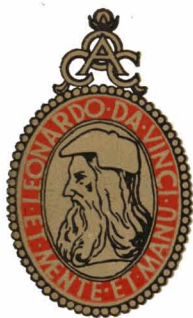


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Atmospheric pollution: will the paint user overcome this problem?
Five papers from OCCA Midlands Section Symposium 1974

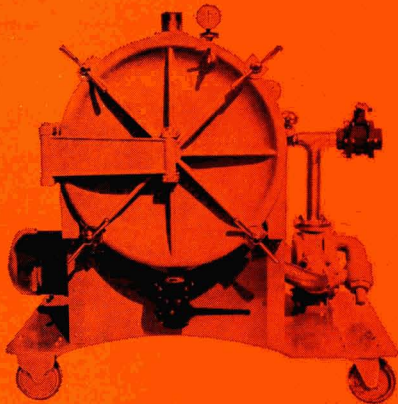
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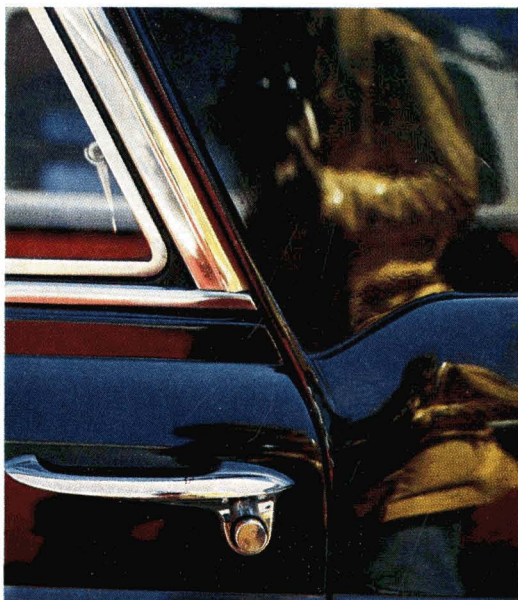
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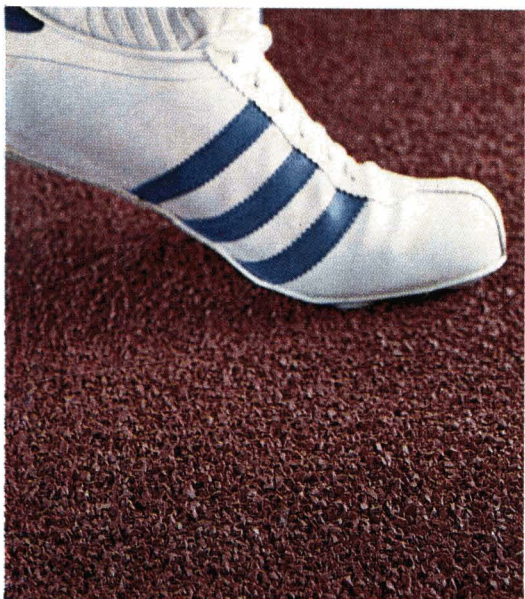
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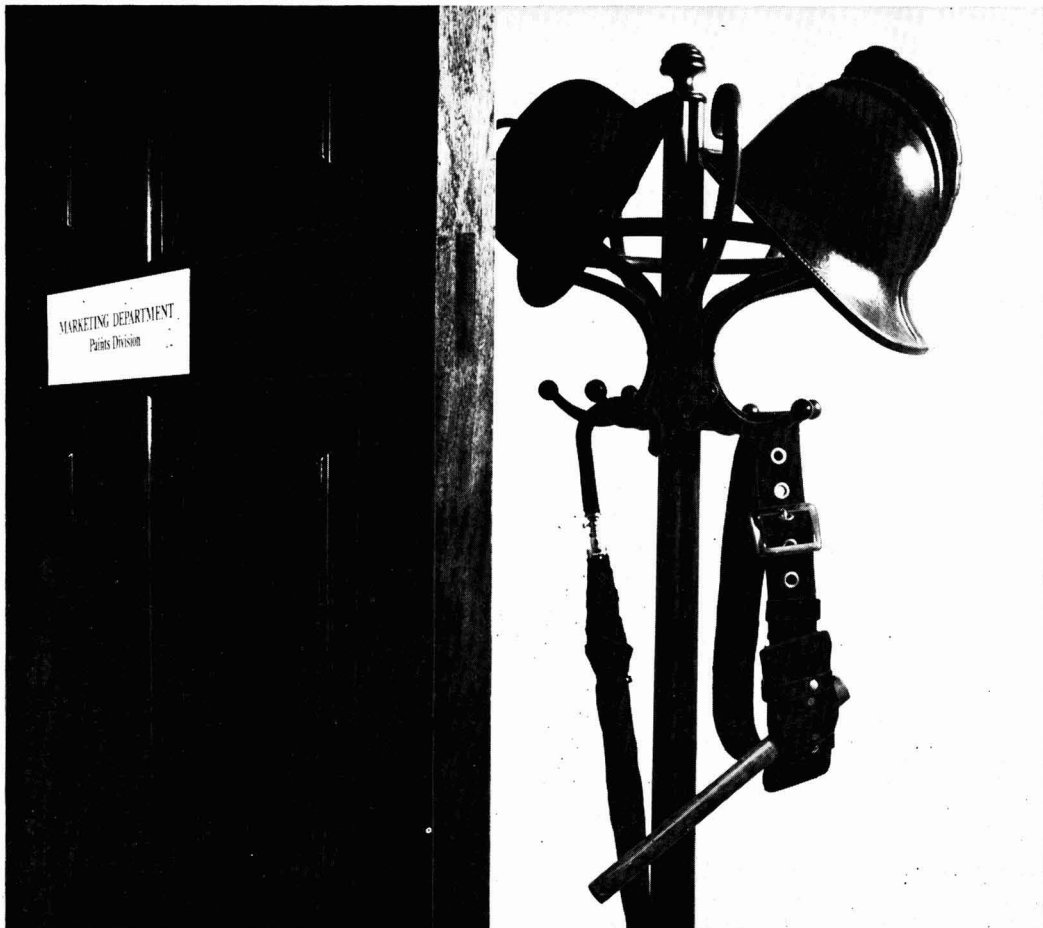
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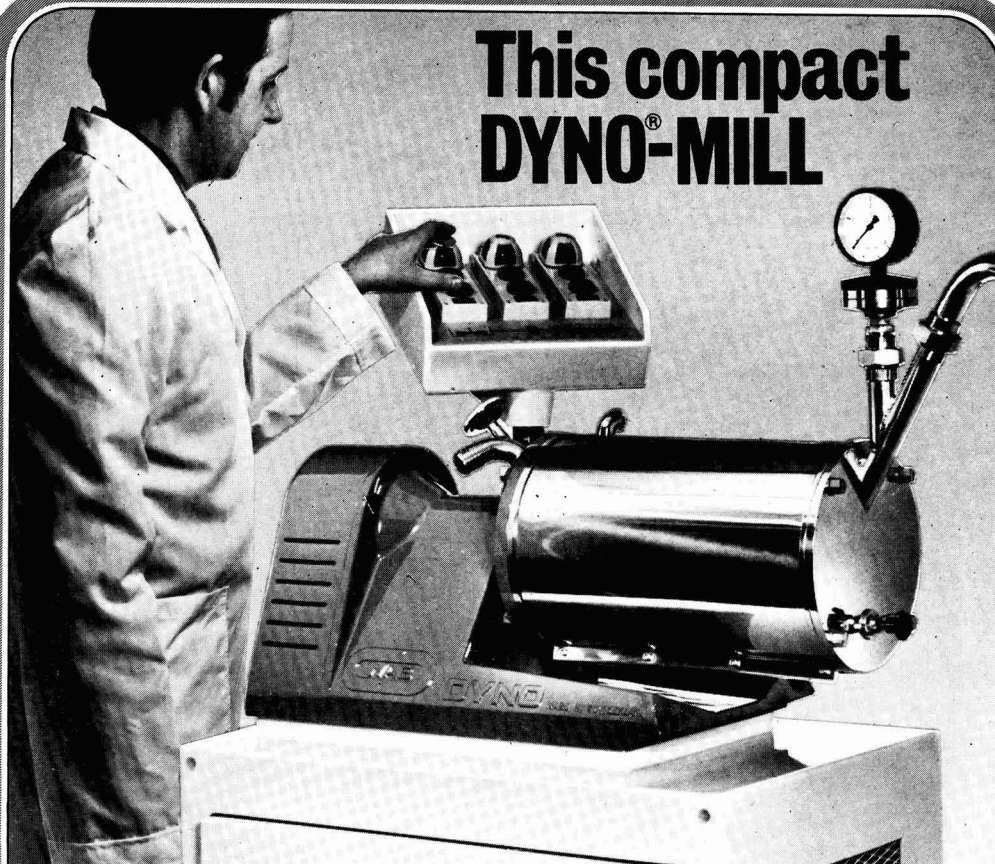
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R. H. Hamblin, MA, FCIS,
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October 1974

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Owing to the illness of the translator, the papers published in this issue do not include translations of the summaries in Russian.

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Atmospheric pollution; will the paint user overcome this problem?

PRESENTED AT A SYMPOSIUM HELD BY THE MIDLANDS SECTION AT EDGBASTON, BIRMINGHAM ON 20 MARCH 1974

SUMMARY

By G. L. Holbrow

The meeting was in general agreement that solvents were not likely to be a serious problem with regard to atmospheric pollution. Toxicity problems seemed to be of minor importance in this country, and this was probably due to the climate being very different from that in the United States, especially the Los Angeles area, where Rule 66 presented a major problem to the paint formulator and user. It was agreed that where there were special local problems with regard to solvents then Rule 66 could be taken as a very useful basis for control. The point had been raised that regardless of toxicity, solvents were expensive materials and were likely to become more so in the future and, therefore, should not be wasted on economic grounds. This was of special significance in relation to the papers presented in the morning session on "Powder coatings" and "Aqueous finishes."

The problem of emission of fumes from stoving ovens had not been resolved into a clear picture as a result of the open forum. There were quite wide differences of opinion, varying from those paint users who claimed there was no problem, to those with both large and small interests who had had problems which, in some cases, had been resolved by choice of suitable paint types. Generally, it had been agreed that toxicity was not a problem, but that unpleasant

odours were the main cause for complaint. It would seem that the severity of complaints depended upon location of the factory. In a residential area, complaints were likely to be received about what was apparently a fairly minor odour problem and here the local authority could make life somewhat difficult for the user. At the present time, local authorities had the power to close down works which were causing undue complaints. In industrial areas, complaints from local residents seemed much less likely to be received and complaints about odour mainly stemmed from the workers within the factory. In an industrial area, there were many factories emitting odours, and emissions from stoving ovens tended to be overlooked.

It was worthy of note that the present situation as regards regulations affecting pollution, which were in the hands of the local authority, might very well in the future pass into the hands of the alkali inspector.

To sum up it would seem that stoving ovens were a problem, but their nuisance could be overcome as some manufacturers had demonstrated, in particular in the paper by Mr Ellis, and guidelines for the paint supplier had been laid down by the lecturers in the morning session.

The problem in context

By D. J. T. Howe

The Paintmakers Association of Great Britain, Prudential House, Wellesley Road, Croydon CR9 2ET

Summary

A brief survey is made of the conditions which necessitated legislation to control atmospheric pollution, and the more important regulations are described. Possible future legislation arising from

developments overseas and, in particular, the unification of regulations within the EEC are discussed.

