to the volume ratio, and by taking the specific gravity of the binder $\rho_b = 1.05$, the calculated PVC is 65.8 per cent; this corresponds to a zinc loading of 92.9 per cent in weight.

As shown in Table 3, such a PVC is not so far from the values of CPVC calculated from the oil absorption data in the case of the distilled zinc dusts; on the contrary, the CPVC's for the atomized zinc dusts are significantly less, standing well below the value of 65.8 per cent. Therefore, dry film from paints formulated according to the above composition show a rather high porosity, due to lack of binder loading; this situation might provoke some weakening in the adhesive-cohesive properties of the film as well as an increased reactivity on outdoor exposure.

Table 3

Geometrics and composition of the dry film for various types of zinc dust

Type of zinc dust	1A	1D	2A	2D	3A	3D
Oil absorption, %	8.49	6.88	8.28	6.58	7.62	6.22
Theoretic CPVC, %	60.7	65.6	61.3	66.6	63.2	67.8
Critical Zn loading, %	91.3	92.8	91.5	93.1	92.1	93.9
Zinc, g/100cm ³	433.2	468.2	437.5	475.3	451.3	484.1
Binder, g/100cm ³	41.2	36.1	40.7	35.1	38.6	33.8
Apparent density, g/cm ³	3.23	3.64	3.33	4.00	3.77	4.26
Calculated PVC, %	58.4	65.8	54.8	65.8	58.2	65.8
Minimal Zn loading, %	90.5	92.9	89.2	92.9	90.5	92.9
Zinc, g/100cm ³	417.0	469.8	391.3	469.8	415.5	469.8
Binder, g/100cm ³	43.7	35.9	47.5	35.9	43.9	35.9

1 = fine grade, 2 = medium grade, 3 = coarse grade, A = atomized, D = distilled

Furthermore, the increased reactivity of atomized zinc dust will not only depend on the film porosity, even more on its increased specific surface area and total surface area of contact between adjacent particles. That behaviour may obviously be expected from the specific characteristics of the pigment in the dry state.

Shape variations from the sphere are responsible for the observed variations in parameters which determine the reactivity of the zinc dust; it is the reason why the classical model derived from the behaviour of spherical particles should be deleted in the case of atomized products. For this new product, it seems reasonable to consider the validity of a new model, on a basis of the following statement: owing to their shape, a higher spacement of the particles, as occurs at random when they are closely packed in the dry state, may be assumed to have no detrimental consequence on the effectiveness of electrical contacts in the resulting paint.

An attempt to check this working hypothesis is possible by comparing some typical properties of paints prepared at the usual 92.9 per cent zinc loading to the ones of paints prepared at a reduced zinc loading; in order to select the suitable zinc loadings to be accounted for, their calculation has been derived from the respective apparent densities of each pair of both kinds of zinc dust having the same size distribution, as follows

$$PVC = 65.8 \times \frac{(\rho_a) \text{ atomized}}{(\rho_a) \text{ distilled}}$$

where ρ_a = apparent density given as the tamped density in Table 1.

This will enable the behaviour of coated test pieces from each type of zinc dust to be compared both at the nominal and reduced PVC's, respectively.

Table 3 also gives, for the several zinc loadings, the theoretical consumption of zinc dust and binder at equal volume of dry film, or in other words at equal thickness of coating on a given surface area: for instance, the figures in grams in Table 3 correspond to 100 microns of dry film per square metre. In this way, it can be shown that, for a reduced PVC corresponding to about 90 per cent of zinc loading, the zinc consumption decreases by about 13 per cent, while the corresponding consumption of epoxy polyamide increases by about 25 per cent.

2.3 Behaviour of coated test pieces

Shot-blasted steel panels 100 × 200 mm were coated by brushing with the various paints whose formulations are fully described in Table 4; the mean thickness of the dry film so obtained is about 40 microns. Optical micrographs of cross-sections of the coating are shown in Figure 2 for the medium grade of distilled zinc dust, and in Figure 3 for the atomized zinc dust having the same size distribution. It is evident that the total surface area of the white-looking zinc particles is more important for the atomized product in both formulations.

The same conclusion may be drawn from examination of the SEM-micrographs in Figure 4, in which the arrangement of the distilled and atomized particles is compared at the highest and lowest zinc loadings, respectively. These observations provide a qualitative

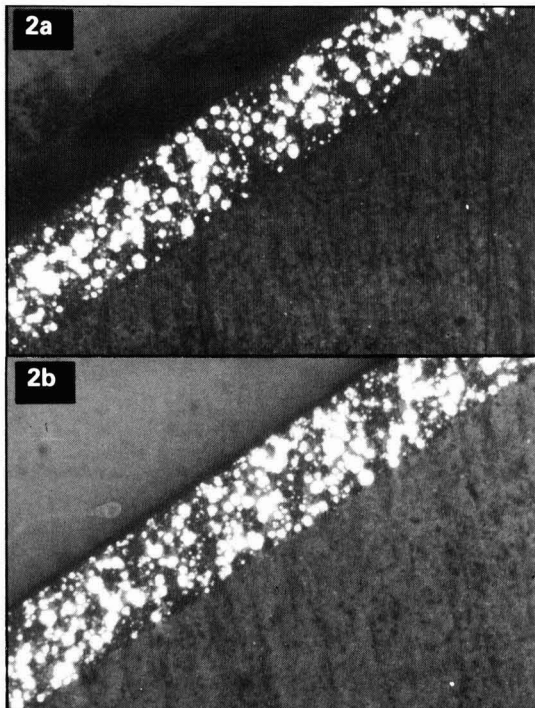


Figure 2. Optical micrographs of a cross-section of a film pigmented with distilled zinc dust (medium grade): (a) at a 92.9% zinc loading (b) at a 89.5% zinc loading (magn. ×400).

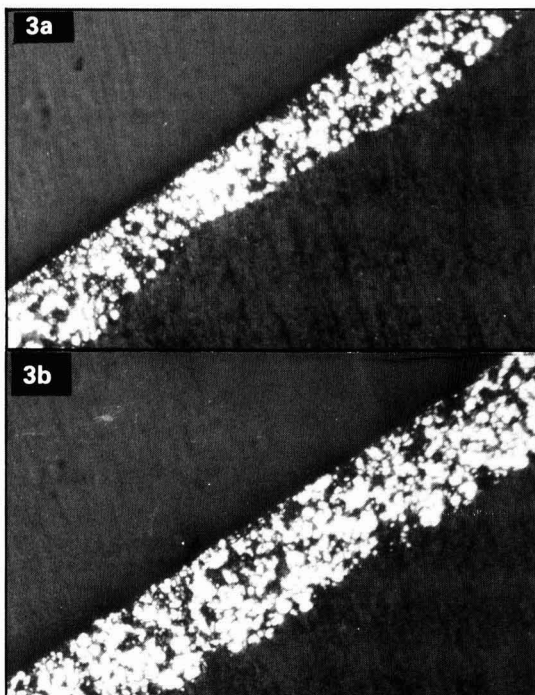


Figure 3. Optical micrographs of a cross-section of a film pigmented with atomized zinc dust (medium grade): (a) at a 92.9% zinc loading, (b) at a 89.5% zinc loading (magn. ×400).

Table 4

Basic formulations calculated from the apparent density of the various types of zinc dust having the same size distribution

Type of zinc dust	1D, 2D, 3D	1A, 3A	2A
PVC, volume %	65.8	58.3	54.8
Zinc loading, weight %	92.9	90.5	89.2
Pack 1. (10 parts)			
Zinc dust, g	920	896	883
Epikote 1001-X-75 (75%), g	61	82	93
Bentone 27, g	10	10	10
Xylene 1/3 vol.			
MIBK 1/3 vol. , g	90	90	90
Ethylglycol 1/3 vol.			
Total, g	1081	1078	1076
Pack 2. (1 part)			
Versamid 115 (60%), g	41	55	62.5
Xylene 1/3 vol.			
MIBK 1/3 vol. , g	67	53	45
Ethylglycol 1/3 vol.			
Total, g	108	108	107.5
Total Pack 1 + Pack 2, g	1189	1186	1183.5
Dry film			
Binder (epoxy), g	45.75	61.5	69.75
Polyamide, g	24.6	33.0	37.5
Zinc dust, g	920.0	896.0	883.0
Bentone, g	10.0	10.0	10.0
Total, g	1000.35	1000.5	1000.25
Solvents			
Mixture of solvent, g (Total, g)	188.65	185.5	183.25
Ratio solvent/zinc dust g/g	0.205	0.207	0.208

1 = fine grade, 2 = medium grade, 3 = coarse grade, A = atomized, D = distilled

confirmation of the expected effectiveness of electrical contacts between adjacent particles of atomized zinc dust at reduced PVC.

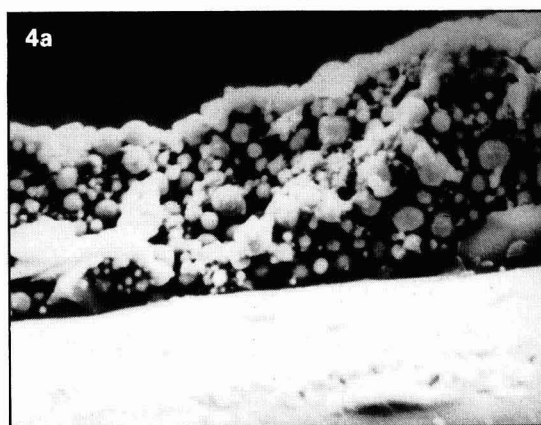
The behaviour of the coated steel when exposed to accelerated corrosion testing enables their performance to be assessed for corrosion resistance and aptitude for cathodic protection properties.

Test pieces coated with paints formulated from both types of zinc dust (medium grade) were exposed for 15 days

in a salt spray cabinet; the weight gains after exposure, which result from the conversion of metallic zinc into hydroxide and oxychloride, are shown in Figure 5. Owing to its higher reactivity, the weight gain appears to be higher for the atomized than for the distilled material at the same 92.2 per cent zinc loading; at a reduced 89.5 per cent zinc loading, the weight gain as well as the protective properties of the atomized zinc dust become comparable to those of the distilled material at the highest zinc loading.

Figure 6 shows differences in weight loss between both

Figure 4. SEM micrographs of cross-section of a dry film of epoxy polyamide zinc-rich paint: (a) of distilled zinc dust at a 92.9% loading, (b) of atomized zinc dust at a 89.5% zinc loading (magn. $\times 850$).





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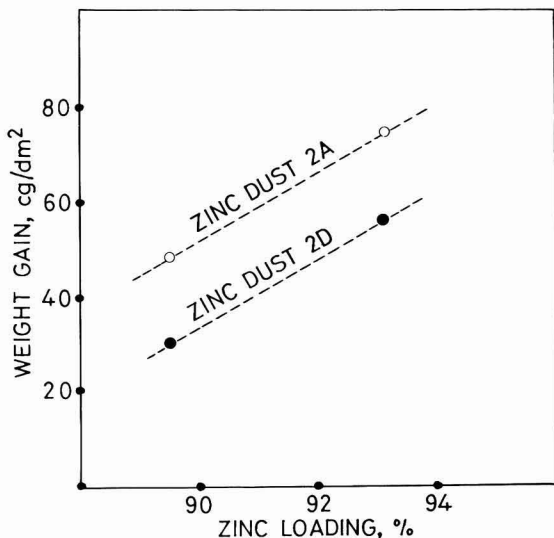


Figure 5. Weight gain after 15 days in a salt spray cabinet, 5% NaCl (symbols defined at base of Table 1).

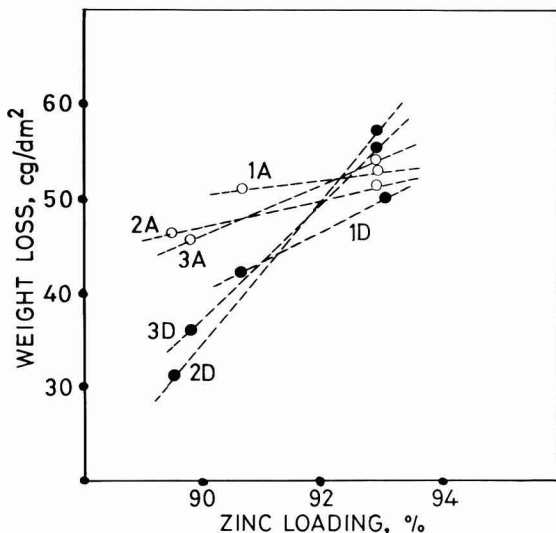


Figure 6. Weight loss after 15 days exposure to 10 ppm SO₂ (symbols defined at base of Table 1).

types of zinc dust after 15 days exposure to an artificial atmosphere containing 10 ppm SO₂, under well-defined conditions (± 94 per cent RH at 35°C). The paints prepared from atomized zinc dusts show approximately the same weight losses at both zinc loadings, while the weight loss at a reduced zinc loading decreases as a result of a decreased reactivity in the case of distilled materials. Again, the protective properties of the atomized product appear similar to those of the distilled material at the reduced and usual PVC's, respectively, with regard to the corrosion resistance as well as the cathodic protection of scratches in the film.

Both kinds of accelerated corrosion testing lead to the same conclusion, that is, optimum protection of steel may be obtained at a reduced zinc loading due to peculiar physical characteristics of atomized zinc dusts; which in this case corresponds to a higher content of binder in the paint, the level of the mechanical properties of the dry film can be expected to show improvement.

Figure 7, shows the improvement in the adhesive-cohesive properties of the paints at reduced PVC's. In the case of the zinc dust medium grade, adhesion measurements carried out by the classical Elcometer test show that cohesion is predominant, the film being completely stripped off after the test. In the other cases, delamination occurs, a part of the coating remaining adherent to the substrate after the stripping; nevertheless, the improvement in the cohesive properties resulting from the increase in binder content is clearly shown.

Discussion and Conclusion

Atomized zinc dust is a new product, but all the grades now available can replace all the zinc dusts commonly used in zinc-rich paints. For more than two years, they have been used in paint manufacture, which is the best indication of their ability to comply with the specifications required by its many users.

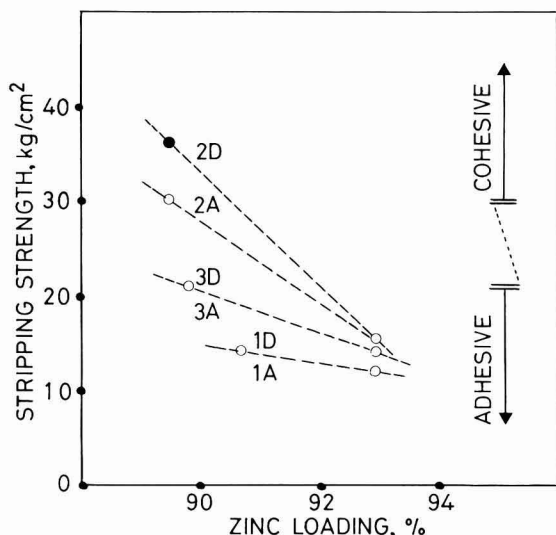


Figure 7. Adhesion measurements by elcometer test (symbols defined at base of Table 1).

They differ from the distilled materials in shape only, and their peculiar characteristics may offer some interesting possibilities; because of the slight variation in shape (the shape progressively departs from a sphere when the particle size increases), the arrangement of the particles in dry films differs from the behaviour of the spherical particles in distilled zinc dusts.

It had been shown how advantage can be taken of this, in order to somewhat reduce the pigment loading without losing the necessary electrical contact between particles. The experimental results described in this paper should only be considered as examples of the modifications which may be expected from the use of this new pigment; they

have been obtained on a laboratory scale, using a well-defined simplified formulation based upon an epoxy polyamide binder. They are intended to indicate a trend for the future use of atomized zinc dusts in actual applications.

Several grades of the product are available, which can be used without any problems for covering the whole range of usual applications, such as blast-primers, shop-primers before top coating, and eventually corrosion protection without a top coat; experiments on test plates after outdoor exposure for more than five years in urban-industrial and marine-industrial atmospheres demonstrate their outstanding behaviour, which compares very favourably to the standards provided by the classical distilled pigment.

There is no doubt that atomized zinc dusts as described have now proved their usefulness as a pigment for paints, which fully complies with the specifications required by this use; at this stage, it is up to the paint maker to take advantage of their properties in his own special formulations, by optimizing these with a view to reaching the best compromise between the desired anticorrosive performance and other characteristics of the coating.

Finally, atomization prepares the way for the production of completely new pigments, such as zinc alloys containing non-volatile additive elements; up to now, little research work has been instituted on the possible uses of zinc-aluminium pigments, containing aluminium in the range 0.25-4.0 per cent². It is evident that a very few per cent of

aluminium drastically reduces the reactivity of the dust, with a simultaneous decrease in the ability to protect cathodically; some modification of both properties appears to be feasible by adjustment of the aluminium content within the above-mentioned range of concentration.

These products are still at the laboratory stage; other compositions of alloys could also be considered if special products were required. Thus further developments in the production of such alloyed pigments will therefore be possible if it provokes the interest of people working in the paint industry.

[Received 20 August 85

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Moisture and painted wood

B. Lindberg

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Summary

The current increased interest for improved durability of wood had been accentuated by rot decay in painted wooden window frames. The reason for this deterioration has been high moisture accumulation in the painted wood followed by an attack of wood fungi.

In Sweden it is estimated that it will cost approximately 2,000 million skr. to repair and prevent threatened windows.

This paper will present information about moisture transportation in bare and painted wood. A painted wood construction as a climatic barrier is exposed from the outside to different water vapour conditions and to water (e.g. rain, wet snow and condensation).

Measurement and calculation of water transports for free films and painted wood are presented and results are given for different paint systems. How the permeability changes by temperature and by ageing are factors which will be discussed. One very important transport of liquid water is the end-grain penetration or capillary flow specially in the corners of wood windows.

Introduction

Wood as a substrate for painting may cause certain problems. Wood is a biological and hygroscopic material, and this is responsible for the character of wood. Changes in moisture content cause the wood to swell or shrink to a certain degree. This change in volume of the wood causes large local movements and the wood will crack especially in the surface which is exposed to much rain and sun (drying out). If the wood is painted, the paint or surface coating often will crack, blister or even peel off due to these movements in the wood substrate. The volume change is different for various parts of the wood material built up by heart-, sap-, summer- and springwood. Spring and summer wood are also called early and late wood respectively. These two types of wood form the annual rings in the wood and show large differences in volume change and density (see Figure 1).

It is well-known that especially during exterior exposure, paint films become brittle. Thus, checking, cracking and scaling of the paint film may occur.

Rapid drying of the surface area of the wood, such as occurs under influence of sunlight, causes typical drying cracks here and also deeper down in the wood. Micro organisms such as fungi spores may enter into the wood through these cracks.

During exterior exposure mainly the UV-part of sunlight in combination with oxygen and water degrade the wood surface. The porous and weak springwood is degraded most severely and a surface with a wave-like structure is formed. The result is a deterioration of the natural glueing effect between the wood fibres and the whole wood surface starts to erode. Simultaneously there is a change in colour from light yellow-white towards a grey appearance.

The degradation of wood by fungi occurs at a high

Wood type	Density (kg/m ³)	Volume change	Length	Direction Tang.	Rad.
Spring wood	306	10.9	0.19	8.1	2.8
Summer wood	674	18.9	0.10	11.3	1.4

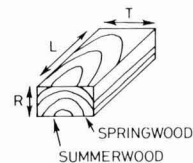


Figure 1 (including the table above). Change in dimension of wood by drying (in per cent).

moisture content (> 20 weight per cent). The wood destroying fungi cause a decrease in the dimensional stability and strength of the wood substrate. The colour is also changed by the attack of fungi e.g. by blue stain. Wood can also be attacked by bacteria (during water storage) and by certain insects. Thus, it is necessary to paint or stain wood surfaces so that an appealing appearance can be achieved on buildings with outdoor exposed wood like facades, windows, doors etc.

The influence of moisture and water

Moisture or water affecting buildings may occur as water vapour or as free liquid water or often as a combination of both. Indoors have mainly water vapour, but on cold surfaces like glass windows during the winter period condensation may occur inside. Outdoors we have often high relative humidity and rain.

An important function of a coating for wood is to help maintain a water content in the wood of less than 20 per cent by weight. Above this value fungi can attack the substrate whether it is painted or not. All wood outdoors normally contains between 10 and 20 per cent moisture due to the relatively high humidity outdoors. Some climatic data for Denmark and Stockholm are given in Table 1. From this table it can be seen that the relative humidity varies between 70 and 90 per cent in the Scandinavian climate with a mean value during the year of 82 per cent RH for Denmark. How the relative humidity affects the moisture content in wood is shown in Figure 2.

Moisture can penetrate both wood and coatings¹. The problem then becomes one of reducing the influx of water during high humidity conditions e.g. during a rain period, while allowing water to come out as water vapour. A levelling out of periodic variations is sought in order to ensure a sufficiently low water content in the wood substrate.

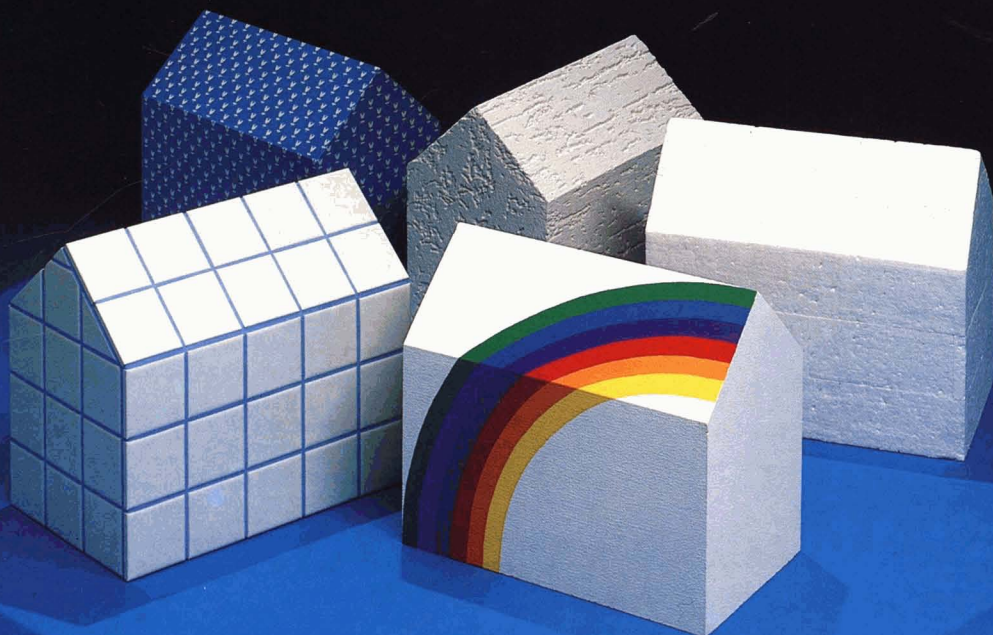
The water vapour transmission for thin building materials like paint films is normally measured in accordance with the so called cup-method (SS 02 15 85). At our institute we have developed a special permeability cup and calculation methods². The principle for these measuring techniques is