Keywords

Processes and methods primarily associated with manufacturing or synthesis

air pollution control
pollution control

Specifications, standards and regulations

pollution control regulations

La pollution atmosphérique—le problème en perspectif

Résumé

On donne un aperçu bref des conditions qui ont exigé la création de réglementation pour contrôler la pollution atmosphérique et l'on décrit les plus importants règlements. On discute la législation

eventuelle à l'avenir qui pourrait se produire à cause des développements d'outre-mer, et en particulier, de l'unification des règlements déjà en vigueur à la C.E.E.

Das Problem im Zusammenhang

Zusammenfassung

Es wird eine kurze Übersicht über die Umstände gegeben, welche Gesetzgebung zur Kontrolle der Luftverunreinigung erforderlich machen. Die wichtigeren Bestimmungen werden beschrieben.

Mögliche künftige, sich aus Entwicklungen in anderen Ländern ergebende Gesetzgebung, und insbesondere die Vereinheitlichung von Bestimmungen innerhalb des EWG werden besprochen.

It is often imagined that problems of air pollution in Great Britain began with the Industrial Revolution. Kilns for firing pottery of the type that would have been used here in the mediaeval period or earlier were shown in action recently on television. The local air pollution created by the smoke from the wood fires must have been considerable.

residential areas of London,² it was shown that although at some periods of the day the smoke pollution in the garage was considerable, the concentration of some harmful pollutants, particularly some carcinogenic hydrocarbons, was at most marginally higher than that in the air outside the garage, and at some periods it was significantly lower.

The UK has been concerned over a long period with all forms of air pollution in urban areas. As long ago as 1661 John Evelyn, the diarist, referred to the situation in London and to "the Cloud of Sulphur spoiling the movables, tarnishing the plate, gildings and furniture and corroding the iron-bars and hardest stones with piercing and acrimonious spirits." Nevertheless, it was the Industrial Revolution which added a new dimension to the problem. Industrial concentrations were allowed without regard for the local air pollution created, and since workers lived within walking distance of their jobs, a concentration of dwellings resulted within the polluted area, which contributed further to the pollution and afforded the workers no respite from it. Although the vast majority of the country was unaffected by the pollution, there were created relatively small areas with highly polluted atmospheres in which a large proportion of people lived, and it has taken nearly a century since the danger was first appreciated to reduce the pollution to an acceptable level.

This being so, legislation directed at maintaining clean air is concerned with pollution irrespective of its source, and only in the cases where the pollutant cannot possibly have arisen from a domestic source can industry, specifically, be singled out.

To counter the opinion that an appreciation of the dangers of air pollution is of recent origin, it should be pointed out that the first Alkali Act became law in 1863 in this country. Further legislation has been introduced either when measures taken are obviously inadequate (as with the increasing smog problem in Los Angeles caused by the temperature inversion phenomenon resulting from its climate and geography), or when dramatic events occur, such as the London "killer" smog of December 1953. The former resulted in the well-known Rule 66 and the latter in the 1956 Clean Air Act. The latter Act has certainly been effective.

This symposium is concerned with industrial pollution and, specifically, with that created by the paint user, but it is difficult to assess the industrial contribution to local pollution: it is less than is imagined, generally. The *Financial Times* suggested¹ in 1971 that 80 per cent of smoke pollution came from household chimneys. In a study carried out in 1956-57 of air pollution at diesel bus garages in two high density

It is interesting to consider the reaction of governments in these situations. Compared with the possible over-reaction of the Americans, the British action can be regarded almost as an example of a national characteristic of understatement. It is the desire of the department concerned to achieve its objective with the minimum interference to industrial practice or domestic life. After all it is no good providing a man with a clean environment if to do so, the product he manufactures

becomes so expensive that his job vanishes, and he is reduced to the misery of unemployment and poverty. A compromise has to be effected. It is suggested that in the future the compromise arrived at will be increasingly in the direction of a better environment.

In considering the relevant legislation, the author will deal first with control of the atmosphere within the factory. Responsibility for this control lies with the Factory Inspectorate of the Department of Employment. If the local factory inspector has reason to believe that an atmosphere inside a factory is hazardous to health because of the concentration of harmful fumes, he can arrange for the air to be analysed by the laboratory of the Inspectorate. If the air is shown to contain, in its opinion, a harmful concentration of a chemical, the factory may be required to introduce measures to reduce the concentration or to provide protection to the employees. Failure to comply can lead to prosecution. The threshold limit values (TLVs) for dangerous gases issued by the department are used to provide guidance as to whether a harmful concentration is present. The TLVs are the mean concentrations of gases above which it is considered dangerous for a man to work during a five-day week, each day being of 8 hours. They were set by the American Conference of Governmental Industrial Hygienists from the latest data available from either experiments with animals or human experience. The levels are not statutory in the UK but are used only as guidelines. For instance, in a case in which there is a claim for damages for an alleged exposure to a dangerous atmosphere, the demonstration that a chemical was present in a concentration in excess of its TLV could be used as an opinion of the danger of the atmosphere from the most expert source in the world.

TLVs are reviewed every year, and when there are changes they tend to be downwards, and to take into consideration the comfort of the worker as well as the safety aspect.

The progress of legislative control of the air outside the factory boundaries is summarised in Appendix 1 in which the most important legislative instruments are listed. There are those which are primarily concerned with smoke abatement such as the 1956 and 1968 Clean Air Acts and their predecessor in 1926. They related to the permissible quality of smoke from industrial or domestic sources, smoke control areas, the power of local authority and means for controlling smoke output from factories.

Emissions from factories are dealt with in general terms in the 1936 Public Health Act. It is concerned with the powers of the local authority in cases where emitted dust or effluvia are prejudicial to the health or a nuisance to the inhabitants of the neighbourhood. The powers granted allow the authority to serve an abatement order on the owner of the premises. The means of abatement is left to him, and failure to comply or persistent recurrence of the nuisance leads to court action.

Certain processes, however, are capable of producing air effluents worthy of special treatment. These processes are dealt with under the Alkali and Works Act. Originally intended to deal with the hazards of effluents from alkali works, its scope has been widened to take in hazards from a range of dangerous chemicals. The Act of 1906 is that which forms the basis of the present control of the air environment outside the factory. It requires certain processes to be registered and to be inspected by the alkali inspectors. It is their responsibility to see that the registered factories operate with a minimum of pollution of the outside environment.

At this time, there are no published statutory limits to concentrations of pollutants from registered works. The system used involves the concept of "presumption limits". The method of control is best described in a paper "Standards of Emission under the Alkali Act" by E. A. J. Mahler,³ from which may be quoted:

"The obligation laid on the great majority of the processes controlled under the Alkali Act is that the 'best practicable means' shall be used for preventing the discharge, either directly or indirectly, of noxious or offensive gases to atmosphere and for rendering such gases which are discharged harmless and inoffensive.

"Whilst standards will not have the same force of law as the statutory limits, it is clearly to the advantage of both industry and the Inspectorate, upon whom the duty of enforcing the law rests, that standards of emission be laid down; if complied with, these can be taken as presumptive evidence that the best practicable means requirement is being observed. Such standards are referred to as 'Presumptive Limits'. They have the advantage over 'Statutory Limits' in that they can be varied at the discretion of the Chief Inspector to take into account advances in technical knowledge without the necessity of having to go through the time-consuming process of bringing in a new Act which would be required to change a Statutory Limit.

"The setting of presumptive standards is entirely at the discretion of the Chief Alkali Inspector. This does not mean that they are necessarily set in an arbitrary fashion. On the contrary, they are usually set only after close discussion with the interested parties and considerations of technical possibilities, costs, current information on the effects of the pollutants on human and animal health and vegetation, and of odour thresholds.

"The philosophy underlying present choice of standards can be stated briefly as follows:

"No emission discharged in such an amount or manner as to constitute a demonstrable health hazard in either the short or long term can be tolerated. Emissions, in terms of both concentration and mass rate of emission, must be reduced to the lowest practicable amount.

"The determination of what is practicable demands striking a balance between technical possibilities on the one hand and costs on the other. The technically possible solution would be impracticable if the costs were so high that the manufacturing operation were thereby rendered unprofitable or nearly so. A great increase in the cost of measures for control would not be justified if the resultant reduction in emission were small. The extent to which emissions can be reduced must often be related to the efficiency of operation of the process itself—for example in the case of sulfuric acid and nitric acid plants.

"Except in the few cases where there is an end use for the product, scrubbing of exits can produce a more difficult liquid effluent than the gaseous effluent disposal problem. Having secured the minimum practicable emission, its height of discharge must be arranged to secure an acceptably low ground level concentration of the pollutant. Where there are authoritative medical rulings on limiting concentrations to which the general public may be exposed, heights of discharge are arranged so these shall not be exceeded and note is also taken of opinions on the concentrations of pollutants that cause damage to vegetation. There is very little reliable

guidance in this field, however, and for those pollutants for which a limit does not exist the concentrations recommended by the Factory Inspectorate as maxima for occupational exposure are taken as a guide. Using the simplification of the Sutton-Bosanquet formulae for dispersion of gases from a chimney developed by Nonhebel and co-workers,⁴ a chimney height is chosen that will give a calculated three-minute mean concentration of the pollutant at ground level, usually of the order of one-thirtieth the value recommended by the Factory Inspectorate for occupational exposure. Such a factor is chosen to allow for the assumed lesser resistance of the young, elderly and sick among the general population and the difference between occupational and residential exposure times. Taking a standard wind speed of 20ft per second, the Sutton formula can be further simplified to that shown below, and this is the one now commonly used in the first assessment.

$$H^2 = 9M/4P$$

where H = Effective chimney height required (in feet)

M = Mass rate of emission of pollutant (in pounds per day)

P = Maximum permitted 3-minute mean ground level concentration at ground level (in milligrammes per cubic metre)

"The actual height of chimney can be deduced from the effective height, allowing other factors for all sorts of local conditions."

The list of legislative instruments includes the later Alkali Acts which are only extensions of the 1906 Act, adding lists of additional scheduled works. A list of registrable works and noxious or offensive gases specified in the Alkali Act is published by the Department of the Environment and appears in Appendix 2. At the moment no paint processes are scheduled. Works are scheduled because of the processes they use. A paint process carried out in a scheduled works does not itself become scheduled.

Thus, in summing up, control of the atmospheres within factories is the responsibility of the Department of Employment's Factory Inspectorate. Control of atmospheres outside factories working certain hazardous processes is in the hands of the Department of Environment's Alkali Inspectorate, but for other processes, including the manufacture and use of paints, the local authority has the powers to deal with hazards to health and nuisance resulting from pollution of the atmosphere outside the factory.

Legislation is not static and for those who have to plan for the future it is wise to form an opinion on the direction of likely changes, and to study the effect of influences at home and overseas, although there is little evidence of any major changes in this area in the near future. The Protection of the Environment Bill which was before the House of Lords in January 1974 left things mainly as they were. However, there has been a Working Party set up by the Department of Environment to prepare a review of sources of complaint from the general public about odours. The next step is for the Working Party to consider best practicable means for minimising and suppressing the odour nuisance which may have been identified.* Among the industries under consideration are paint manufacture and application. The possibility exists, therefore, for a paint manufacturer or user to be

considered a sustained or frequent nuisance to those in the neighbourhood, the processes concerned may become registrable and subject to the authority of the alkali inspectorate. The remedy is in the hands of the industry to conduct its operations in a manner whereby no nuisance is caused and, therefore, escapes being added to the list of registrable works.