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				RE 545 Z	RI 538 Z		
	Adhesives for insulation blocks	RI 538 Z		RE 524 Z	RE 545 Z	EPMZ 1	RE 526 Z
	Full thermal protection adhesives and jointless compounds	RE 545 Z		RE 524 Z	RE 526 Z	RE 530 Z	RE 546 Z
		RI 538 Z					
	Repair mortars, concrete repairs	RE 545 Z		EPMZ 0	RE 524 Z	EPMZ 1	RE 546 Z
		RI 538 Z		RE 526 Z	RE 530 Z		
	Wall claddings and jointless compounds	RE 530 Z	RE 546 Z	RE 524 Z	RE 526 Z	50/25 VLZ	RI 538Z
				RE 545 Z			
	Floor levelling compounds without casein	EPMZ 0		EPMZ 1	RE 524 Z		
				RE 526 Z	RE 545 Z		
				RI 538 Z			
	Floor levelling compounds with casein			RE 524 Z	RE 526 Z		
				RE 545 Z	RI 538 Z		
	Sealant slurries	EPMZ 0	RE 545 Z	RE 524 Z		EPMZ 1	RE 526 Z
	RI 538 Z						
	Plastics-enhanced lime/cement plasters and coatings	RI 538 Z		RE 524 Z	RE 526 Z		
				RE 530 Z	RE 545 Z		
				50/25 VLZ	RE 546 Z		
	Grouts	RI 538 Z		RE 524 Z	RE 526 Z	RE 530 Z	RE 546 Z
				50/25 VLZ	RE 545 Z		
	Jointing compounds, joint fillers	RI 538 Z		EPMZ 1	RE 524 Z	RE 546 Z	
				RE 526 Z	RE 530 Z	50/25 VLZ	
				RE 545 Z			
	Wall and ceiling trowelling compounds	RI 538 Z		RE 524 Z	RE 526 Z	EPMZ 1	RE 530 Z
				RE 545 Z	RE 546 Z	50/25 VLZ	
	Powdered dispersion paints	RI 538 Z		50/25 VLZ		RE 524 Z	RE 526 Z
						RE 530 Z	RE 545 Z
						RE 546 Z	
	Wallpaper adhesives, wood glues	D 50 R	D 50 SZ			RE 524 Z	RE 526 Z
						RE 545 Z	RI 538 Z
						D 50	
						D 50 SZ	
	Wallpaper adhesives, wood glues	D 50 R	D 50 SZ			RE 524 Z	RE 526 Z
						RE 545 Z	RE 546 Z
						50/25 VLZ	RI 538 Z
						D 50	
						D 50 R	D 50 SZ
						D 50 R	D 50 SZ
	Gypsum			RE 526 Z		EPMZ 0	EPMZ 1
				D 50 R	D 50 SZ	RE 524 Z	RE 530 Z
						RE 545 Z	RE 546 Z
						50/25 VLZ	RI 538 Z
						D 50	
	Ceramic compounds			D 50 R	D 50 SZ	EPMZ 0	EPMZ 1
						RE 524 Z	RE 526 Z
						RE 530 Z	RE 545 Z
						RE 546 Z	
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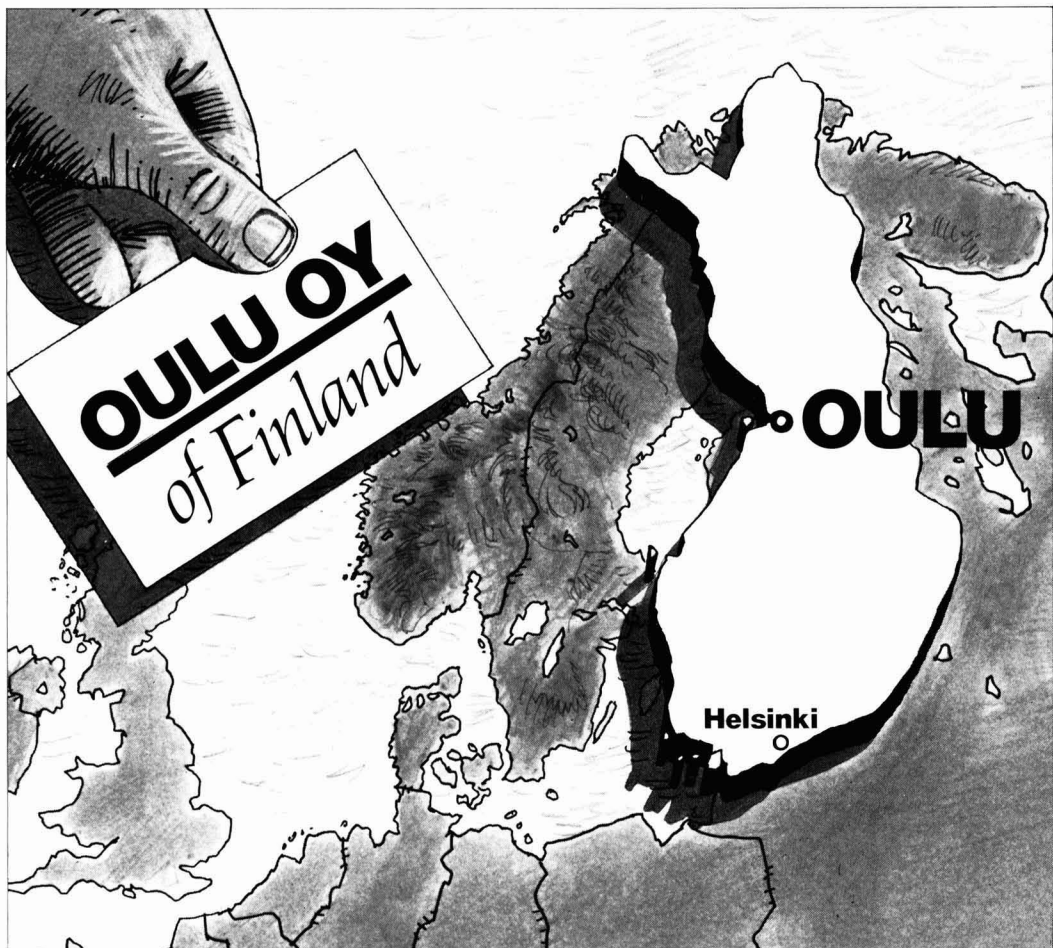
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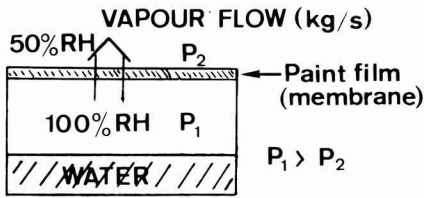
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Table 1

Mean climate data for Denmark and RH for Stockholm

	J	F	M	A	Reference year		Ju	Au	S	O	N	D	Mean
					M	J							
Danish climate													
Temp., °C	-0.1	-0.4	1.7	6.2	11.1	14.5	16.6	16.3	13.1	8.7	4.9	2.2	7.9
Rel. Humidity, RH	89	87	85	78	72	73	76	79	83	86	89	91	82
Rain, mm	55	39	34	39	38	48	74	81	72	70	60	55	55
Dew point, °C	-2.0	-2.1	-0.2	2.9	6.7	10.7	12.4	12.5	10.5	7.6	3.4	-0.7	5.1
Stockholm													
Rel. Humidity	85	81	78	72	65	66	72	75	81	84	88	87	78

given below:



- F_p = Flow due to difference in vapour pressure (kg/s)
- k = Permeability coefficient (kg·m/s·m²·Pa)
- Δp = $P_1 - P_2$ = difference in partial pressure (Pa)
- d = Thickness of paint film (m)
- A = Area of paint film (m²)

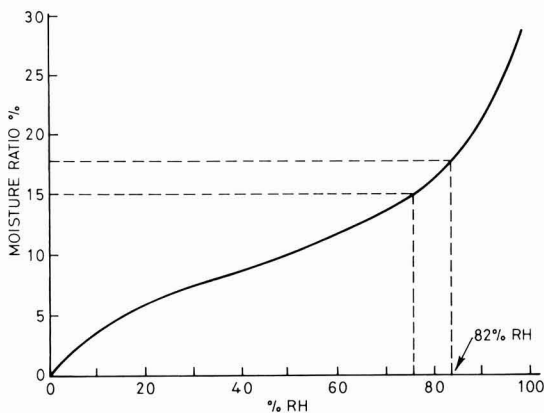
From these definitions the well-known diffusion equation is derived:

$$F_p = k \cdot \frac{P_1 - P_2}{d} \cdot A \text{ (kg/s)}$$

The diffusion resistance z_p is then defined as:

$$z_p = \frac{d}{k} \text{ (m}^2 \cdot \text{Pa} \cdot \text{s/kg} = \text{m/s)}$$

Figure 2. The moisture content equilibrium curve for wood at varying relative humidity (20°C).



Normally we have water in the cups and these are kept in a climate room of 50 per cent RH, 23°C. The constant flow F_p is found by weighing the cups on an analytical balance. If there is a problem of getting a free continuous paint film, the wet paint is applied to a sheet of paper as a support.

Some of the measured results carried out at the institute are presented in Table 2. These show that the diffusion resistance of the two coat acrylic latex ($\approx 80 \mu\text{m}$) corresponds to the 10 mm wood, while both the linseed oil and alkyd paint are much more resistant to water transport. Many wood constructions are thicker than 10 mm e.g. wooden frames and in these cases the wood gives a higher resistance than the acrylic latex paint studied.

As seen from the diffusion equation the diffusion resistance z_p is proportional to the thickness of the material through which the diffusion takes place. In the case of painting the situation can be illustrated by Figure 3. With consideration being given to the most common types of surface treatments on wood, the diagram is divided into staining and painting with fully pigmented paints.

From a more general point of view, a paint system (two or more coats) or paint with a resistance above $z_p = 10 \times$

Figure 3. Diffusion resistance z_p (Pa·s·m²/kg) for paint films as a function of film thickness.

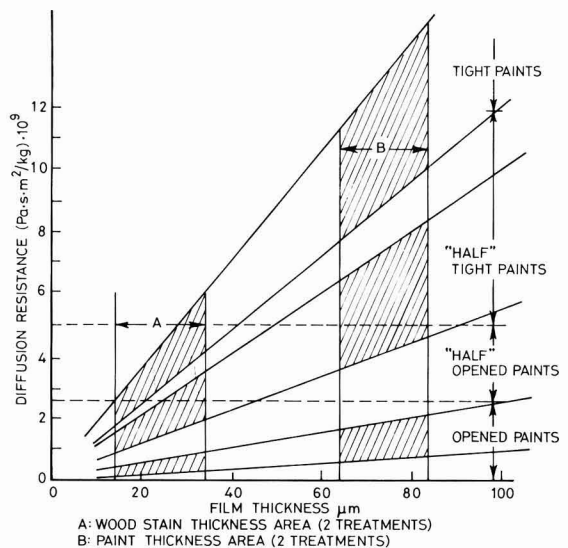


Table 2

Diffusion resistance measurements

Paint	Thickness (μm)	Diffusion resistance z_p^* ($\text{m}^2 \cdot \text{s} \cdot \text{Pa} / \text{kg} = \text{m} / \text{s}$)
Linseed oil white, PVC 32	75	6.0×10^9
Alkyd paint white, PVC 29	80	8.2×10^9
Acrylic latex white, PVC 35	80	1.1×10^9
10 mm wood panel 1 fibres	10,000 (10 mm)	$1.2 \times 10^9 \dagger$

* 100 to 50% RH and 23 °C

† In SBN 1973: 3 the value 6.8×10^9 is given

10^9 ($\text{m}^2 \cdot \text{s} \cdot \text{Pa} / \text{kg}$) may be considered as a diffusion tight coating on wood while a so called "open" paint may have a z_p -value under 2.5×10^9 . The resistance of a coating may be varied by the film thickness and/or by choice of paint type as well as formulation to a certain extent.

In "Svensk Byggnorm, kommentarer (Swedish Building Regulations, Comments) 1975 : 3" water vapour resistance is given for different paint types at typical film thicknesses. The diffusion resistance in this norm is given in s / m , here indicated as z_p . Between z_p and z_v the following relation exists $z_p = 135 \times 10^3 \times z_v$ at 23°C. The reason for the existence of two diffusion parameters is that z_p is related to the difference in water vapour partial pressure (Pa) and z_v in water vapour concentration (kg / m^3 air).