There is little evidence yet to suggest that events overseas will have much effect on legislation in the area in which the author is concerned. Perhaps the most sensational proposal is Rule 66 of Los Angeles, which would prevent the sale or use of coating compositions containing photochemically reactive solvents. The rule limits the use of certain combinations of solvents such as some aromatics, some unsaturated hydrocarbons, ketones, alcohols and trichloroethylene. A limit to solvent discharge from a baking oven of 15lb per day is among its requirements. It is doubtful whether such rules will be accepted in this country, partly because it is unlikely that the severity of the problem in Los Angeles will be met, and secondly because it is not the usual method for tackling such a problem.

One of the consequences of this country joining the EEC has been the requirement to accept harmonised legislation from Brussels. Where differing legislation in the member states can result in barriers to free trade, or unfair trade advantage or the free passage of labour from one state to another, attempts are made to produce a common legislation or what is known as "harmonised legislation" for the nine countries of the EEC. A Working Party has been considering laws for control of environmental pollution. So far, no attempt has been made to prepare a directive but they have suggested an environmental programme for study and research.⁵ Proposals or methods for controlling air pollution have differed. There are those who propose control at the point of emission, and others who propose standards for maximum concentrations, such as (TLV/30) for a five-minute exposure, (TLV/300) for a five-minute exposure of a substance with a particularly objectionable smell, and (TLV/3000) for continuous exposure.⁶ The proposals for differing methods of control have to be reconciled before any progress can be made. It is estimated that it will be many years before there is a directive in the field of interest today, and consequently any changes in legislation due to EEC activity need not be expected for some time.

Finally, the responsibility to deal with the nuisances of air environmental pollution from paint manufacture and use rests with the local authorities. The chance of the industry being considered registrable, and thus subject to the more rigid control of the alkali inspectorate, is in the hands of the industry itself. Provided it does not constitute a sustained nuisance or provided, of course, that there is no major catastrophe, which would precipitate panic legislation, that state of affairs should continue.

[Received 6 May 1974]

References

1. *Financial Times*, 26 October 1971.
2. Commins, B. T. *et al.*, *Brit. J. Industr. Med.*, 1957, 14, 202.
3. Mahler, E. A. J., "International Clean Air Congress", London, October 1966.
4. Nonhebel, G. *et al.*, "Gas purification processes", Chapters 18 and 19, London, Geo. Newnes Ltd.
5. Official Journal of the European Commission, December 1973, 16, No. C112.
6. Ireland, F. E., BOHS Symposium "Environment in Perspective", November 1972. (Unpublished as yet.)

*The first report of the Working Party has just been published by the Department of Environment entitled "Odours".

Appendix 1

List of the more important legislative and other documents relevant to control of air environment from factory pollution in the United Kingdom:

1. Alkali and Works Regulation Act 1906
2. Public Health Act 1936
3. Clean Air Act 1956
4. Clean Air Act, Alkali and Works Order 1966
5. Clean Air Act 1968
6. Clean Air Act, Alkali and Works Order 1971
7. Protection of the Environment Bill 1973

Appendix 2

Lists of registrable works and noxious or offensive gases specified in the Alkali Act and Orders:

Non-scheduled works

Alkali
Cement
Smelting

Scheduled works

Sulphuric acid
Sulphuric acid (Class II)
Chemical manure
Gas liquor
Nitric acid
Sulphate of ammonia works, and muriate of ammonia (NH₄Cl)
Chlorine
Muriatic acid (HCl)
Sulphide
Alkali waste
Venetian red
Lead deposit
Arsenic
Nitrate and chloride of iron
Bisulphide of carbon (CS₂)
Sulphocyanide
Picric acid
Paraffin oil
Bisulphite
Tar
Zinc
Benzene
Pyridine
Bromine
Hydrofluoric acid
Cement production
Lead
Fluorine
Acid sludge
Iron and steel
Copper
Aluminium
Electricity
Producer gas
Gas and coke
Ceramic
Lime
Sulphate reduction
Caustic soda

Chemical incineration

Uranium
Beryllium
Selenium
Phosphorus
Ammonia
Hydrogen cyanide
Acetylene
Amines
Calcium carbide
Aldehyde
Anhydride
Chromium
Magnesium
Cadmium
Manganese
Metal recovery
Petroleum
Acrylates
Di-isocyanates
Mineral

List of noxious or offensive gases

Muriatic acid (HCl)
Sulphuric acid and sulphuric anhydride
Sulphurous acid and sulphurous anhydride (except those arising solely from the combustion of coal) (SO)
Nitric acid and acid-forming oxides of nitrogen
Chlorine and its acid compounds
Bromine and its acid compounds
Iodine and its acid compounds
Fluorine and its compounds
Arsenic and its compounds
Ammonia and its compounds
Cyanogen compounds
Pyridine
Bisulphide of carbon
Chloride of sulphur
Acetylene
Sulphuretted hydrogen (H₂S)
Volatile organic sulphur compounds
Fumes from benzene works
Fumes from cement works
Fumes from tar works
Fumes from paraffin oil works
Fumes containing copper, lead, antimony, arsenic, zinc, aluminium, iron, calcium or their compounds
Fumes containing chlorine or its compounds
Smoke, grit and dust
Fumes containing uranium, beryllium, cadmium, selenium, sodium, potassium or their compounds
Carbon monoxide
Acetic anhydride and acetic acid
Aldehydes
Amines
Fumes containing chromium, magnesium, manganese, molybdenum, phosphorus, titanium, tungsten, vanadium or their compounds
Maleic anhydride, maleic acid and fumaric acid
Products containing hydrogen from the partial oxidation of hydrocarbons
Phthalic anhydride and phthalic acid
Picolines
Fumes from petroleum works
Acrylates
Di-isocyanates

The effects of powder coating

By J. M. Schouten and N. Kloos

Scado BV, PO Box 615/Postfach 615, Zwolle, Netherlands

Summary

The effect of anti-pollution regulations in the fields of architectural and industrial paints is considered and the consequences for the industrial user may lead to increased use of powder coatings to satisfy the demand for non-polluting materials.

A study made in Holland has indicated that although the paint industry makes only a small contribution to the total atmospheric

pollution, nevertheless large amounts of solvent vapour are emitted into the atmosphere.

Polyester powder coatings provide a range of very versatile materials for the replacement of solvent-based systems and at the same time offer important technical improvements. The volatile matter other than solvents emitted during application is briefly considered.

Keywords

Types and classes of coatings and allied products

powder coating

Processes and methods primarily associated with manufacturing or synthesis

air pollution control

pollution control

Les effets de revêtements en poudre

Résumé

On considère l'effet dans le domaine des peintures industrielles et agricoles des règlements anti-pollution. On suggère que leurs conséquences à l'égard de l'usager industriel puissent augmenter l'emploi des revêtements en poudre afin de satisfaire la demande pour les matériaux non polluants.

Une étude effectuée en Hollande a indiqué que le bien que l'industrie de peintures ne fasse qu'une petite contribution à la totalité de pollution atmosphérique, néanmoins les quantités

importantes de solvants sont dégagées à l'atmosphère.

Les revêtements en poudre polyester donnent une gamme de matériaux polyvalents qui peut remplacer les systèmes à base de solvant et en même temps qui offre d'importantes améliorations techniques. On considère brièvement la nature des matières volatiles, autre que les solvants, dégagées pendant le procédé d'application.

Die Auswirkung der Verwendung von Pulverlacken

Zusammenfassung

Die Auswirkung von Anti-Pollutions-Gesetzesmassnahmen auf die Verwendungsgebiete von Lackfarben für landwirtschaftliche Maschinen und von Industrielacken wird einer Betrachtung unterzogen. Die sich daraus für den industriellen Verbraucher ergebenden Folgen könnten zur stärkeren Verwendung von Pulverlacken führen, um die Nachfrage nach nicht-liftverschmutzenden Materialien zu befriedigen.

Aus einer in Holland durchgeführten Untersuchung ergab sich, dass, obwohl die Lackindustrie nur in geringem Masse zu der

gesamten Luftverunreinigung beiträgt, nichtsdestoweniger grosse Mengen von Lacklösungsmitteldämpfen in die Atmosphäre ausströmen.

Es gibt Polyester Pulverlacke in einer Auswahl von sehr vielseitiger Beschaffenheit, mit welchen Systeme auf Lösungsmittelbasis ersetzt, und gleichzeitig wichtige technische Verbesserungen geboten werden können. Kurz besprochen werden ebenfalls andere flüchtige Bestandteile als Lösungsmittel, die während der Verarbeitung freigesetzt werden.

Faced with the title question "Will the paint user overcome this problem?" it should be realised that roughly there are two groups: the industrial paint users and the architectural paint users. It is obvious that the industrial paint user is always in a more favourable position with regard to pollution prevention than his architectural colleague. His products, in principle, are always coated in a room that can be isolated from the open air. To prevent solvent vapours reaching the atmosphere he can either:

1. Re-collect these vapours (or burn them).
2. Try to find systems which do not contain the unwanted materials.

The architectural painter, however, does not have this choice. For him it is practically impossible to avoid vapour losses; he is totally dependent, therefore, on a non-polluting

paint system. With regard to the paint he uses, he is restricted further in his possibilities, because:

- (a) his only tool in most cases is the brush, so he has to use liquid paints, and
- (b) the coatings he is applying, generally, cannot be cured by heat, which means that they have to be based on binders curing at room temperature either chemically (oxidative) or on physically drying types.

When anti-air-pollution rules are introduced, he will ask the paintmaker to deliver paints containing no solvents at all, or containing harmless solvents only. In the latter case, water is the most attractive solvent.

Fifteen years ago, the authors' company recognized these trends and investigations were started to develop water-

soluble binders for the paint industry. This resulted, as should be known from past OCCA exhibitions, in a series of resins called the "Scadosols," which, however, still contained coupling solvents and amines. Today the results of recent developments indicate that this last problem has been solved, and it is believed that a very promising system for application in the architectural field has been found.

Reverting to the industrial painter and his need for non-polluting materials, it was indicated earlier that, in fact, he has two alternatives: to re-collect and/or burn solvent vapours, or to look for solventless systems. Comparing these two, it has turned out to be far more attractive to choose systems containing no solvents at all. Because of the fact that the application methods in this field are more versatile, the problem can be solved in different ways. When he wants to stick to the old familiar paints he can ask for solventless liquid paints and when he can afford the equipment for applying solid materials he will try a powder coating, which is the subject of this paper.

Powder coatings were already in existence several years ago and in the paint industry, epoxy resins were dominating the scene. For reasons which need not be explained in detail here, it was decided to develop systems based on polyesters.

Before discussing the effects of different systems on air pollution, it is interesting to consider how much of the total atmospheric pollution is caused by the paint industry and its users. In Holland an investigation has been carried out by T. Doorgeest of the Verfinstituut TNO, and from his work the following summary and conclusions may be quoted:

In 1967 in Holland approximately 38 000 tons of solvent vapour were emitted to the atmosphere, as a result of the preparation and application of paint. In addition to these quantities, three other contributions must be considered, such as spray losses (approximately 200 tons), vapours formed during heat curing of stoving enamels (approximately 400 tons) and volatile materials formed during the oxidative drying of architectural paint (another 400 tons).

Thus the total of all these contaminating vapours amounts to approximately 39 000 tons, which seems to be a considerable amount. But comparing this amount to the total amount of harmful contaminants emitted yearly, it turns out that the paint makers and users are responsible for only 0.1 per cent of the total air pollution in Holland. This might be considered "disappointing" with regard to the effort the paint industry is making to restrict air pollution, but although the effect on total pollution is rather low, it must be realised that local nuisance could be severe.

If it is assumed that in the near future regulations will come into operation to improve the situation, then it is reasonable to anticipate them, and it is considered that the switch over to non-polluting materials will continue rapidly in future years.

Having made the decision to change over to a non-polluting stoving system, the choice of system presents no problem, in the authors' opinion. It surely has to be a powder coating

and, depending upon the requirements, a choice can be made from the many powder coating resin types already on the market. This is not the place to discuss in detail the advantages and disadvantages of all these systems, and the discussion will be restricted to polyester resins, in order to illustrate how pollution aspects can play a role, even within this group of modern resins.

Some of the more usual types on the market today are:

- (a) Hydroxyl and carboxyl groups containing polyesters.
- (b) Polyester-melamine types.
- (c) Polyester-caprolactam blocked isocyanate types.
- (d) Polyester-glycidyl types.
- (e) Polyester-epoxy types of the well-known diphenylolpropane type.

With regard to air pollution, the following remarks can be made: types (a), (b) and (c) all produce condensation products, such as water, (a); methanol, formaldehyde, acetals, (b); and caprolactam, (c). Concentrations up to 5 per cent have been calculated, based on a pigmented coating.

A very attractive type in this range is type (a), (from the anti-air-pollution point of view), although this needs very high curing temperatures (up to 240°C). Systems (d) and (e) upon curing do not produce volatile products as a result of their curing mechanisms, which are of the so-called "addition" type, and thus may be considered completely non-polluting systems.

Moreover, the attractive curing cycles and the extremely good properties of the final coatings obtained from these systems are the arguments for the promising developments to be expected in this field. The authors believe these arguments may even play a more important role than the non-polluting aspects.

It is worthwhile mentioning that especially in the field of powders based on thermosetting polyesters, which are predominantly based on terephthalic acid or dimethyl terephthalate, the electrostatic powder application technique makes it possible to employ these unique materials in the surface coating industry, because normally these polyesters are practically insoluble in the usual solvents.

This applies especially to polyester powders; epoxide powders could be dissolved and applied by normal paint spraying techniques. This applies also to acrylics. It is, however, beyond the scope of this paper to discuss extensively the many areas in which powder systems do excel; details can be found in every leaflet from powder producers and in the coating literature.

Returning to the title question of this symposium, "can the paint user overcome the problem of atmospheric pollution?" the answer is that he certainly can, on the condition that the paintmaker provides him with the right materials.

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Aqueous coatings

By R. N. Washburne and J. N. Sparrow

Rohm and Haas, DCL Laboratories, Zurich

Summary

Since 1967 Federal legislation in the USA has caused paint users rapidly to adopt water-based systems to reduce solvent emission into the atmosphere. Similar legislation is likely to be made in the future by many other countries.

Keywords

Types and classes of coatings and allied products

water-base paint

The developments in the technology of water-based coatings suitable in the fields of wood finishing, metal strip coating, metal decoration, tin plate coating and maintenance paints are reviewed and discussed.

Processes and methods primarily associated with manufacturing or synthesis

air pollution control

pollution control

Rèvements Aqueux

Résumé

Depuis 1967 la législation fédérale aux U.S.A. oblige les usagers de peinture d'utiliser avec empressement les systèmes aqueux afin de réduire les quantités de solvants dégagés à l'atmosphère. Probablement, à l'avenir, plusieurs autres pays dresseront de pareille législation.

On passe en revue et on discute les développements dans la technologie des revêtements aqueux convenables d'être utilisés dans les domaines de finition de bois, laquage en continu, application au rouleau et dans les peintures de manutention.

Lacke auf Wasserbasis

Zusammenfassung

Die Federal Gesetzgebung in den U.S.A. veranlasste Lackverbraucher schnellstens auf wassergetragene Systeme überzugehen, um die Abgabe von Lösungsmitteldämpfen an die Luft zu reduzieren. Es ist anzunehmen, dass in vielen anderen Ländern in Zukunft ähnliche Gesetze erlassen werden.

Die Entwicklung in der Technologie wassergetragener Anstrichmittel, welche sich für Zwecke der Holz-, Metallbandlackierung, Metalldekoration, Weissblechlackierung und Instandhaltungsarbeiten eignen, wird rückblickend und vorausschauend besprochen.

Against the background of ever-increasing legislation on ecology and environmental protection in the United States, this paper is concerned with the contribution that water-based systems can make, particularly in the industrial finishing field, and introduces the use of water-based vehicles specifically designed for industrial coatings applications.

The Research Department of the authors' company, Rohm & Haas Limited, has concentrated on development of polymer composition and formulating techniques. Whilst this was concerned initially in the decorative paint area, the industrial coatings industry has not been ignored and thermoplastic and thermosetting acrylic solution resins have found a broad usage in a variety of industrial applications. They provide excellent coatings for metals, plastics, wood, vinyls and other substrates.

It is not to be inferred that this type of formulation is simple however: the use of water is the direction in which the authors consider the industry is currently moving. Air pollution legislation, citizens' concern with the environment and safety regulations for employees are combining to impose an almost impossible challenge to the formulator and user of solvent-based coatings. The terms "exempt solvent," "restricted solvent," "hourly emissions" and so forth, have become as familiar to the formulator as is the vocabulary of quality and cost.

Of course, water-based coatings are not the only solution to this problem; Mr Kloos and Mr Waghorn discussed powder coatings and non-aqueous dispersions, respectively.

It is thought that water-based systems are gaining the most attention for two reasons: firstly, they can be applied with equipment currently in use with little or no modification, resulting in an economic saving on capital expenditure; secondly, the technology is well known for water-based coatings. The first all-acrylic emulsion for exterior trades sales paint was introduced over 20 years ago and since then

This experience has led to the development of resins for water-based coatings which can often compete on a performance basis with the solvent-based systems with which the coatings industry is familiar, however, factory application of water-based coatings has been going on for years in the building products industry strictly on the basis of their performance. Acrylic emulsions have been used with excellent results for coating cement asbestos shingles and for sandable sealer coatings on hardboard and sidings.

Generally speaking, the advantages of emulsion polymers lie in areas in which high molecular weight is desirable; that is, to provide excellent toughness and durability and good water and chemical resistance. Their disadvantages are due to the fact that the polymer exists as discrete particles, which makes formulating more complicated. For example, pigment wetting is more difficult and coalescing aids must be added to allow the harder polymers to fuse into a coherent film.

The colloidal dispersion resins are also available in the United Kingdom. These are polymers of lower molecular weight than the emulsion polymers and they contain water-soluble groups on the polymer molecule. Thus part of the polymer is solubilised whilst part remains a dispersion. This type of polymer can be considered a hybrid between emulsion and solution polymers with properties intermediate to them, depending on the degree of solubilisation.

The third type is the low molecular weight dissolved polymer of the water-reducible type. This also represents the typical solution polymer, of which the water-reducible polymer is just a special case. It consists of smaller spheres of polymer, to which water-solubilising functionality has been added, often as the carboxyl group. By adding a base, the solubility of that segment of the polymer can be increased, causing the sphere to swell and expose additional carboxyl groups which can then be further solubilised. As the colloidal dispersion resins are further solubilised, their characteristics become more like those of the solution polymer. Both advantageous and disadvantageous characteristics are then developed.

Emulsions have an opaque appearance, their viscosity is largely independent of molecular weight, the particle size averages 0.1 microns and the molecular weight 10^6 . Water solubilised resins are translucent in appearance, the viscosity somewhat dependent on molecular weight, the particle size is ultra-fine and the molecular weight is from 2 to 20×10^4 . With water-reducible resins, the appearance is clear, and the viscosity very dependent on molecular weight, which is from 2 to 5×10^4 .

The discrete particles of the emulsion polymer and the lack of a significant number of functional groups are the physical characteristics which cause the formulation complexity of the emulsion to be greater than that of other types. A coalescing agent is required, particularly for the harder polymers, to enable the separate particles to fuse into a coherent film on drying. A coalescing agent should be a relatively high boiling solvent to allow adequate time for coalescence, before evaporating from the paint film. Due to the solubilised nature of the colloidal dispersions, little or no coalescing agent is required. Because they are not particulate in nature, water-reducible polymers do not form films by the fusion mechanism, but by chain entanglement.

The lack of functional groups in emulsion polymers is both a blessing and a curse with respect to pigments. Reactive pigments are less subject to change or degradation in emulsion systems. Since acrylic emulsion polymers are usually formulated at an alkaline pH, for optimum dispersion stability, care should be taken not to use alkali-sensitive pigments. Adequate pigment dispersion is another problem with emulsion polymers, since functional groups are not present in the water phase to assist grinding, and surfactants and dispersants must be added to emulsion systems to obtain the necessary wetting and for good dispersion of the pigments.

The viscosity of the water-reducible solution systems increases gradually as the solids increase. This allows the desired viscosity to be obtained relatively easily by varying the solids content. On the other hand, in emulsion systems, the viscosity remains approximately constant as the solids are increased until a critical point is reached where the viscosity increases rapidly. Unless the solids content of the emulsion system is formulated in the critical range, where the viscosity is increasing rapidly, additives are required to adjust the viscosity to the desired level. Typical additives

are polyacrylates, such as a low molecular weight ammonium polyacrylate, or cellulosic thickeners. The water-soluble resins again are hybrids, and the viscosity can be increased by further solubilisation with alkali or suitable solvent.

With regard to application characteristics, the water-solubilised resins are generally intermediate between the emulsion and solution types. These rankings are relative and are made for a class of materials. Even the poorest rated class in the given category could be a material of excellent performance particularly if the specific product in the class had been designed with that category in mind.

The first category is subject to many application difficulties, such as ease of clean up, foaming, substrate wetting and various methods of application. Emulsion resins are ranked poorest here since the additional ingredients required to formulate coatings makes a specific formulation very sensitive to these variables. However, by careful formulation, these difficulties can be minimised or eliminated. High solids at application viscosity is an advantage of the emulsion-based coating since faster application speeds and dry times are possible.

Good film formation is a basic pre-requisite for a satisfactory coating performance and is somewhat more difficult to obtain with emulsions, but not impossible. Knowing the application conditions, such as temperature and porosity of the substrate, drying rates, film thickness and number of coats in mind, it is easier to formulate for satisfactory film formation.

Gloss is particularly important. At present, emulsions, in general, yield the lowest gloss of the three types of vehicles. Gloss readings in the low 80s at 60° are adequate in many applications. Formulating techniques and new emulsion polymerisation processes are constantly disclosing ways of obtaining higher gloss and gloss clarity.

Generally speaking, acrylic resins are excellent performers in all three of the categories. However, there are variations. Emulsion-based coatings will produce the toughest, most durable films with the best resistance compared with polymers of similar composition. Durability will be related, generally, to molecular weight, assuming good film formation; the molecular weight of emulsion polymers is usually over 1 000 000.

Having outlined the three water-based acrylic systems for industrial finishing, the criteria employed in selecting a suitable system may be discussed.

The performance of emulsion-based coatings is as follows:

Ecology is very good, ease of application below average, the performance is excellent, investment is below average and the operating costs above average. With reference to the ecology, most States in the USA now make water-based systems exempt from any limitations on usage and it is considered that whilst these may not be the ultimate for the long term, they certainly are the best route for a number of years, perhaps well through this decade.