Water and moisture uptake is much more rapid through the ends, where the wood fibres are freely exposed. The transport of water is at least 200 times as fast parallel to the wood fibres compared to the perpendicular direction. The problem with water take-up or removal from end wood is a typical problem in connection with wooden window frames, where the decay to a large extent can be explained by water penetrating from end wood. As the moisture or water transport is relatively fast along the wood fibres, the moisture can distribute rapidly and also reach long distances into the wood material. Also large cracks in the flat surfaces parallel to the fibres must be considered to be comparable to end wood with respect to water transport.

In the industrial production of wooden windows, they are not specially treated in order to seal the end wood. At our institute we have found³ that an effective protection against water transport through end wood is a paint or varnish that can form a real film on the end wood grains. Such a film will work as a water barrier. A good result was obtained with an epoxy-ester varnish tested on wood posts (Figure 4). The side surfaces of the posts were not painted in the first test.

The wooden posts were also investigated with an acrylic paint on the side-surfaces and in this case it could be noticed that the moisture content increased even more. The reason is that the moisture could not dry out so easily from the side-surfaces. The conclusion must be reached that for painted wood it is even more important that the end wood is sealed or kept free from contact with liquid water more effectively.

When painted wood pieces are immersed into water for a

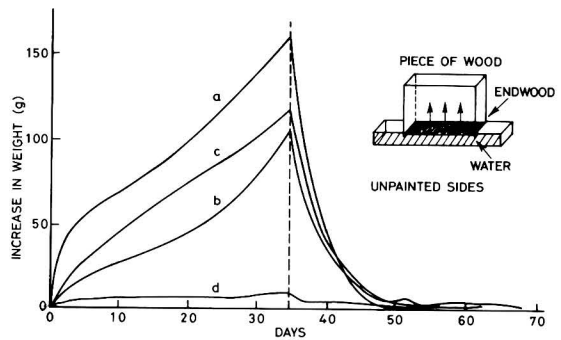


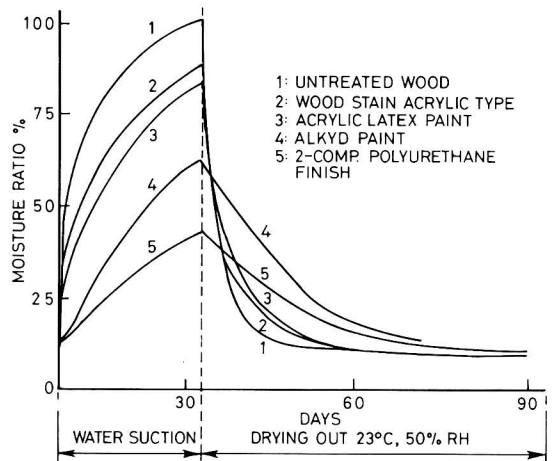
Figure 4. Water uptake through end wood of wood posts ($5 \times 5 \times 32$ cm): a) untreated, b) priming oil for wood, c) linseed oil, d) epoxy-ester floor varnish.

longer time, a relatively large difference in water uptake is obtained for different paint types. In one experiment⁴ wood panels were immersed for 30 days under water and then allowed to dry for approximately two months (Figure 5).

After approximately 90 days of testing, all the panels had recovered to the original value (12 weight per cent). It is clear that untreated wood is exposed to very high and rapid variation in moisture content, which easily will cause cracks in the wood surface. On the other hand a tight paint such as the two-component polyurethane we tested to a large extent will reduce the water take-up and slow down the fluctuation of moisture content. However, a problem with very tight paints is that high moisture content often occurs when the paint starts to crack. The free rain water is readily absorbed into the crack and spreads out in the wood and under the paint film. The drying out of this water as vapour then takes a long time.

Both studies at NIF and the Swedish Wood Science Institute (STFI) have confirmed that the influence of only relative humidity gives little variation in moisture content between different "open" and "tight" paint types.

Figure 5. Water take-up for wood panels ($1 \times 7, 5 \times 15$ cm) with different paint types.



In one investigation in a special climate box with a separating insulating wall between a warm and a cold side, we could not find any large difference in moisture content in 10 cm thick wood pieces mounted into a wall of cellular polystyrene³. The testing was carried out for a period of 17 weeks. The principle of this test in a climate box is shown in Figure 6. Here the moisture content was measured between metal pins with an electrical moisture meter, 1 cm from each side and in the middle of each piece of wood. Compensation for the temperature influence on the measuring values was taken into account.

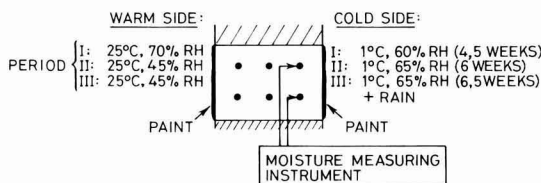


Figure 6. Moisture measurement in a wooden block inside a climate box.

The most critical point due to the risk of moisture accumulation is normally behind the paint film on the cold side. To illustrate that there was little difference in moisture content, the measured values 1 cm behind the paint on the cold side are shown in Figure 7 for untreated wood and wood painted with an acrylic, an alkyd and a two-component polyurethane paint. Even during the simulated rain period with water spray on the paint films on the cold side, only slight differences were registered. The explanation for this is that the painted surfaces are vertical and no cracks exist in the unweathered paint films. In other words the rain drops can run off easily and are not really absorbed through the paint film, anyhow not into the measuring point 1 cm into the wood.

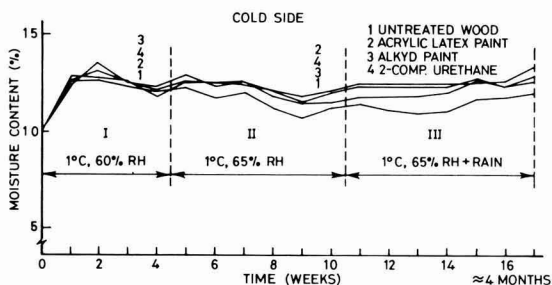


Figure 7. Moisture content in 10 cm pieces of wood on the cold side (1 cm inside the wood).

On the other hand we have measured high moisture contents in wooden window constructions exposed outdoor without a rain shield, with horizontal surfaces and with joints, where free water can easily penetrate into the construction.

Influence of weather

During outdoor exposure to sun and rain, the diffusion resistance may change. We have found (Table 3) that the diffusion resistance increased to about double its initial value after 300 hours ageing in a laboratory weathering

Table 3

Diffusion resistance variation for an acrylic latex paint (thickness 100 μ) in a laboratory weathering machine (100 \rightarrow 50% RH, 23°C)

Exposure	z_p (Pa·s·m ² /kg) $\times 10^9$
Unexposed	0.81
100 hours	1.4
250 hours	1.8
690 hours	1.7

machine for an acrylic latex paint. After about 300 hours there is no longer an increase in diffusion resistance and this means that the paint film has "stabilized" with respect to curing, film formation and evaporation of volatile components. If the exposure goes on for a long period and if cracks appear, as often occurs in practice, the resistance decreases locally around the cracks.

We have also studied the influence of temperature on the vapour diffusion. If we consider wooden facades during the winter period, a facade paint in fact has a low mean temperature. The investigated paints all increased their diffusion resistance at the lower temperature. This is somewhat thought-provoking, during the cold season it is typical that the water vapour transport occurs from the inside to the outside of a heated building. Thus, the facade paint must be sufficiently diffusion open with a good margin. It should also be noted that the wood material itself also increases its diffusion resistance at lower temperatures.

If we know the fundamental moisture relations for painted wood (to which NIF has given some contribution) it should be possible to increase the service life of painted wood outdoors.

Acknowledgements

The work described here has mainly been supported financially by the Swedish Building Research Council.

[Received 18 June 1985]

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OCCA Ties are now available from the Association's offices, with a single Association Insignia on either a blue or maroon background. The price is £4.25 each (including VAT) and orders (prepayment only) to Priory House should state clearly the number and colour(s) required.

next month's issue

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

Antifouling paints based on WW rosin and chlorinated rubber; influence of binder composition and content by *B. del Amo, C. A. Giudice, J. D. Rascio and O. Sindoni, CIDEPINT, Argentina*

Effect of temperature on the properties of calcined cadmium sulphoselenide pigments by *V. G. Kulkarni and P. D. Garn, The University of Akron, Ohio, USA*

The orientation of micaceous iron oxide particles in organic coatings applied to edges by *S. Wiktorek and E. G. Bradley, Australian Iron & Steel Pty Ltd, Australia*

occa meetings

Scottish Section

Development and innovation in coating media

The first technical meeting in the New Year was held on 6 February 1986 at the Hospitality Inn, Glasgow. Ray Munn of *Cray Valley Products Ltd* gave the lecture entitled "Development and Innovation in Coating Media".

Mr Munn reviewed the developments of solvent based resins over the last 20-30 years. In coming to the present day he highlighted two important considerations, price of resins and the return for paint and resin manufacturers and safety considerations. These factors had stimulated development in high solids media, the use of alternative "safer" solvents and safer curing systems in the epoxy and polyurethane fields.

There was considerable interest amongst members who engendered a lively question time, with additional help from visitors.

Hugh Munro concluded the session with the vote of thanks applauded by all.

Burns supper

On the 21 February 1986, Eastern Branch held their Burns supper, a now regular annual event. It was the largest Burns evening ever, 98 attending; a fitting tribute to Alex McKendrick, who first organised the event, and who was appropriately remembered at the start of the evening.

The Chairman, Nigel Baird, conducted proceedings in an exemplary fashion and he and Tom McMahon must be congratulated on their good organisation and the enjoyable evening provided by the excellent fare and excellent artists.

Experiences of Dosing in Paint/Ink Industries

At the meeting on the 13 March 1986, Mr Ted Meijer, Managing Director of *Machinefabriek Klieverik*, Holland gave a lecture "Experiences of Dosing in the Paint and Printing Ink Industries".

His company had designed a machine, which was available in a range of sizes to suit the customer. This machine allowed the paint or printing ink manufacturer to accurately blend a range of liquid media, pigment pastes and solvents

in batch sizes from 10 litres to 2,000 litres. Above this size it was probably more economical to manufacture direct from raw materials. The dispensing of each component was carried out rapidly by a combination of fast, slow and dropwise flow to achieve the required amount accurately. Gravimetric control was preferred. The amounts required could be calculated and checked back using a computer, and dispensing could be either manual or automated. The operation whether manual or automatic could be reversed.

The benefits of the system allowed low raw material and finished product inventories, low wastage and fast and accurate manufacture.

Mr Meijer completed his lecture by introducing to his audience an interesting range of tank cleaning equipment manufactured by his company which he claimed substantially reduced costs in use of cleaning materials and time of cleaning. It also eliminated need for caustic cleaning.

Mr Geoff Staytt, of *Haeffner Machinery Ltd*, then gave a short talk on mixing machinery illustrating various ideas that he had met which had been put into use in Europe and could well be followed in the UK. Ideas which were simple and not necessarily expensive. The emphasis in Europe was also to manufacture equipment to client's requirements without enormous capital outlay.

Question time produced considerable interest covering points such as: accuracy of colour matching, limitation on size of batch, allowing for expansion in number of dosing components, wastage control, variations in strength of component among others. The vote of thanks was given by Nigel Baird and received with acclamation. The light buffet for members before the meeting was provided by *Haeffner Machinery* and very much appreciated by all.

R. L. Barrett

Irish Section

Quality Control Standards

On 12 March 1986, Mr J. Murphy, Chief Executive of the Irish Quality Control Association, presented a lecture entitled "Quality Control Standards".

SURFACE COATINGS

VOL I-RAW MATERIALS AND THEIR USAGE

Prepared by OCCA Australia

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

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

Volume 1 is available by placing orders (prepayment only) through the Oil & Colour Chemists' Association at £32.50 (inc. p&p in the UK) plus £3.00 for orders sent overseas by surface mail.