Problems of application involve difficulties of spraying, blistering and poor flow characteristics, but bearing in mind that this is the safe route with respect to air pollution, research effort is being poured into water-based systems with advances such that these coatings can be applied without blistering at up to 1.5ml dry film thickness and flash-off times before

stoving are being reduced. It is now possible to flow or roll coat emulsion systems, and in the United States the wood panel board industry has used emulsion systems for many years on exterior finishing; the cement asbestos industry uses emulsion systems almost exclusively, and metal coil coating lines are now turning to emulsion-based finishes. In performance, thermosetting systems are highly durable, bearing in mind that their high molecular weight gives these polymers an advantage in terms of performance.

Finally, operating costs using emulsions systems may well be above average. For example, where bell electrostatic spraying equipment is used, it is likely that conversion to a disc may be necessary to spray electrostatically. Further, there may be problems in earthing electrostatic spraying which could add to cost. In terms of raw materials, the emulsion system could be higher at least in the near future but with increasing solvent costs, greater adoption of these systems could cause a reduction in general raw material costs. The problem of energy for the oven, because of the high heat of volatilisation of water can be offset by the higher solids of water-based systems and there may be a necessity for zoning in ovens to prevent blistering and mud cracking. Some slowing of production lines might be involved, again adding to operating costs, and this must be considered as a disadvantage in these ecologically safe systems.

For water-based colloidal dispersions, the rating under ecology is above average or very good, the ease of application is just below average, the performance good, investment below average and the operating costs above average. These dispersions can be considered about the same as emulsions regarding ecology, but they have better application properties. They will not match the performance of emulsions in most cases, but where the performance is adequate for the end use, the application properties should be some mitigation. The

colloidal dispersions have better gloss than emulsions, but their cost on a raw material basis could be considered slightly higher although advantages in application may well cancel out this additional cost.

For water-soluble coatings, the rating under the heading ecology is above average, ease of application above average, the performance is below average, the investment below average, and the operating costs above average.

Although solution polymers in water are free from air pollution, in some cases, use of the co-solvents necessary with these polymers may cause problems, particularly with the specific legislation in certain areas in the United States. (Rule 66).

The application rating gives the best of all of the water-based class. Performance and durability are less than the other two water-thinned systems, so that whilst best gloss and application properties are obtained, this will be at the expense of durability and performance. The investment and operating costs are essentially the same as for the other water-based systems discussed.

In summary, three routes have been outlined by which the water-thinned industrial systems can be used to obviate ecological and pollution legislation, and whilst none of these three systems represents an ideal either on application, performance or cost at the present time, there is no doubt that these current problems will be eventually overcome or minimised and that in the very near future the paint user will be able to switch to water-thinned systems with sure confidence that pollution will be minimal and safety and environmental protection upheld.

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The role of non-aqueous dispersions

By M. J. Waghorn

ICI Limited Paints Division, Wexham Road, Slough, Buckinghamshire

Summary

The contribution which can be made by non-aqueous dispersions to the reduction of the amount of objectionable solvents discharged into the atmosphere is considered. Their advantages over con-

ventional solvent-based paints has accelerated their adoption in the USA. These products may be used in existing plants with little or no process modification.

Keywords

Types and classes of coatings and allied products
non-aqueous dispersion

Processes and methods primarily associated with manufacturing or synthesis

air pollution control
pollution control

Le rôle des dispersions non aqueuses

Résumé

On considère la contribution à la diminution de la quantité de solvants nuisibles dégagée à l'atmosphère que puissent mettre en évidence les dispersions non aqueuses. Leurs avantages en comparaison avec les peintures traditionnelles à base de solvants

ont accéléré leur réception favorable aux U.S.A. On peut utiliser ces produits aux installations actuelles après peu ou aucune modification du procédé.

Die rolle nichtwässriger Dispersionen

Zusammenfassung

Betrachtungen werden angestellt über den möglichen Beitrag, den nichtwässrige Dispersionen zur Minderung der Mengen unangenehmer, in die Atmosphäre entlassener Lösungsmittel leisten können. In den U.S.A. haben deren Vorteile gegenüber

Lacken auf Lösungsmittelbasis ihre Adoption beschleunigt. Produkte dieser Art können in bestehenden Anlagen mit nur wenig oder keinerlei Verfahrensänderungen angewandt werden.

The increasing concern during the last few years about atmospheric pollution has caused both manufacturers and users of organic coatings to think about ways of reducing the contribution to the total pollution level from this source. Although this contribution amounts overall to a very small percentage of the atmospheric contaminants generated by industry as a whole, there can well be local concentrations of harmful materials in the vicinity of plants where finishing is carried out on a large scale, for example in car finishing operations.

substantial quantities of expensive esters, ketones, and/or other oxygenated materials.

The other approach is to formulate with larger amounts of non-polluting aliphatic hydrocarbons which are cheap and available in a variety of boiling ranges and evaporation rates. Their use in solution paints based on conventional resins is limited by the low tolerance of such resins to aliphatics, and the high viscosity produced by the incorporation of such "slow-cutting" materials in the solvent mixture. The case is completely altered, however, if aliphatic hydrocarbons are used as the main component of the continuous phase for a non-aqueous dispersion (NAD) of the same resin.

The advent of Rule 66 in Los Angeles County (and the broadly similar Regulation 3 in San Francisco) brought matters to a head, and means of reducing levels of polluting solvents had to be found quickly by paint formulators in order to conform to the new restrictions. Few people need to be reminded of the qualitative requirements of Rule 66, but in summary it limits the total olefine content of the paint solvents to 5 per cent; aromatics with eight or more carbon atoms, for example xylene, to 8 per cent; and branched chain ketones, toluene, ethylbenzene and trichlorethylene added together to a limit of 20 per cent. All these percentages are volume fractions of the total volatile matter and the total fraction of all three classes added together must not exceed 20 per cent.

As an example, consider the thermosetting acrylic type of car finish used extensively by the motor industry. The tolerance of the resin system to aliphatics is low, and such materials are usually supplied in a xylol/butanol mixture and thinned with xylol/toluol/higher aromatic mixtures before use. By Rule 66 these are highly polluting. Using the "Dispersymer" technology developed by ICI Paints Division, the same resin can be prepared as a non-aqueous dispersion in aliphatic hydrocarbon resulting in a product in which a substantial part of the resin is in a stabilised suspension. The aliphatics are now being used deliberately for their non-solvent properties. It remains for the total solvent mixture to be formulated so that it contains some solvents for the polymer such that when the aliphatic non-solvents evaporate, swelling and coalescence of the dispersed particles occurs to give a continuous paint film. For this purpose esters and/or ketones are more effective than aromatic hydrocarbons, being stronger swelling and coalescing agents than the latter. Hence it is a mixture which can easily be adapted to conform to Rule 66 and offer several other positive advantages in application properties.

These regulations were drawn up with the expressed purpose of reducing smog formulation in the particular climatic conditions existing in these two American cities, and the detailed restrictions are placed, therefore, on those chemical structures which can be photochemically oxidised to yield smog-forming nuclei. There is a school of thought which says that unless similar climatic conditions exist elsewhere the provisions of Rule 66 are not applicable. Furthermore, Rule 66 does not restrict some solvents which are known to be hazardous to health, such as benzene and methanol, the use of which is often restricted by a clause in the paint user's specification. In spite of the very specific objectives for which it was drawn up, however, Rule 66 is very likely to be used as the starting point when other authorities are considering the pollution problem, and regulations of this type are likely to be seen in Japan and possibly in some heavily industrialised regions of Western Europe. Comments from investigators in the USA that these smog-forming nuclei can also be responsible for eye irritation and damage to vegetation and building structures, tend to reinforce the view that elimination of solvents restricted by Rule 66 must be a step in the right direction.

This type of NAD is now used in large quantities by the motor industry and a version to accommodate Rule 66 is used extensively in the USA. The other properties of NAD systems, that is full build in two coats, rapid viscosity increase as the suspension changes to solution (giving excellent control in metallic finishes and resistance to sagging) and fast release of the non-solvent aliphatics, are all highly desirable features in their own right.

From the paint formulator's point of view the obvious major change required in solvent-borne finishes is to reduce the aromatic content of the solvent mixture to a low level. Aromatics are used in large quantities in conventional solvent-borne industrial finishes because of their cheapness and the fact that the resin systems used are easily soluble in those materials. To replace the aromatic solvents (for example toluene, xylene and higher aromatics) by other solvents for the resin is one possible route which involves the use of

From the quantitative point of view, this type of system offers much potential. With current formulations, the presence of dispersion polymer allows faster throughput with conventional spray equipment and this can lead to more effective utilisation of paint solids. Paint savings of 20 per cent are possible by careful control of application parameters and this in itself leads to a reduction in the amount of volatile matter being discharged. Further improvements in application solids are almost certainly possible by adapting the technology to provide even higher proportions of dispersed resin, so that the required application viscosity is reached with less thinning solvent. Where solvent-borne systems are concerned, therefore, NAD technology has obvious advantages for meeting any future pollution requirements.

The major factor in the speed of adoption of NAD finishes has undoubtedly been the fact that they fit directly into existing customer process schedules and facilities without basic modifications. This has been of great value in the USA

where Rule 66 formulations have been adopted with the minimum of expenditure on plant alterations and paint costs.

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The view of the user

By A. J. Ellis

Smart and Brown Engineers Ltd., Trading Estate, Spennymoor, Co. Durham

Summary

The production, ecology, economy and efficient application of paint finishes with reference to powder coating, electrostatic

spraying and electrodeposition are described and discussed from the point of view of the large industrial user.

Keywords

Types and classes of coatings and allied products
powder coating

Processes and methods primarily associated with:
manufacturing or synthesis

air pollution control
pollution control

application of coatings and allied products

electrocoating
electrostatic coating

L'avis de l'utilisateur

Résumé

Au point de vue de l'utilisateur important, on décrit et discute la production, l'écologie, l'économie et l'application efficace des

peintures à l'égard de revêtements en poudre, de pistolage électrostatique et d'électrodeposition.

Die Ansicht der Verbraucher

Zusammenfassung

Von Standpunkt industrieller Massenerzeugung aus werden Produktion, Ecology, wirtschaftliche und wirksame Anwendung

von Lacken, elektrostatisches Spritzen und Elektrophorese beschrieben und untersucht.

As substantial users in the field of domestic appliances and fluorescent lighting the author's views cover a fairly large area of industrial finishing. In fact, in the domestic appliance field some 60 000m² are coated per week and one million square metres per week in the fluorescent fitting activity. Needless to say, the most important user as far as volume is concerned will be the motor industry, but broadly speaking the processes are similar and no doubt most of this talk would apply to both industries.

Fabricators in this particular field must satisfy in turn the end user and in order to achieve an acceptable and durable finish there are many problems to overcome. The housewife has today a very large array of almost lethal "paint removers" at her disposal, ranging from wire wool through the range of various liquid soaps and automatic dishwashing and clothes washing materials to the caustic oven pad and this she will not hesitate to use on any paint finish to remove offending stains.