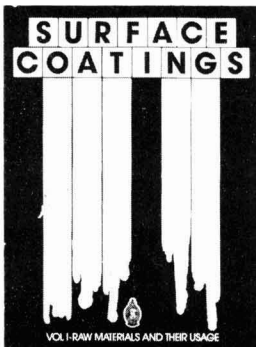
Volume 1 - Hardback - 408 pp.

Contents

The Past, Present and Future of the Surface Coatings Industry
 Introduction to Polymer Science
 Vegetable Oils
 Oleoresinous Media
 Alkyd Resin Technology
 Manufacture of Alkyd Resins
 Applications of Alkyd Resins
 Polyesters
 Amino Resins
 Phenolic Resins
 Polyurethane Resins
 Epoxy Resins
 Water Dispersible Epoxy Coatings

Silicone Resins
 Acrylic Solution Resins
 Emulsion Polymerization Theory
 Emulsion Properties 1:
 Effect of Monomer Composition
 Emulsion Properties 2:
 Effect of Water Phase and Particle Size
 Emulsion Properties 3:
 Film Formation
 Emulsion Polymers: Manufacture and Testing
 Applications of Emulsion Polymers
 Water-Reducible Resins

Water-Soluble Polymers
 Solvents
 Inorganic Pigments
 Titanium Dioxide Pigments
 Organic Pigments
 Extender Pigments
 Paint Driers
 Paint Additives
Contributors and Reviewers
Appendix: Useful Data and Conversion Tables
Index



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 Priory House, 967 Harrow Road, Wembley, Middlesex HA0 2SF, UK

Please arrange for me to receivecopy/ies of "SURFACE COATINGS", Volume 1 Raw Materials and their Usage at £32.50 each (inc. p&p in the UK) plus £3.00 for orders sent overseas, at the following address:
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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.

Volume 2 gives a comprehensive overview of decorative and industrial paints. Cross references to appropriate chapters in *Volume 1* are provided and the index covers both volumes. Revised and rewritten by over 80 expert contributors from industry, research institutes and universities, the books represent the most up-to-date reference available on paint technology.

Volume 2 is available in December by placing orders now (prepayment only) through the Oil & Colour Chemists' Association at £32.50 (inc. p&p in the UK) plus £3.00 for orders sent overseas by surface mail.

Volume 2 – Hardback – 480 pp.

Contents

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 Paint Manufacture: Processing Operations
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 Industrial Coatings
 Automotive Coatings
 Lacquers
 Conversion Coatings
 Powder Coatings

Ultraviolet-Cured Coatings
 Printing Inks
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 Colour Matching (Using Computerized Techniques)
 Testing and Quality Control
 The Substrate and its Preparation
 Metal Cleaning and Pretreatment
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 Corrosion and Prevention
 Industrial Coatings: Application and Curing Methods
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 Technical Service in the Surface Coatings Industry
 Standardisation, Inspection and Accreditation in Australia
 Statutory Requirements of the Paint Industry
 Appendix: Paint Calculations
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 Glossary of Terms
 List of Contributors



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To some perhaps this was a new concept of this subject, as it was emphasised that quality control is not confined to laboratory product testing but covers the whole administration process. For a company to obtain the Quality Mark it is necessary to agree to an audit of one day's duration during which all aspects of its operation are critically examined. In order to retain the Quality Mark an annual audit/inspection is required, and companies which have gained the Quality Mark (shown below) display it on their stationery, transport, packages, etc.

A vote of thanks to the Speaker was proposed by the Section Chairman, Mr Peter Holmes, who felt that all who attended the meeting would find it profitable.

R. C. Sommerville

Natal Section

Waste disposal in paint and allied industries

The first lecture of 1986 was held on 18 March 1986 at the Westville Hotel, Durban. Mrs Jackie Swart, Technical Officer of *Waste-Tech (Pty) Ltd* gave a very interesting talk on Waste Disposal in the Paint and Allied Industries.

The speaker listed into the following categories the types of waste normally produced by the industry: solvents, pigments, biocides, fillers and resins. Of these, solvents and pigments are considered the most hazardous. Solvents are flammable and are prone to leaching. Landfilling of solvents is considered dangerous and wherever possible, recycling through distillation should be considered. The advantages and disadvantages of solvent co-disposal with domestic waste versus lagooning were discussed.

Emulsion sludge can be landfilled and the liquid drained to the sewers provided the pH is adjusted. Non-recoverable wastes can be incinerated but this type of operation is in its infancy in SA and is expensive.

Landfill sites are divided into three classes viz. Class 1 sites having low permeability, Class 2 sites being the sanitary type, with a lower attenuation zone and Class 3 sites which are below the water table and are therefore unacceptable. Only Class 2 sites are available in Natal and these are strictly controlled with regular borehole water tests being conducted. Wherever possible, the disposal of solvents in Class 2 sites is discouraged.

The lecture was well documented with charts and slides showing typical landfill operations.

A lively question time ensued and Mrs Swart was able to reassure many members who were local residents that the Westville landfill site at present used and maintained by *Waste-Tech* was under diligent control.

A vote of thanks was given by Mr Alan Mackenzie and the audience responded with generous applause.

R. H. Philbrick

London Section

Health and safety symposium

On 10 April 1986 the London Section held a one day symposium on "Health and Safety in the Coatings and User Industry" at the Royal Institution with over 80 members and guests in attendance. Mr K. Arbuckle, Chairman London Section, introduced the day's programme.

In the morning session there were five speakers commencing with Mr M. J. Levete and Mr W. E. G. Moffat of the Paintmakers' Association who together talked on the "Control of Substances Hazardous to Health—Draft Regulations—The Implications for the Painter". Mr I. Scott (formerly of ICI Paints Division) then spoke on "Hazardous Raw Materials used in the Coatings and Ink Industries". This was followed by two speakers from the London School of Hygiene and Tropical Medicine. Dr C. Purnell spoke on "Environmental Assessment for COSHH Regulations" and Dr A. Salmon spoke on "Toxicological Implications of the proposed COSHH Regulations". The morning session closed with a lively discussion followed by an excellent buffet lunch at the Institution.

Three speakers gave talks in the afternoon session. Mr D. J. Reynolds of Berger, Jenson and Nicholson talked on the "Risks of Fire and Explosion in the Paint Industry". Mrs D. Cornelius of Cray Valley Products then spoke on "Aspects of Labelling and Related Legislation for Supply and Conveyance". Finally Dr L. O'Neill of the PRA talked on "Sources of Toxicological Information". There then followed a discussion in which the speakers re-emphasised the far-reaching effects that the new COSHH regulations will have on the industry when they come into force next year. Finally Mr D. J. Reynolds summed up, followed by Mr K. Arbuckle proposing a vote of thanks.

Midlands Section – Trent Valley Branch

Quality control of organic pigments

The Trent Valley Branch held a meeting in November 1985. This was preceded by a splendid buffet generously sponsored by *CIBA GEIGY Pigments*. Adjourning to the lecture theatre a talk on "The Control of the Quality of Organic Pigments with special reference to Paints and Inks" was given by Dr S. G. Lawrence of *CIBA GEIGY Pigments*.

The aim of the quality control process is to ensure consistency in the performance of successive deliveries of pigment. In order to ensure this a system of control is needed which on one hand monitors and controls the manufacturing process—Production Control, and on the other hand tests and characterises the end product and compares these results with agreed specifications—Quality Control.

Production Control: The need to be able to monitor and control the manufacture of pigments is a factor that is considered right back in the initial design of the manufacturing

unit and in common with many other industries there is a move towards semi automated process control by micro-processors. In addition to process control, samples are removed at various stages throughout production and subjected to more-or-less simple tests designed to give an idea of how the pigment would behave in an application system. These tests are rapid so the feedback may be provided to production.

Quality Control: The main criteria for acceptance of a pigment delivery is its performance in the end application system. In all cases its performance is compared to that of a standard with obvious emphasis on those properties most likely to be affected by variation in the pigment characteristics, e.g. colouristics, flow, gloss, dispersion level, opacity, etc.

The quality of pigment is therefore monitored and controlled during its manufacture. This together with the testing of the pigment in its applicational end use aims to ensure a high quality product.

After a lengthy and informative discussion the vote of thanks to Dr Lawrence and *CIBA GEIGY* for a most enjoyable evening was proposed by Mr D. G. Grantham.

J. C. Ellis

Aspects of Vehicle Painting Past and Present

The final technical meeting of the 1985/86 session was held on 27 March 1986, at the British Rail Engineering School, London Road, Derby.

The paper entitled "Aspects of Vehicle Painting Past and Present" was presented by Mr D. R. Orrell, Technical Advisory Manager of *Joseph Mason plc*, who generously sponsored the evening.

Mr Orrell based his lecture on a letter written to an authority on coach painting in 1870 asking why with modern improvements such as wheeled vehicles attaining speeds of 60 mph and messages flashed through the air at the speed of lightning, vehicle painting required up to 90 days painting before being ready for the road.

Using this idea Mr Orrell examined various aspects of vehicle painting comparing how things were done in the 1870's compared to the present day.

The lecture started with a comparison on the raw materials used in paint manufacture giving examples of how in the 1870's all the raw materials were of natural origin, whereas today the majority are man-made. This then naturally was followed by examples of how the paint manufacturing process had progressed over the last 100 years from hand grinding using a slab and muller to the latest technology in concentrated dispersion coupled with automatic dispense systems.

Once the paint had been manufactured it then had to be applied to vehicles and comparisons were made in surface preparation techniques, substrates, application techniques, indicating that instead of the 90 days required in the 1870's

a vehicle could now be turned out in approximately 24 hours for simple one-colour jobs.

The lecture was then finished with comparisons between the types of vehicles used in the two eras covering mass public transport, goods haulage and individual transport for the masses and the higher echelons of society.

At the conclusion of the lecture, questions from the audience were answered by the speaker and the evening was closed with a vote of thanks from the Treasurer, Mr D. Grantham.

M. J. Hannah

AGM

The Trent Valley Branch of the Midlands Section of OCCA held their 23rd Annual General Meeting on the evening of 11 April 1986 in the lofty setting of The Heights of Abraham, Matlock Bath, after an exciting ascent to the summit by cable car. The meeting was followed by a film show given by the Restaurant's Manager Mr Emery, who described some of the history of the site and especially the building of the restaurant and the cable car system at a cost in excess of £2m. The evening was concluded by an enjoyable meal in preparation for the spectacular descent, this time in the 'dark'.

J. R. Kitchen

Auckland Section

Goods and services tax

The Auckland Section of the New Zealand Division held its Annual General Meeting on 25 March 1986 at the Sorrento Lounge, One Tree Hill, Auckland, with approximately 65 members in attendance.

The guest speaker preceding business was Mr Allan McKnight a taxation accountant employed by NZFP. The title of Mr McKnight's address was "The Imposition, Assessment and Payment of GST, Including Imports and Exports".

GST (Goods and Services Tax) is a form of VAT which will be introduced on 1 October 1986. Mr McKnight's talk covered general principles, regulations, transitional provisions and special cases applicable to the new tax.

A lively and lengthy question period ensued followed by a vote of thanks by Mr Wayne Gemmill.

Quality assurance

The Auckland Section met on 22 April 1986 at Waipuna Lodge Hotel, Mt Wellington. Ms Lynne Forster, Senior Technical Representative of TELARC (Testing Laboratory Registration Council) spoke on "The Role and Relevance of TELARC to the Paint Industry". Special attention was given in her talk to the new Public Sector Paint Committee. In New Zealand, TELARC provides a national third party

accreditation programme for both testing laboratories and suppliers' quality assurance systems. A question and discussion period followed, where members put forward their thoughts and ideas about the process of registration with TELARC and the assessment criteria. The merits of adapting Canadian, British and Australian standards for New Zealand laboratories were discussed at length. Another area which interested members were the costs involved with the assessment and registration procedure. Ms Forster also informed members of the new Quality Assurance creditation system.

A vote of thanks was proposed by Mr Tom Hackney, *Oregon Paints*.

W. A. Whitburn

Manchester Section

Wood preservation

The final lecture in the 1985/6 Manchester Section programme was held at the Georgian House, Blackrod, Bolton. The lecture entitled "Wood Preservation" was presented by Mr A. E. Hilditch, Technical Director of *Cuprinol Ltd*, and was attended by 60 members and guests.

Wood deteriorates by fungal and insect attack. Other organisms which do not in themselves attack wood, such as green algae, retain the moist conditions ideal for fungal attack. Wood is in dynamic equilibrium with moisture, the swelling and shrinking due to moisture causing cracking in timber. Depending on the type of wood therefore, decay can occur very quickly.

For fungal growth to occur, wood, water and air are required. The most common is wet rot, which is caused by a wide variety of microscopic fungi. Wet rot does not usually completely destroy a whole piece of wood, and sapwood is more prone to decay than hard wood. Other forms of fungal growth do not cause the wood to deteriorate, but cause permanent and unsightly staining.

Dry rot differs from wet rot in that it only occurs in buildings and does not occur outside in the wild. Although much less common than wet rot, it is capable of growing long distances over surfaces which it cannot feed from, and as a result, can completely destroy a building.

The most common insect to attack wood is the furniture beetle (woodworm). It is usually first noticed in furniture, but also attacks structural timber, and uncontrolled can take about 15 years to destroy a building. Its natural habitat is woodland and forest, however the adult can fly, and therefore all buildings are at risk. There are other insects which attack wood, such as the death watch beetle, but these primarily occur in hardwoods such as oak, and are therefore only found in old buildings.

Outside, wood has to withstand UV light from the sun, air borne water vapour, oxygen, dirt and spores, rain and insects.

Because it is subject to so much attack from the

environment, in order to prevent decay, it is necessary to treat wood with a preservative.

The ideal preservative would prevent all fungal attack and kill all insects. It would be harmless to plants and animals, persistent in wood, but not in the environment. It would be clean and odourless, it would not be detrimental as regards appearance, and would be cheap and easy to manufacture. There is no known ideal preservative.

The cheapest known product is Creosote which is coal tar based. There are two basic types of commercial wood preservatives. The water borne types being water soluble, tend to be leached out, and as water is only absorbed slowly by timber, are not suitable for the DIY market, and require sophisticated plant for effective use. Solvent borne systems are the most common in the DIY market. They penetrate wood readily, and do not affect its dimensions. Performance depends on application, brush application is least effective, the aim being to get as much preservative as possible penetrating the wood. Industrially, the majority of cases, dip application is used, and this is very effective. Increasingly application by a double vacuum process is being employed, this results in the maximum depth of penetration, with minimum effective use.

The lecture was followed by an extensive question time, and a vote of thanks was proposed by Jef Kelly.

M. G. Langdon

Midlands Section

Silicone resins and additives for paints and inks

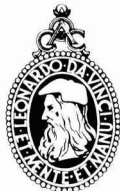
The final technical meeting of the Midlands Section was held on the 20 March 1986, at the Clarendon Suite, Stirling Road, Edgbaston, Birmingham.

Members and guests heard Mr A. Smith and Herr V. T. Kropac, both of *Tego Chemie Service*, give talks on "Silicone Resins and Additives for Paint and Ink".

Herr Kropac gave the first talk on "Silicone Resins". These resins are used for building protection, weather resistant coatings, high temperature paints and insulating varnishes. Silicones are derived chemically from quartz and silicates, modified with organic groups to give polymers. Herr Kropac showed numerous slides to illustrate the various chemical structures that are used to make up these polymers. The silicate structure is not degradable by oxidation, temperature or radiation, thus giving it excellent durability. The speaker concluded his part of the talk by describing in some detail the types of resin that are available listing their advantages and disadvantages. He also indicated some of the pigment types that can be used with these polymers.

Mr A. Smith then took over the meeting, and with the aid of slides, showed how silicone additives are prepared and used. Polymethylsiloxanes form the oldest group of mar-resistant, flow and levelling additives that are used. It has been suggested that they form a surface of dense

NEW PUBLICATION



“THE SURFACE COATING & RAW MATERIAL DIRECTORY 1986”

Edited by H. Worsdall

Contents

- **INDEX**— Lists in English, French and German of product names and reference number under which they appear on the Product Pages.
- **HEALTH, SAFETY & LABELLING**— Information in English, French and German concerning the latest Health, Safety and Labelling regulations. A system of marking relevant products is used, which runs throughout the Product Pages.
- **PRODUCT PAGES**— **Additives—Chemicals—Containers, Packaging and Equipment—Extenders and Fillers—Oil and Fatty Acids—Pigments—Plasticisers—Resinous Materials and Varnishes—Soaps and Driers—Solvents**— A comprehensive table of products in alphabetical and numerical order, listing the Head Office/Works of the manufacturers below.
- **SUPPLIERS & MANUFACTURERS**— Lists of names, addresses, telephone and telex numbers of paint and ink manufacturers and raw material suppliers, together with an outline of products supplied or manufactured. Where applicable supplementary names of agencies and subsidiary companies are provided with cross-referencing. In the case of a company which has more than one office/works, product information will appear in italics, under the first entry for that company (marked *Head Office). Thereafter that company's offices are then listed according to the alphabetical order of their country.
- **TRADE NAMES**— Trade Names, in sections for paint, ink and raw materials with user/owner names and product description for the raw material section.
- **SERVICES, ASSOCIATIONS & CONSULTANTS**— Lists and information, including addresses and activities.

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packed methyl groups and because of their low surface tension find use in both solvent and water-based products. The polymethylsiloxanes can be modified by chemical reaction with organic groups and it is these groups that determine the end use of the product.

Mr Smith concluded his talk by saying that the additives had been systematically thought out to meet the specific needs of the market.

The chemical modifications had been so chosen that the largest number of technical parameters with regard to paint formulating had been taken into consideration.

After a lively question time, Mr D. Penrice closed the meeting with a vote of thanks to the two speakers.

B. E. Myatt

news

Surfex 86 Exhibition

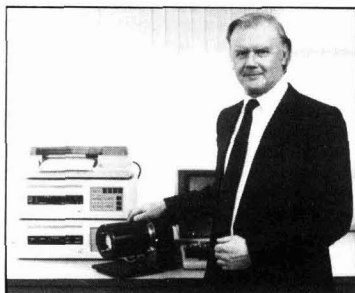
A review of the Association's Surfex 86 Exhibition held in Harrogate 14-15 May will appear in the July issue of JOCCA. Due to the success of OCCA's first northern exhibition, the next OCCA exhibition in two years time will again be held in Harrogate on 15-16 June, 1988.

Becker acquisition

The *Becker Group*, the Swedish multinational paint company who own Goodlass Wall & Co Ltd of Liverpool has acquired powder coating manufacturer, *Dufay Vanguard Ltd* of Darlington. The new company will trade as *Beckers Powders* and will provide Becker with additional strengths in the pipe coatings, rebar and specialist decorative powder markets.

Queen's Award to Polymer Laboratories

Polymer Laboratories Ltd, of Loughborough founded by company chairman Professor Ray Wetton, received the 1986 Queen's Award for Technological Achievement for the development of the *Dynamic Mechanical Thermal Analyser* (DMTA). The DMTA provides both research and industry with a tool for the rapid and accurate measurement of the principal physical properties of a wide range of non-metallic materials, such as thermoplastics, rubbers, coatings, foodstuffs, bone and ceramics.



Prof. Wetton and DMTA

The DMTA measures the physical properties of any solid materials over temperatures ranging from that of liquid nitrogen to +500°C. As temperature is scanned upwards at a controlled heating rate, the modulus of the materials and its damping factor (ratio of energy lost/energy stored per cycle of vibration) are determined every 4 seconds by imposing a small sinusoidal vibration on the sample. Measurement of the response and subsequent data analysis gives the required elastic and viscous components. A peak occurs in the damping term whenever a new mode of molecular motion occurs. These results allow the phase structure and molecular motion to be defined and determine the use characteristics of the materials.

New zinc dust plant

Durham Chemicals report that their new distilled zinc dust plant at Birtley is now on stream. The new facility increases capacity and improves product quality. All grades of zinc dust are air classified resulting in a tight control over particle size distribution. *Durham's Zinc Dust Ultrafine* has been developed for use in anticorrosive 'zinc rich paints'.

Clandon on a 24 hour call basis

Clandon Scientific's Service Dept of Aldershot now accepts telephone calls for assistance and emergency callouts on a 24 hour basis. The telephone number is 0252 512811 and an answering machine operates after 5.30 pm for early action on the following day. *Clandon Scientific Ltd* are the officially appointed agents for Yellow Spring Instruments, NOVA Biomedical, Setaram, Outokompo, KDK and Sequoia Turner.

New Bayer division

Rhein Chemie, the chemicals and raw materials company supplying UK processors and manufacturers, has become a division of *Bayer UK Ltd* of Newbury.

SOLVAY widens its activity

Solvay of Brussels, Belgium has acquired the trademark *VIDAR* and patent rights

from *SKW Trotsberg AG* of West Germany. *VIDAR* powders (made from fluorinated monomer) are used in the coil coating industry, aluminium profiles coating and coated fabrics.

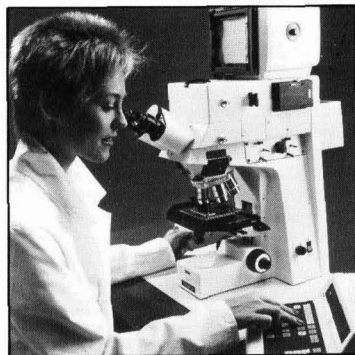
HMG Mauritius Association

H Marcel Guest of Manchester has formed an associate company in Mauritius. The new organisation called *Paint & Allied HMG Ltd* is based in the island's capital, Port Louis. HMG (UK) will supply its partner with specialist machinery, raw materials and technical expertise.

products

Light microscope

Carl Zeiss of Oberkochen of W. Germany has introduced a new reflected-light photomicroscope called the *Axiophot A*. This has been developed for materials' research and applied science. The instrument uses Zeiss Epiplan objectives with chromatic correction and observation using different contrast-enhancement methods (brightfield, darkfield, DIC, polarization) is possible with the same objective. Photomicrography is available on the *Axiophot A* with two 35 mm cassettes (with motorised rewinding) and a



Zeiss Axiophot A

9 × 12 cm sheet-film camera for metallographic standard magnifications. The microprocessor-controlled photographic system with automatic exposure control includes functions like spot measurement and scale-bar imprint.

Reader Enquiry Service No. 40



Sheen Polygauge

Sheen gauge for very thick coatings

Sheen Instruments of Teddington has introduced a new non-destructive thickness measurement gauge called the *Polygauge*, which will measure laminates of any non-magnetic material up to 31 mm thick or linings of up to 19 mm thick. This magnetic thickness gauge has a four digit liquid crystal display and an accuracy of ±3%. The *Polygauge* will measure the thickness of laminates, linings and coatings of any non-magnetic material, such as plastic, heavy duty paint coatings, rubber, paper, wood, glass and concrete on ferrous metal substrates.

Reader Enquiry Service No. 41

New dispersion and mixing machine

OBS of Milton Keynes has available the Oliver + Batelle/Sussmeyer *Duo-mix*. This machine is installed through the floor to facilitate the charging of the cylindrical steel mixing vessel. The vessel has a sloped and dished bottom fitted with a ball-type discharge valve. The cover is also dished and is equipped with a clampable manhole cover/powder charging port, ensuring a totally enclosed operation. The cover has an aperture for connection to liquid product lines, such as water or resins, together with an air vent.

If used for the manufacture of PVA emulsion paint, or as a pre-mixer for sand/beadmill refining procedures, a twin-shaft configuration is favoured. In this

instance a slow speed anchor is used for mixing/agitation duties coupled with a high speed dispersion turbine.