The problem, therefore, starts with an acceptable and durable finish. In the past it was possible by means of brute force and high cost materials to apply substantial paint finishes, but over the years it has been necessary to "cut the cloth" and apply the minimum acceptable thickness of finish. This, in turn, has been affected by the steel supplier who provides a wide range of finishes to the steel and, in many cases, steel is received oiled up with a material which is extremely difficult to remove. This, together with the materials applied and impacted during pressings and drawings gives further problems in the pre-treatment part of the finishing process. Over the years, most companies have installed fairly elaborate and expensive pre-treatment and paint plants, generally, consisting of spray degreasing, spray rinsing, spray phosphating, drying prior to applying a "wet-on-wet" white paint finish with a solvent base. The same remarks apply to the large domestic appliance plants in the USA and on the Continent, and a problem arises from the natural reluctance



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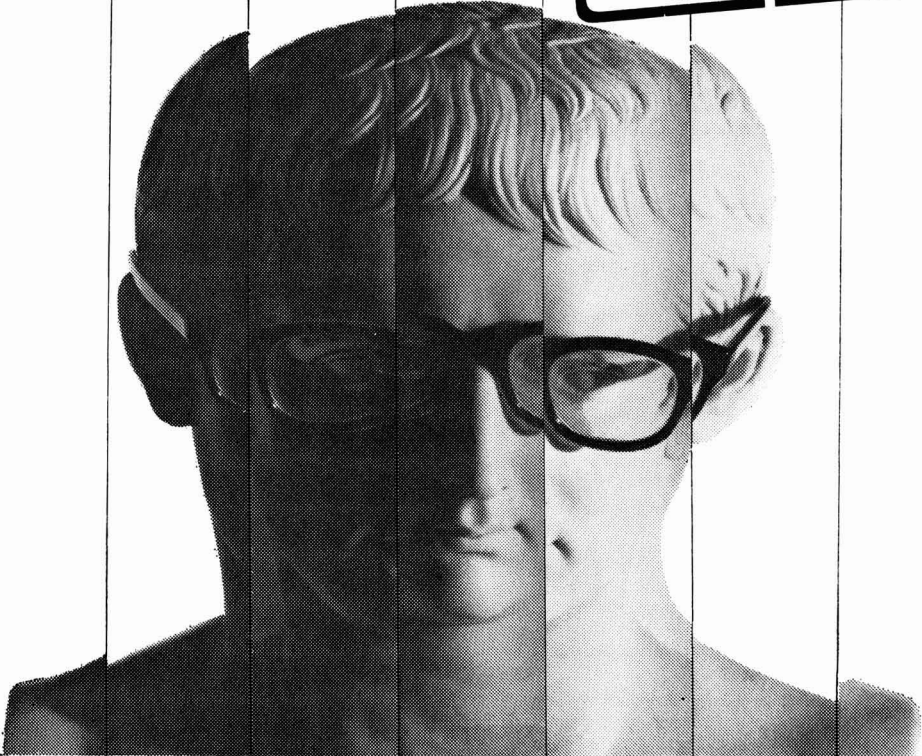


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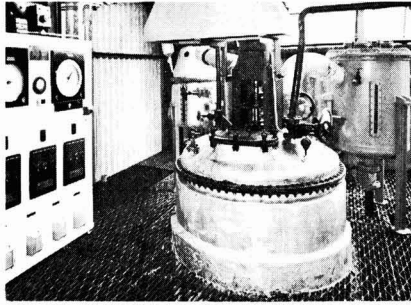


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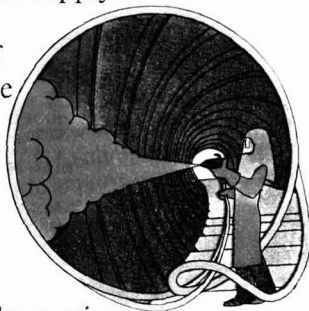
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of the producer to scrap his plant and look at the more modern methods of applying a finish coat.

The first thing which came to mind, naturally, was the effluent problem particularly in Britain where not so many years ago, apart from a few isolated places, river authorities could not make much impact on the type of effluent which was discharged from production units and, in fact, it is only now that the Anti Pollution Acts are being invoked and large companies are being made to introduce effluent treatment on a large scale. In this country, it will be some time before the effluent discharged from large plants can be classed as satisfactory. This was appreciated by the author's company in 1967 largely due to the fact that the local authorities were introducing a new sewage treatment plant and this coincided with the local Water Board increasing its prices by a factor of three. (The reason for this increase being water shortage in the area and the new Derwent Dam coming into operation.)

At that time a total of 800 000 gallons of effluent per day was being discharged from the site through the local sewage system and at that stage little attention had been paid to treatment other than allowing it to flow through lime pits to ensure that at least the pH value was correct. By introducing an effluent treatment plant it was possible to recirculate and recover water and reduce the discharge to 120 000 gallons per day. Most important of all, the liquid so discharged was of drinking water quality and continues to be so today. The cost was high but the savings enormous. In addition to the water saving, there was recovery of nickel salts and by the introduction of ultra-filtration, paint which was returned to the electrophoresis plant.

As already mentioned, there are many firms throughout the country who do not pay sufficient attention to the effluent problem. Some years ago in America, and largely because of the problems in California, the word "smog" was invented. Authorities began looking at the atmospheric pollution from paint units and, as a result, after-burners were introduced to reduce atmospheric pollution from that source. Naturally, this is a palliative and does not satisfy the real need.

This is where the paint manufacturers' particular expertise began to make itself felt in producing new paint systems. New paint systems are all very well for expansion projects and newcomers into paint finishing trades, but not for the manufacturer with a large and expensive pretreatment and electrostatic solvent-based paint plant, which was for many years considered the ultimate in paint application and, in fact, has produced and will produce for many years acceptable and durable finishes.

Some eight years ago a search was made for a means of reducing costs of paint application and it was felt that the electrophoretic method of applying, at least, a primer coat would assist materially in cutting costs. In addition there was a possibility of applying a white finish coat by this means. Many agonising problems have arisen, however, with this type of application, but a commitment had been made and the issue had to be pursued. In retrospect, this was the correct course but in the early days, neither did it produce an acceptable undercoat nor did it cut costs. Needless to say, by constant endeavour and application to the plant a satisfactory undercoat was obtained and the electrostatic application of a solvent-based acrylic top coat became possible.

Although there is no atmospheric pollution with an electrophoresis plant, it soon became evident that there was a major effluent problem, and as recirculated water was being used,

problems which had not been foreseen took much longer to solve. Sufficient to say, the electrophoretic priming coat with a light grey finish is very satisfactory. It is extremely difficult to remove. The economics were only corrected after the introduction of an ultra-filtration plant. Many problems were experienced with modules and the very sensitive, very fragile material used punctured frequently, rendering the system inoperative. Fortunately, this has now been rectified and as a result application of the priming coat by electrophoresis is now at an acceptable cost level.

Coincident with obtaining the priming coat, a pilot plant has been working on a white material and it seems certain that with assiduous attention to this plant, a satisfactory white finish coat will be obtained. In this respect, most US manufacturers have been experimenting with and using electrocoat and, at least, one company is producing parts for an air-conditioning plant in white with this type of application. One advantage which should be mentioned is the fact that by electrocoating, every nook, cranny, sharp edge and recess on the parts receives an equal paint thickness and in the early days these manufacturers experienced the same problems as the author in using an anodic system. There is always some iron migration from the surface of the steel to the paint finish and with white finishes this shows up as red streaks. The solution to this problem lies with attention to formulation of the cleaners and the use of zinc phosphate.

The white system uses extensive pretreatment plants prior to a zinc phosphate coating. It is claimed that the one-coat finish on certain parts of equipment is acceptable and extremely durable. In the author's opinion, this method gives much better results than he can report.

Electrocoat, therefore, has a great future and it is visualised that it will necessitate a sophisticated pretreatment plant and the "know-how" will probably have to be imported from America, as UK companies engaged in this part of their trade do not seem to be applying themselves sufficiently to the problems involved. Perhaps too much emphasis is being put on this point as the users may be at a similar stage in the game.

After pretreatment, with the amount of work which has been put into the electrocoat system, it is likely that a cathodic system will be preferred because, due to the different electrochemical reactions, there will be no dissolution of iron on the cathode, thus eliminating staining; no oxidation of the film occurs, since hydrogen is produced at the cathode. Thus some of the major electrocoating problems have been solved.

Coincident with this, there are probably one or two rinsing stages after the electrocoat deposition, de-ionised water will be used, but it is believed that recycled water might possibly be used in the first rinse tank in place of the costly de-ionised water, in which case the rinse water could be recirculated through a Dorr-Oliver or similar ultra-filtration system to complete the cycle, and this would give an ideal non-polluting system either as a liquid effluent or a gaseous discharge.

Great emphasis is being placed today on powder coating application and arising from satisfactory results which were indicated some two years ago it decided that the next major plant to be installed by the author's company in one of its factories would be one for the application of powder coating. In view of the many problems experienced with the introduction of the electrocoat, it was decided at the outset that this plant would process zinc-coated material only, and

the plant now operating is capable of processing 6 000m² on Zintec coated steel. This large plant comprises a trichloroethylene degreasing unit and a 12-gun powder coating reciprocating system feeding directly into a direct gas-fired oven. This plant has been in operation some eight months and is now producing an acceptable and durable finish. At the moment efforts are being made to improve the gloss and it is thought that higher gloss will be obtained in a very short time. There is no doubt that this plant is the best from a shop floor point of view. It is the cleanest and least troublesome of all the many systems on the site. There are no effluents nor atmospheric pollution problems other than the burning of propane gas in the drying oven.

Looking into the future, a new installation is envisaged which will have a fairly sophisticated pretreatment plant with a zinc phosphating system prior to the electrocoat. The effluent, naturally, from this plant will require to be treated. It is felt that either of the two systems previously described should be acceptable.

At this stage it is important to indicate a resurgence in the thinking on the standard electrostatic method of applying a finish. The suppliers of plant and materials are now providing a water-reducible material. There are many problems using this, but they appear to have been solved by the use of paint containers and by all the necessary lines being satisfactorily insulated to satisfy the high voltage requirements of this method. At this stage care must be taken when making any comment on this method as it could be a last despairing throw, but there is ample evidence to indicate this is an achievable process. Again, as it is water-reducible, there are obvious stoving problems and still some form of atmospheric pollution.

In conclusion, some remarks may be made on the economies of the various systems and in this respect only material costs

will be considered as each plant has its own particular problems and system of application. Probably the cheapest form of paint application, paint dip, should be taken as a basis. A satisfactory one-coat grey or probably white self-etch finish coat material costs 2.8p per square metre and a two-coat finish, one coat an electropainted priming coat grey, the other electrostatically applied white, 4.86p per square metre. This latter type is a well established finish and the costs of material are reasonably accurate. Application of white epoxy powder single-coat acceptable and durable finish costs 6p per square metre. It should be appreciated that the application of this modern material is at an early stage of development and thinner coatings and price reduction to approximately 4p per m² can be expected within the next 12 to 18 months. All the above are based on present day prices.

Finally, attention should be drawn to a problem which all plant users have and that is jig stripping. Jig stripping, in general, has been carried out by the dangerous and expensive chemical stripping method or by piling the jigs in a heap and pouring paraffin over and igniting it with consequent distortion of the jigs and problems associated with this. A device has been developed and used recently which burns off the jigs very satisfactorily; it consists of a furnace capable of receiving the jig; the furnace is started by direct gas flame, and once the paint is ignited the gas is cut off, then an after-burner comes into use immediately and consumes the smoke and particles, the resulting residue in the bottom of the furnace being virtually pure titanium pigment, plus some carbon, which after calcining can be used again. By this method only a small number of additional jigs is required, and a continuous recycling and processing through the furnace maintains jigs in a satisfactory condition.

[Received 6 May 1974]

Discussion

DR K. G. REED asked whether there really was a problem as far as hydrocarbon emissions were concerned. There certainly was in the USA due to photooxidation, but this did not apply in Europe. The quantity of atmospheric aromatic solvent in this country was at present only about 20 per cent of the permissible figure, and a practical approach to the situation was required.

MR N. KLOOS said the problem varied according to which solvent was involved. In the case of aromatics, the maximum allowable concentration was 200ppm. It would be complacent to assume that even this lower limit was entirely safe if maintained for prolonged periods.