Complementing the twin-shaft system is a third shaft incorporating a medium-speed mixing impeller which has an efficient pumping action to ensure the rapid incorporation of the additives, resins and emulsions after the dispersion cycle.

Reader Enquiry Service No. 42

New toner resin

Degussa AG of Frankfurt am Main, W. Germany, has a new toner resin called VP OT 409. This is a suspension polymer with a monomer composition of 70% styrene and 30% acrylate, and is suitable for powder toner formulations which are fixed by heat or by combined heat and pressure. Since the resin is extremely brittle below the glass transition temperature (64°C), it can be processed most effectively by the grinding and screening processes normally used in toner production.

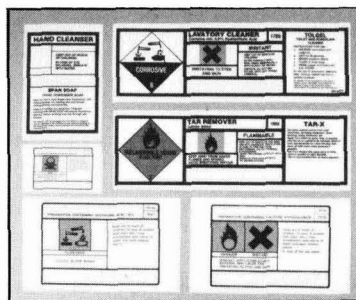
Reader Enquiry Service No. 43

Chemical warning labels

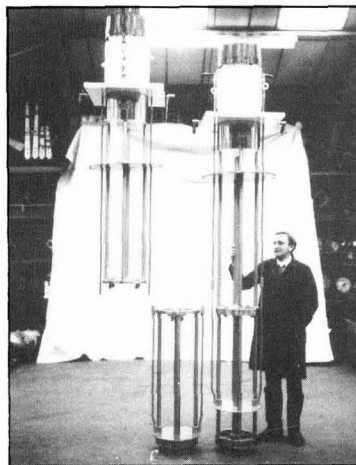
Limpet Tapes Ltd of Huntingdon has available a range of self-adhesive, chemical warning signs, in the form of perforated tape. These labels provide details of potential hazards relating to the handling of dangerous chemicals and conform to the Statutory Instrument 1244 Health and Safety Dangerous Substances Regulations 1984, which became effective from, 1 January 1986.

The signs carry a coloured universally acknowledged symbol or symbols, for instantaneous recognition, and are related to specific chemicals. The nature of the danger is provided, such as 'IRRITATING TO EYES', 'TOXIC BY INHALATION' and 'CAUSES BURNS' etc., and the advice is also given on preventive measures and action to be taken in the event of accidental contact.

Reader Enquiry Service No. 44



Limpet warning signs



Greaves GM 25 mixer

New sectional assembly mixer

Joshua Greaves and Sons, of Bury, mixer specialists, has introduced an effective solution to the problems traditionally encountered when installing deep tank mixers in situations where working head-room is restricted. Their new *GM 25* mixer is engineered to split into two sections prior to installation, eliminating the need for drastic measures such as the removal of roof panels in order to gain the manoeuvring space usually demanded by a one-piece mixer of this type. Each *GM 25* is custom-built to individual requirements, allowing the construction split to be incorporated at any juncture along the length of the mixer shaft. Reassembly is simple, the whole reassembly and installation process taking no longer than half an hour. Two-speed and variable speed models are available, and shaft lengths in excess of three metres have been manufactured by Greaves using their split-shaft method. The *GM 25* is used primarily for the preparation of CMC but will also emulsify, disintegrate, homogenise and dilute.

Reader Enquiry Service No. 45

Colour control spectrophotometer

Europa Colour Systems of Ellesmere Port, (agents for Datacolour, Switzerland) has available a new portable multi-channel spectrophotometer for colour control called the *Datacolour Simultan* Spectrophotometer. This instrument allows the possibility to measure accurately large and awkward shaped objects, such as car paintwork, ceramics and plastic mouldings. These cannot be measured normally using a conventional stationary reflectance spectrometer. The machine has a flexible fibre optic light lead up to 5 m long and a measuring aperture of only

15 mm which allows curved surfaces to be measured accurately. The instrument conforms to DIN5033 and 6174 standards for X Y Z tri-stimulus values and CIE Lab L*, a*, b* co-ordinates and colour differences and pass/fail decisions can be either printed or displayed.

Reader Enquiry Service No. 46



Simultan spectrophotometer

PPG new cellulose products

PPG Industries of Birmingham has available two new nitro-cellulose based air drying products, a primer filler, 'Kondar' and a high build formulation of its 'Flow-line' enamel. Kondar is a light grey primer/surfacer. Flowline is an enamel for cars available in over 8,000 colours.

Reader Enquiry Service No. 47

literature

HSC guidance for substances used in the printing industry

Outline guidance for manufacturers, importers and suppliers of chemical products used in the printing industry on the information they need to give their customers has been published by the Printing Industry Advisory Committee (PIAC) of the Health and Safety Commission. "The provision of health and safety information by Manufacturers, Importers and Suppliers of Chemical Products to the Printing Industry". This guide lists the minimum information which should be available to users of any chemical product supplied to the industry and is available from HMSO or book-sellers.

UN numbers

An update list of the UN numbers designed to identify chemical substances and their potential transport hazards has been published by the Chemical Industries Association. Each substance is defined by a straightforward system—whether it is flammable, explosive, corrosive etc., whether there is a secondary risk involved and the degree of danger as indicated by the packing group. The publication may be purchased from: Publications Department,

Chemical Industries Association Ltd, Alembic House, 93 Albert Embankment, London SE1 7TU.

meetings

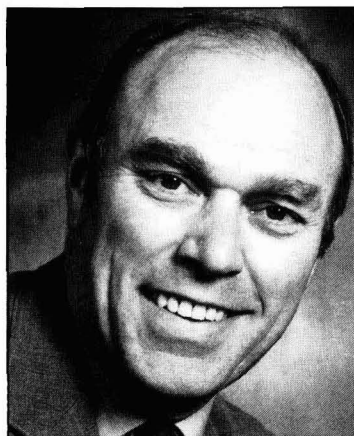
The W. D. Wright 80th birthday conference

Professor W. D. Wright celebrates his 80th birthday and this is being marked by a conference at Imperial College, London, on 19 November, 1986, organised by the Colour Group. The celebration conference at Imperial College will pursue the theme of the past, present and future of colour perception and measurement in science and art. For further information contact: Margaret Halstead, Thorn EMI Lighting Ltd, Jules Thorn Lighting Laboratories, Lincoln Road, Enfield, Middlesex EN1 1SB.

people

New Managing Director for Paint Research Association

John Bernie BSc, MSc(Eng), CEng, MICorrST, MIM, has been appointed Managing Director of the Paint Research Association. He has extensive experience in industry and research management which should be a considerable asset in his new role. Formerly he worked for Lloyd's Register of Shipping for three years and was Chief Inspector of the Caltex Oil Cape Town Refinery from 1972 to 1976. Experience in industrial contract work was gained with the Institute for Industrial Research and Standards in Dublin and the National Corrosion Service. For the past three years



John Bernie

he has been Head of the National Corrosion Service with responsibility for maintaining this Government advisory service to industry and for the development of major collaborative research programmes.

bsi news

BSI publications are obtainable from: BSI Sales Department, Linford Wood, Milton Keynes MK14 6LE (orders by post only).

All sales enquiries by telephone/telex should be directed to 0908 320066/Telex 825777 (BSIMK G).

British Standards

The following publications are now available:

Test methods for paints: BS3900

Part A8. Test for flash/no flash (closed cup equilibrium method): 1986 ISO 1516.

Part A9. Determination of flashpoint (closed cup equilibrium method): 1986 ISO 1523.

Part A13. Test for flash/no flash (rapid equilibrium method): 1986 ISO 3680-1983.

Part A14. Determination of flashpoint (rapid equilibrium method): 1986 ISO 3679.

Sieves, sieving and other sizing methods: BS410

Specification for test sieves: 1986.

Powder cement paints

BSI has published a revision of BS4764. Specification for powder cement paints, to supersede the 1971 edition, which is withdrawn.

International new work started

Paints and varnishes—through dry test

Will set out the test procedure for assessing, under standard conditions, that a paint film has achieved a "through dry state", ISO/TC 35/SC 9 through PVC/10.

Surface Coatings Volumes

The two volumes produced by the Oil & Colour Chemists' Association Australia (which were temporarily out of stock in the UK in the early part of 1986) are now once more available.

Orders may be placed through OCCA's headquarter offices at Priory House, 967 Harrow Road, Wembley, Middlesex HA0 2SF, using the forms which appear on pages V and VI in this issue.

Asked his views on Micro, Ken Mullen gave a typically colourful reply.



He let his cab say it all for him.

Initially excited by the gloss, he's since become equally enthusiastic about its durability.

Like most customers, Ken's interested in the price and the result, not the why's and wherefores.

So what's it to him that Sachtleben's unique Micro extender allows such a significant reduction in the amount of costly TiO₂ and other colour pigments?

That its ease of dispersion radically reduces equipment wear, saves time and energy?

That its weathering qualities make light of environments far more hostile than Waterloo Station?

Or that the gloss he admires so much can be achieved with a low binder level – let alone an average particle size of just 0.7 μm ?

As Ken puts it: "Paint's not my business. Mind you, I did have that Picasso in the back of the cab once."

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Reports of Council Meetings

A meeting of the Council took place on Wednesday, 19 February 1986 at 1.30 pm, at the Great Northern Hotel, King's Cross, London N1. The President (Mr F. B. Redman) was in the Chair and there were 24 members present.

The 1985 Annual Report of the Council for presentation to the Annual General Meeting in June was adopted and consideration given to the Agenda for the AGM. It was reported that Mr H J Clarke and Mr G. R. Robson would be retiring at the AGM from the offices of Honorary Technical Education Officer and Honorary Overseas Secretary respectively and that nominations for their successors would be required. Council agreed to appoint Mr J. R. Bourne as President Designate at the AGM.

The Council discussed at length the findings of Working Groups on the future of the New Zealand Division and the re-equipment of the headquarters offices.

The arrangements for the AGM had been outlined in the January and February issues of the *Journal* and it was reported that the Bristol Section had arranged, without charge to members, for a ferry boat to take members participating in the morning visit to and from the "SS Great Britain". Council recorded its thanks to Mr R. Saunders and the Bristol Section for the work undertaken on these arrangements. The Council Reunion would be held in conjunction with the AGM Luncheon and Lecture.

Council resolved that any members in arrears with 1986 subscriptions should not be sent copies of the *Journal* after the March issue.

It was reported that the second Monograph had been printed and that the third was scheduled to appear in May.

The topic for the Association's Conference at Eastbourne (17-20 June 1987) was discussed and all members were asked to submit names of potential lecturers and subjects. It was reported that the FSCT would appreciate a paper nominated by OCCA for its meeting in Atlanta 5-7 November 1986.

Brief details on the second joint seminar with the Society of Dyers and Colourists and other societies, to take place in October 1986, were given. It was agreed that the 1989 Conference should take place at Chester.

The Director and Secretary reported that the Honorary Editor and he had met

Mr F. Adefarati (Chairman of the Nigerian Branch) during his stay in hospital in the UK and that Mr Adefarati had later visited Priory House and discussed ways in which the Nigerian Branch activities could be stimulated. It was reported that eight members had been admitted as ATSC.

Full particulars on the Surfex 86 Exhibition were given and discussed and it was emphasised that all sections should endeavour to encourage visits by parties.

The "Official Guide" would appear as a pull-out section of the April issue of the *Journal* and pre-registration cards would be included to facilitate ease of registration at the Hall.

Under Section Reports, details were given of various activities which had taken place since the last Council Meeting and there being no other business, the President thanked members for their attendance and declared the meeting closed at 4.00 pm.

A further meeting of Council at the same venue took place on 16 April at 1.30 pm. The President (Mr F. B. Redman) was in the Chair and there were 19 members present. Before turning to the business of the meeting, the President asked the members present to stand in silent tribute to the memory of Mr A. R. H. Tawn (a former Honorary Editor and Honorary Research & Development Officer), who had died since the last Council meeting.

The President extended a welcome to Mr J. R. Bourne whom he had invited to be present.