MR D. J. T. HOWE commented that the figures usually quoted in this country referred to mean threshold limit values (TLVs), and comfort levels ought to be considered; for example, a substance might smell unpleasant at its TLV, in which case it should be reduced. Solvents only provided problems where accidental large doses occurred locally. Reducing such losses was becoming more a conservation than an environmental problem. Work was currently proceeding in an effort to discover which industries were responsible for wasting these increasingly valuable products.

DR G. DE W. ANDERSON agreed with Mr Howe that comfort rather than toxicity was the significant factor in solvent emissions.

DR L. A. O'NEILL thought it seemed probable that the main atmospheric pollution problem with paint arose not from solvent emissions but from breakdown products formed during the stoving operation which gave rise to the "burnt paint smell." With the possible exception of the epoxy cured polyester type, powder coatings would produce decomposition products. The widely used water-based electrocoat paint could give rise to very unpleasant odours, and so also could non-aqueous dispersions (NADs).

MR KLOOS then stated that the powder coatings based on addition type resins had a non-volatile content of about 99 per cent and did not release significant amounts of breakdown products.

MR M. J. WAGHORN said that the breakdown products of NADs were similar to those of the more conventional products but that the reduction of aromatic solvents did provide a much better working environment.

MR J. SPARROW replied that the presence of amines would certainly contribute to any smell produced, but in terms of the products under discussion it should not be strong.

MR HOWE commented that a report on the subject had recently been issued. Only recently had there been any hazard but complaints from the public due to the smell nuisance were increasing. Many industries were involved, including the paint industry. Measurement and classification was difficult, and the PRA were currently involved in this area with respect to paint and the Department of the Environment required much more information on the subject.

The toxicologist was more concerned with poisonous substances than with bad smells. Nevertheless, unpleasant smells were a real problem which had to be tackled.

DR ANDERSON very much hoped that the work of the PRA would identify the various paint smells. Local authorities were likely to object to smells, and the problems could easily become over-emphasised.

MR HOWE stated that the processes covered by the Alkali Act were constantly increasing, and paint processes might well be added to the list. This could well prove to be an advantage for the industry.

MR R. J. KING said it was expected that there would be legislation covering total emissions, but this had not so far been forthcoming. Local effects were troublesome where paint users were in areas of high population density and the three main types of objectionable smell were acrylic and oxidative smells and those of the isophorone type. Two questions to arise were concerned with methods which the PRA could offer to industry as a means of preventing obnoxious fumes from stove ovens and whether local effluents were more problem than atmospheric pollutants.

DR O'NEILL thought that practical support from industry was necessary. Sample collection techniques had been developed and gas chromatographic analysis was proving successful. Information on specific problems was being sought by the PRA, so that investigations could be made.

DR ANDERSON asked how serious the problem was with stoving ovens and whether delegates had any examples to quote.

DR P. SEWELL replied that a serious problem existed at a large local factory applying automotive wheel finishes. The process gave rise to very unpleasant smells, and there were many complaints. Improvements in both plant and paint supplies were being urgently sought. The use of after-burners to eliminate the "burnt paint" smell would be impractically expensive and this was not necessarily the answer to the problem.

MR D. KERRISON said it must be stressed that electrophoretic paints represented only a small proportion of the total water-based outlet, and not all suffered from the drawbacks of the electrocoat materials, namely amine emission, maleinised oil breakdown, and so on.

On the assumption that too much legislation was undesirable, he asked Mr Waghorn's opinion on the subject of flash point regulations. The amendment to Rule 66 which allowed 20 per cent solvent in formulations seemed to suggest a compromise until suitable water-based systems became available.

MR WAGHORN replied that NADs were not sold only because of the pollution aspect, although this was, of course, important. Flash point regulations had to be related to the user's overall requirements, and the user would equip himself to cope with low flash materials. Formulations could be modified to produce high flash NADs. In fact, some countries had already introduced high flash requirements for these products.

MR F. D. TIMMINS thought that the problem was obnoxious products. There was no general problem with atmospheric pollution, but solvents created bad working conditions in

workshops and other enclosed areas. The products under discussion only had limited fields of application. He suggested that water-based materials might replace the conventional coatings on railway vehicles, bridge structures and similar uses. Powder coatings appeared to be useful only on relatively small components. It seemed probable that solvent-based coatings would continue to predominate, but under stricter control. The inevitable price increases would have to be accepted as a fact of life, and it was doubtful whether the much-publicised raw material shortages really existed. It was useless to envisage a brake being applied to the usage of any raw material, as human ingenuity would continue to come up with suitable alternatives.

MR HOWE said that the Department of the Environment was not likely to place any restriction on the usage of white spirit, which was likely to be used in many of the applications mentioned by Mr Timmins. Raw material shortages were indeed very serious, contrary to his opinion, and much higher costs would also be involved. There was no doubt though that alternative materials would be found. In answer to Mr King's second question, the small amount of atmospheric contamination which occurred was soon diluted, apart from small pockets of concentration. The aqueous environment, on the other hand, did not necessarily dilute toxic substances, which could be concentrated in organisms, for example, mercury in fish.

MR SPARROW remarked that water-based acrylics were already being used in rolling stock finishes.

Further to Mr King's comments on acrylic smells, there was no doubt that the propionate contaminants were a problem, although there was no health hazard. The problems were being tackled and the degree of success indicated by the usage of certain water-based coatings on direct contact food packaging papers. The demands of the paint industry would also be met, but at a price.

MR KLOOS stated that pyrolysis occurred during the stoving of water-based coatings. Ovens and after-burners were expensive, and the only long-term solution to the smell problem was the use of powder coatings and of water-based materials.

DR ANDERSON commented that the subject had returned to smells, and the two areas of discussion were now (a) stoving ovens, and (b) waste disposal and effluents.

MR D. E. HOPPER said that during the stoving process, pvc organosols produced the most objectionable smell. Alkyd-melamine systems came next. From the operative's point of view, acrylics and silicone polyesters were not troublesome.

In residential areas, complaints about atmospheric pollution predominated, whereas in industrial areas effluent problems assumed greater importance. A more uniform approach was required. Up to the present time, aqueous coatings had involved many problems during application, thus making a labour-intensive industry even more costly.

MR H. J. GRIFFITHS said that with reference to the identification of smells, presumably, there were plants where only one product was handled, thus allowing the emission to be studied in isolation. On the subject of powder coating costs, Mr Ellis's paper quoted product costs per unit area only. It might not be strictly fair to use these for making comparisons with electrodeposition and other paints, when application costs were a major proportion of the total finishing cost.

MR ELLIS replied that the costs quoted were for powder at 500 microns film thickness. It was very difficult to provide an application cost, as methods of application varied considerably. Certainly, powder coatings were most effective in hiding blemishes and defects in substrates, being superior to conventional electrostatic paints in this respect. Powders also showed an improved wrap-round effect, and reduced labour costs accordingly.

MR KLOOS thought it was possible to apply as little as 5 microns of powder, and the range of coating thickness available made possible optimum utilisation of the product.

DR P. R. SEWELL said that his company's problem involved a plant where one product was handled, as mentioned by Mr Griffiths. This was for an electrophoretic dip paint, which was used to paint car wheels. Analysis of the paint revealed one ingredient which was largely responsible for the smell produced on stoving. Reformulation had largely overcome the problem, thus supporting the view that the paint manufacturer and not the user should accept responsibility.

MR F. ARMITAGE asked how the performance of polyester powder coatings compared with the best acrylic powders. The concentration of Mr Kloos on the polyesters was not justified by their comparatively low usage relative to the acrylics, particularly in Japan and the USA.

MR KLOOS replied that in Europe some twenty times more polyester powder was used, compared with acrylic powders. Polyester gave superior durability and flow, less odour and equal gloss.

MR D. D. KAYE commented that the use of aqueous paints in a water-wash spray booth would give rise to the problem of sludge removal. It was difficult to see how this could be overcome, remembering that each booth contained 2 000 gallons of water.

The water-based systems mentioned in Mr Sparrow's paper contained solvents which would be released to atmosphere. The examples given were all more toxic than ethyl cellosolve.

MR SPARROW said a water-wash booth should not be used with the water-based systems under discussion.

MR KING remarked that it should be possible to use an additive in order to precipitate the water-soluble paint.

MR KERRISON said it was probably unfair to classify specific polymers as being malodorous, since operatives would normally accept odours over a period of time which were originally thought to be unacceptable. For instance, certain acrylic-based inks which were initially unacceptable were now used in food packaging applications.

MR BURGESS said that UK standards differed from those of the USA, and the water-based and powder coatings were still at an early stage of development. There was little incentive at present for manufacturers to reduce pollution levels when end users did not wish to pay the appropriate price.

DR SEWELL stated that the incentive to conform to acceptable levels of pollution would be by way of enforcement by HM Inspectorate of Factories.

MR KLOOS commented that one German company had been closed down because of pollution problems. The adoption of powder coatings overcame those problems and had also provided a cheaper process than had the original solvent-based system.

DR ANDERSON, in summary, said the discussion had been wide ranging and indicated that the problem of atmospheric pollution had to be tackled by all concerned, and not just by the paint manufacturers.

Whatever the basic problem, it was not toxicity. Rule 66 was not really relevant in this country. Cost increases were an important factor, and helped to justify a loss prevention programme. The use of water-based materials was very attractive in this context. No real conclusions had been reached on the problem of smell emission, where the circumstances would vary from location to location. The various contributors had discussed their own products, all of which were originally developed for their inherent qualities, rather than as an answer to the pollution problem.

It appeared that the most relevant problem for the industry was that of waste disposal; for example, the disposal of the precipitate from the water-wash spray booth.

The future for wood: a look towards 2000*

By J. Maddern Harris

Forest Products Division, Forest Research Institute, Rotorua, New Zealand

Summary

There are many reasons for the continued use of wood in the foreseeable future, but there are also many features of wood that must be improved to make it more competitive with man-made materials. The trend towards greater use of reconstituted wood can be expected to continue, and economic pressures will force

radical innovative processes on the rather conservative timber industry, particularly in the fuller utilisation of what are currently "waste" materials—bark and lignin. The perpetually renewable ligno-chemicals should be prepared to take over from petrochemicals to provide new materials.

Keywords

Types and classes of structures or surfaces to be coated

composition board
timber
wood
wood product

Processes and methods primarily associated with surface preparation before coating

wood stabilisation

Les perspectives pour l'industrie de bois: un coup d'oeil vers l'an 2000

Résumé

Il existe plusieurs raisons pour lesquelles à l'avenir tel que l'on saurait prévoir on continuera à utiliser le bois, mais il y a certaines caractéristiques que l'on doit améliorer afin qu'il soit prêt à offrir de meilleure concurrence aux produits synthétiques. On saurait s'attendre à ce que la tendance à l'emploi augmenté de bois aille continuer, et à ce que les contraintes économiques aillent imposer

des procédés novateurs sur l'industrie de bois, encore assez conservatrice, surtout en ce qui concerne la meilleure utilisation des déchets tels que l'écorce et la lignine. Afin de fournir de nouveaux produits, on doit assurer que les substances lignochimiques, issues des sources toujours renouvelables, soient disponibles pour remplacer les substances pétrochimiques.