The Agenda for the Annual General Meeting, to take place on 18 June, was finalised and the Accounts for 1985 approved. Matters concerning statutory returns, the lodgement of Section Annual Reports and monthly VAT returns were noted for action by individual members of Council and Sections.

The arrangements for the visit to the "SS Great Britain" on the morning of the AGM and the related lecture which would follow the Council reunion luncheon on the same day were reported. Council thanked the Bristol Section Committee and in particular Mr R. Saunders (Vice President) for their assistance in making these arrangements.

It was noted with satisfaction the number of members in arrears with annual subscriptions was comparable to the

number at the same time in 1985 and Section Committees were asked to remind members wherever possible to remit the amount due as quickly as possible. No further issues of *JOCCA* would be sent until the receipt of payment.

It was reported that the April issue of *JOCCA* containing the "Official Guide" had been despatched and that Monograph 3 as well as Monograph 2 would be available at the Association's Information Centre. It was expected that the Raw Materials Directory, being compiled by Mr H. C. Worsdall, would also be available at the Exhibition. New stocks of the Surface Coatings Volumes 1 and 2 (which had not been available for many months) had now been received from Australia by the UK publishers.

It was reported that Mr D. W. N. Clayton would be presenting a paper on behalf of the Association at the FSCT Convention in Atlanta in November and the need for papers for the Association's Conference at Eastbourne in June 1987 was stressed. Details of the Call for Papers was given on the cover of the February issue of *JOCCA* and members were asked to send in names of potential lecturers.

Details of nominations requested for services on BSI Committees were given and suggestions made. A further report was given on the Joint Symposium with the SDC and other bodies to be held in October 1986—details would appear in the *May Bulletin*.

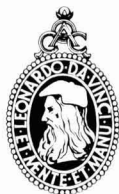
Aspects of the Open Tech course were discussed and it was noted that candidates might finish Module 8 in 1988 and should be encouraged to apply for admission to the professional grade. It was reported that preliminary arrangements were in hand for the holding of the 1989 Conference at Chester.

The Director and Secretary reported on a visit to Priory House by the Chairman of Ontario Section (Mr R. Purnell) and also on discussions which he had had with the Honorary Secretary of the Nigerian Branch (Mr K. Apatira).

Disappointment was expressed that it had not been possible to hold an inaugural meeting of a potential Far East Branch, but Council would pursue this possibility.

At the Professional Grade meeting held earlier, one ATSC had been transferred to FTSC and two further members admitted as ATSC; two candidates for LTSC were awaiting visas having submitted their "written evidence" for assessment.

OIL & COLOUR CHEMISTS' ASSOCIATION



MONOGRAPH SERIES

No. 3: PAINTING ON ZINC SURFACES AND ZINC CONTAINING ANTI-CORROSIVE PRIMERS

by E. V. Schmid, Protective Coatings Consultant, St Gallen, Switzerland

Now available from association's office by prepayment only

Protection of steel by zinc coatings — zinc coating processes — hot dip galvanizing — electroplating — metal spraying with zinc — overcoating with zinc rich primer — reactions of zinc metal — reactions of the metallic zinc surface — loss of adhesion by osmosis — reactions of zinc with fatty acids — cleaning and surface preparation (pretreatments) — cleaning the surfaces — pretreatment by chemical conversion coatings — wash primer — general views on organic coatings on zinc surfaces — alkali resistant binders and pigments — low water vapour permeability — passivating pigments — practical experiences with coating systems — one coat systems — multi-coat systems — stoved systems — underwater systems.

To Oil & Colour Chemists' Association, Priory House, 967 Harrow Road, Wembley, Middlesex, HA0 2SF.

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I enclose remittance for £ (prepayment only)

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Copies of Monograph 1, "**Marine Finishes**" are still available. Please enter the number required in the box below and add £2 to your remittance for each copy.

MONOGRAPH 2 IS ALSO NOW AVAILABLE FROM OCCA

It was unanimously agreed to confer a Commendation Award upon Dr Leslie Valentine in recognition of his outstanding service to the Association and to the industry.

Section representatives reported on recent activities including the successful London and Manchester Seminars.

Full details of the final arrangements for the holding of SURFEX 86 Exhibition were given including a short reception of exhibitors during the build up day, when a souvenir would be given to exhibitors and two plaques, which would be presented on design to the best small and best large stands.

It was reported that Association ties were available from Priory House.

As Mr Finlay would leave the Council at the AGM after many long years of active and devoted service a special note of thanks was recorded to him. A vote of thanks was also recorded to those members not remaining on Council for the forthcoming session. There being no other business the President thanked members for their attendance and declared the meeting closed at 3.30 pm.

Irish Section

Annual Dinner Dance

The Irish Section held its Annual Dinner Dance at Jury's Hotel, Dublin, on 22 November 1985, when 150 members, their wives and friends attended. The OCCA President, Mr F. B. Redman and his wife were present, and Mr Aiden Brophy the President-elect of the Irish Paint Manufacturers' Federation, and his wife, also attended. The evening was considered most enjoyable and thanks are due to the Social Committee for the arrangements entailed.

Annual Ladies' Evening

The Irish Section held its Annual Ladies' Evening on 12 February 1986, at the Ashling Hotel, Dublin. Mr A. Priestman, who is well-known and respected in the Irish Paint Industry having at one time been Managing Director of Crown Paints Ireland, gave a talk with slides entitled "Roses, Roses, Roses". This was well received and was followed by the usual wine and cheese party. Some 40 members, wives and friends attended, and it was generally agreed that members' rose culture in 1986 should benefit from the experience.

R. C. Somerville



At Bristol Section's Annual Dinner Dance (left to right): Mrs Windsor, Mr F. B. Windsor (Chairman, Manchester Section), Mrs Jukes, Mr R. Jukes (President, BPVL Club), Mrs Fell, Mr A. W. Fell (Chairman, Thames Valley Section), Mrs Prigmore, Mr. M. Prigmore (Chairman, Bristol Section), Mrs Redman, Mr F. B. Redman (President), Mrs Barrett, Mr R. Barrett (Chairman, Scottish Section), Mr R. H. Hamblin (Director and Secretary).

Bristol Section

Annual Dinner Dance

The Bristol Section held its Annual Dinner Dance at the Unicorn Hotel, Bristol, on 21 March 1985. The Chairman of the Section (Mr Maurice Prigmore) welcomed the guests of the Section—the President (Mr F. B. Redman) and Mrs Redman; the Chairmen of the London, Manchester, Scottish and Thames Valley Sections, the President of the Birmingham PVL Club and their ladies and the Director and Secretary.

The President responded on behalf of the guests and the company then enjoyed dancing to the "Wright Choice" until 1 am.

Obituary

Les Hopwood

Mr R. L. Devenish writes:

The sudden death of Les Hopwood on 28 February, in his 66th year, ended a nearly 50-year connection with the surface coatings industries.

A Blackley "lad", he had not unnaturally joined "The ICI" aged 16 at the local Dyestuffs (now Organics) Division. When his six years as a Beaufighter pilot in the 1939-45 war, plus a spell at Manchester University, are included he worked for this Division in several marketing capacities for over 40 years.

He moved to Scotland in the mid-1950's as a Pigments & Chemicals Representative and stayed for 17 years. During this time he was actively involved with OCCA committee work becoming the Section Hon. Treasurer.

Deciding on a change of scene he engineered a move, in the same capacity, to the West Country for the three years prior to early retirement from ICI in 1977. Then rapidly tiring of inactivity, he joined Durham Chemical Distributors and worked for them until his death. During this period he maintained his link with OCCA and was a committee member of the Bristol Section.

I first met Les nearly a generation ago. He was a large bluff man, full of integrity and technical competence, with at the same time a relaxed entertaining manner. His interests centred largely around his work and family.

His many friends, particularly in Scotland, will remember him with affection. Our sympathy goes to his wife, Marie and son, John.

News of Members

Mr A. C. Jolly, BSc, FTSC, has recently been made Fellow of the Plastics and Rubber Institute.

Mr A. McLean (President 1977-79) retired at the end of May after nearly forty years' service in the industry and the Association wishes him a long and happy retirement.

Gordon Robson, Chairman of Manchester Section, from 1983-85 has retired recently from ICI Organics Division and has begun a new career in Housing and Estate management, particularly for the retired. Joining OCCA in 1968, Gordon became Hon. Technical Liaison Officer of the Manchester Section in 1977, and in 1981, Vice Chairman. Following his service as Section Chairman, he became a Vice President of the Association. During this time he has diligently furthered the aims of OCCA both here and abroad and, particularly when Section Chairman, has been greatly helped by Joyce, his wife. They are to remain in the Manchester area, and Gordon intends to maintain contact with the Association. We wish him every success in his new career.

D. A. Plant

Jordan Award

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

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

2. The final date for submission of applications will on this occasion be 31 December 1986 and it is hoped to present the award at the Association's Conference in the following year.

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

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

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

professional grade

At a meeting of the Professional Grade Committee held on 16 April 1986 the following admissions were made:

Transferred from Associateship to Fellowship

Canterford, Barry Albert (*London*)

Admitted to Associateship

Pursglove, Alan Bryce (*West Riding*)
Saadatjou, Naghi (*General Overseas—Iran*)

new members

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

Ordinary Members

Barron, L M (*Manchester*)
Bastuba, D (*Transvaal*)
Batist, J D (*Cape*)
Bone, J B, BSc (*Auckland*)
Brown, H M, MSc (*Wellington*)
Bush, H C, BSc (*London*)
Deam, E, BSc (*Auckland*)
Gilbert, J C, BSc (*Auckland*)
Glynn, J J, BA (*Ontario*)
Guy, A, MSc (*Newcastle*)
Hobley, B (*Ontario*)
Kershaw, A P (*Manchester*)
Lee, W D (*Manchester*)
Lupupa, T M, BSc (*General Overseas — Zambia*)
McLaughlin, H J (*Newcastle*)
McNair, M R (*Cape*)
Muganga, J M (*General Overseas — Tanzania*)
Palmer, M, BSc (*Thames Valley*)
Parker, A W, BSc (*London*)
Roberts, I G, GRIC (*Transvaal*)
Souter, J G, BSc (*Cape*)
Stoddard, J (*Auckland*)
Vale Pereira, J H R (*General Overseas — Portugal*)
Van der Walt, B (*Transvaal*)
Vink, A F, BSc (*Cape*)
Wells, C J, BSc (*London*)
Zietman, I, BSc (*London*)

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Flow behaviour is critical to the commercial potential of all types of paints, inks and oils—whatever their ultimate end use. Identification of flow characteristics at the R & D stage could save millions at the manufacturing stage.

Haake Viscometers are versatile, cost effective and easy-to-use. They also feature the largest range of sensors and software available. With their built-in modularity they're expandable too—so that your system can grow with your needs.

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Battery Electric Reach-type Forklift Truck. Electronic control. Power steering. Proofed to Group 2. 4,500lbs basic capacity. 17' 6" lift on a triple stage mast. Full free lift. Side-shift attachment. Complete with Battery Charging Unit. Overhauled, repainted and serviced. Guaranteed. This machine has been serviced every six weeks by Lansing Bagnall. Excellent condition throughout.

Offered at a realistic figure of £5,950 + VAT (One only)

ALSO

CONVEYANCER

Counterbalance type. Group 2. 4,500lbs capacity. 14' lift. Complete with Battery Charging Unit. Overhauled, repainted and serviced. Guaranteed.

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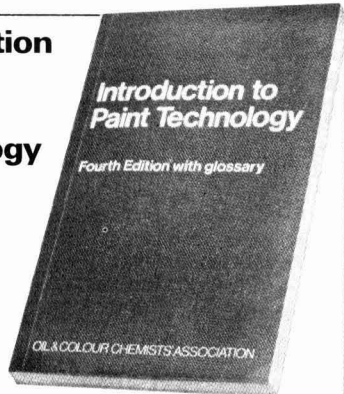


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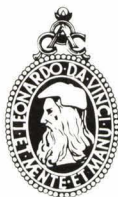
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