Die Zukunft von Holz: ein Blick nach dem Jahre 2000

Zusammenfassung

Viele Gründe sprechen für die weitere Anwendung von Holz in der voraussehbaren Zukunft, viele Besonderheiten von Holz erfordern jedoch auch Verbesserungen, um es gegenüber Kunststoffen konkurrenzfähiger zu machen. Es steht zu erwarten, dass der Trend in grösserem Umfange Holz in rekonstituierter Form zu verwenden, anhalten wird; ebenfalls, dass wirtschaftlicher Druck

der ziemlich konservativen Holzindustrie radikale innovative Verfahren aufzwingen wird, insbesondere zur volleren Ausnutzung von noch als "Abfallstoffe" betrachteten Materialien—Rinde und Lignin. Die ewig erneuerungsfähigen Ligno-Chemikalien sollten so zubereitet werden, dass sie zwecks Entwicklung neuer Stoffe die Rolle der Petro Chemikalien übernehmen können.

Introduction

Foresters and scientists concerned with research on forest products are more accustomed to looking into the distant future than are most producers of biological raw materials. Long-term planning is essential for an industry in which it takes anything from 20 to 100 years for a new crop of trees or a new silvicultural concept to come to fruition. For this reason, it is obviously essential that when planting new forests, selecting suitable species, and deciding on appropriate growing regimes, there should be a clear idea of what kind of wood should be grown and for what end use.

Indeed, the first question to be answered must be "Why should wood continue to be used in the future?" Enthusiasts for wood will point out its general attractiveness, and will maintain that customer demand for fine woods in furniture, panelling, and so on will continue for many years. This will, of course, account for only a small part of total wood usage, but it is an important and critical part for the surface coatings industry. For other uses it seems certain that the very diversity of the various species of wood and types of wood products

available, together with the ease with which they can be handled, cut, fixed, and joined, will ensure the continued use of wood in one form or another.

In a world increasingly conscious of environmental matters, and increasingly aware of the need to conserve raw materials, continuity of supply from forests which conserve land, protect water supplies, and provide for recreational needs, must also be regarded as features that will favour the continued use of wood. It is one of the world's few continuously reproducible resources, and its production generally enhances, rather than detracts from the environment.

On the other hand, if wood is to remain a "competitive material, it is essential that more attention be paid to those features which are disadvantageous as compared with metals, plastics, and other possible substitutes. Among these technical drawbacks of wood can be included its variability and less predictable properties, its lack of durability—apart from a few exceptional species—and its dimensional instability. Even more important, perhaps, are the high labour costs of conventional methods of using wood in buildings, the high

*Presented to the Auckland and Wellington Sections at their July 1973 Convention, Wairakei, New Zealand.

maintenance costs of wood in exterior use, and the waste of raw material involved in producing sawn timber, plywood, chemical pulp, and many other wood products, for which conversion rates from growing timber to primary product often amount to less than 40 per cent.

These are the areas in which the author predicts that economic pressures will force changes to occur. It is proposed, therefore, to examine some of the responses that are possible and to guess which are the most likely to happen between now and the year 2000.

Properties

Variability

Very encouraging results are being obtained by breeding trees with less variable wood properties. This is a fascinating story on its own but, in most countries, there is no possibility that improved tree strains will have any significant effect on timber production before the year 2000. What will happen is that the inherent variability of wood will be minimised by greater use of non-destructive testing methods such as machine stress grading, so that much of the wood used for structural purposes will have predictable performance. The use of ultrasonics and X-rays has also been mentioned in this connection.

One of the major sources of variability in utility woods, such as pine, are the knots that arise from unpruned persistent branches. Modern silviculture of fast-growing species, such as the radiata pine grown in New Zealand, aims at producing a considerable volume of pruned (knot-free) wood. Consequently, from 1990 onwards, there should be an increasing supply in New Zealand of that rarest of commodities today—clear, knot-free wood from young, man-planted forests.

Durability

With modern methods of wood preservation, sufficient timber species can be made resistant to attack by fungi, insects, or marine borers to ensure that lack of natural durability is no longer a major problem. However, current research is seeking alternatives to filling the wood with poisons such as arsenic, copper, or chromium salts. Instead, attempts are being made to reduce the nutritional status of the wood, by removing essential food elements, so that wood pests cannot attack it. Treatment with ammonia gas during kiln drying and cyanohydrate have both shown some promise in this respect.

Dimensional stability

Some progress has been made towards stabilising wood by impregnation with monomers, such as styrene and methyl methacrylate, which are cured by radiation polymerisation, but so far no process shows promise of economic large-scale application. The complexities of wood micro-structure and the economics of wood impregnation may well continue to frustrate these developments, so that it may be more logical to turn to re-manufactured wood board products for applications where dimensional stability is essential.

Need for new products

There are other reasons for looking towards radical technical innovations in the field of remanufactured or reconstituted wood products. The economic pressures on foresters to

produce wood more cheaply, and to use more of what they produce, will tend to reduce the time allowed for trees to grow before they are harvested. For example, in New Zealand, the Forest Service is required to apply rates of compound interest of at least 7 per cent to the costs of all forest operations from the time of land clearance until final harvests. Even under these constraints, pine forestry can produce handsome profits because growth rates as high as 400ft³ per acre per annum are not uncommon on average-to-good forest land, and forest rotations can be reduced, therefore, to 25 years, or even less for some end uses.

These economic considerations alone will favour increased production of reconstituted wood products. As forest rotations become shorter, log sizes will decrease even though efficient silviculture may offset this to some extent. In any case, it is to be hoped that new developments in logging will improve total wood usage by picking up a higher proportion of the small-diameter material now left in the forest. Sawing is a wasteful and often uneconomic way of converting such small material, whereas it can be converted efficiently into reconstituted wood products, which form the fastest growing sector of the timber industry.

According to FAO statistics, the ratio of solid wood to reconstituted wood used in the world was 4 to 1 in 1960 but had dropped to 2 to 1 in 1970. Board products have the advantage that they can be made in large dimensions with uniform properties. They also have superior dimensional stability, and large areas can be fixed in position with low labour costs. Thus, although sawn timber improved by new-look forestry and modern technology will hold many of its markets, there are good grounds for believing that the real innovations will come through factory production of factory-finished prefabricated building components made largely of reconstituted wood products.

“Synthetic” woods of many kinds are already available in industrialised countries. Almost all are dependent on petrochemicals for the basic plastic component or for the glues that hold wood particles together. Even the well established particleboard and resin bonded fibreboard require 8 per cent adhesives in their manufacture. Currently this is a costly part of production so that there are obvious attractions to using wood wastes as a source of adhesives if this is at all possible. In fact, two sources of waste material might be used for this purpose on the scale required.

Use of bark

Phenolics derived from pine bark are already in use to a limited extent, for example in the plywood industry. Between 10 and 20 per cent of the volume of pine logs delivered to mills consists of bark. From this waste material yields of phenolics, though variable, can be as high as 70 per cent. For the most part, the phenolic compounds are in the form of highly polymerised condensed tannins, which are largely insoluble in water though they are very readily solubilised in alkali solutions. The use of caustic soda on radiata pine bark, for example, almost entirely separates the condensed tannins from the carbohydrate components; as it is these phenolics which make the carbohydrates in the bark resistant to enzymatic or acid attack, their removal could open the way to total bark utilisation.

At the moment there are several problems in the way of large-scale commercial exploitation of phenol/formaldehyde (p/f) glues derived from pine bark. These include the variability of the product and its shorter than average pot life. However, neither of these problems appears to be insur-

mountable, and prospects look good for large-scale use of bark phenolic resins well before the year 2000.

Use of lignin

Another waste material that has been widely investigated as a source of simple chemicals is the lignin contained in waste liquors from chemical pulping. The prospects for lignin utilisation are perhaps less encouraging than those for bark, but potentially even more rewarding. At present, concentrated liquors from the sulfate, or kraft, process are burnt for the recovery of pulping chemicals and to produce power, so that they are not totally wasted. But for every ton of pulp produced there is something more than half a ton of lignin dissolved in waste liquor. There are also many other organic constituents, including fatty and resin acids (sometimes partly recovered as tall oil) as well as formic acid, acetic acid, and other acids derived from carbohydrates, whose recovery is very difficult. The thioglignin, however, can be precipitated under acid conditions and it proves to be quite reactive. Actually, lignin itself has been used with varying success as the sole binding agent in boards and paper laminates, taking advantage of the glass transition that occurs between 140° and 190°C, depending on molecular weight and moisture content. However, success seems more likely to come from using lignin derivatives as the phenolic ingredients of (more expensive) p/f resins.

The ways proposed for making resins from lignin are many and various. Patented processes involve reacting lignins with epoxides, isocyanates, and animal glues, oxidising them with sodium periodate, reducing with sulfur dioxide, and many other methods, but none has so far achieved widespread commercial acceptance. Another approach is to use hydro-reforming and hydro-cracking techniques which have been so successful in petroleum technology. A great deal of work has gone into this field of research. Without going into details, the best of the processes developed so far, though not yet competitive with production from coal and petroleum sources, has given considerable yields of quite simple phenolic products using reaction times as short as 15 minutes at 450°C and at 2 500 psi. The general conclusion, before the recent increases in oil prices, was that if improvements to the catalysts could raise yields by 50 per cent, or if corresponding savings could be made elsewhere, the process would become economically attractive. The time is obviously opportune to re-examine the situation.

Role of lignochemicals

The utilisation of bark and lignin has been discussed at some length, although these are wood products which, if used at all today, are mainly burnt for whatever power they may produce. The reason for this was to illustrate the point that much fuller utilisation must be achieved if the lignochemical industry is to compete with petrochemicals. The important thing at this stage is that wood, the perpetually renewable resource, should be able to take over wherever possible from the dwindling oil resource, when the time arises.

If reconstituted timber of structural dimensions can be produced from wood and from what are currently wood wastes alone, the next questions to be answered are "What form will these reconstituted products take?" and "What will they be used for?" It is suggested that the answers will lie largely in the field of building, and of housing in particular, mainly industrialised housing, because of the need to minimise labour content and to make most effective use of whatever labour is essential.

Housing for the future

It is difficult to define industrialised housing processes completely, but it is possible to think in terms of component structures, or of three-dimensional modules. Component structures are mainly two-dimensional—wall panels, roof trusses, partitions, floor assemblies, and the like. Three-dimensional modules are essentially box-shaped units that are largely completed in the factory and need only to be connected together at the building site. These concepts are not mutually exclusive. For example, a house built primarily of two-dimensional components might still contain a factory-built three-dimensional "utility core" consisting of central heating system, bathroom, lavatory, and kitchen in which most of the engineering components of a house are conveniently housed and economically constructed.

For repetitive units—small blocks of flats, terraced houses, and town houses—the three-dimensional modules will find increasing applications. But even for the individually designed one-family home, factory-produced two-dimensional components could lead to radical developments and improvements. Rapid acceptance of factory-built gang-nailed trusses and of particleboard provides an early indication of this trend.

The basis might well be a ribbed or corrugated board material, rather similar to particleboard but stronger, formed by some new development in continuous extrusion. On both faces of this core material, further wood-based board materials with properties engineered to meet their situation would be glued. Exterior walls would have a highly resin-reinforced board on one side to provide shear strength and weather resistance, and a sound-resistant board on the other, both fixed to the core with phenolic resins. Flooring would require the equivalent of a dense particleboard attached to one face of the core only. Non-loadbearing interior walls would employ a much lighter core with sound-proofing faces, and so on. All panels would have uniform thickness, so that designs and fastenings could be standardised. The thickness of the ribs or corrugated material of the core, and the quantity of resins or reinforcing fibres incorporated, could all be modified to meet a variety of strength requirements.

As to surface coatings, there would naturally be a demand for factory finishes too. Interior surfaces would presumably be not so very different from those in use today. In any event, materials such as particleboard, softboard, and hardboard, fabricated under factory conditions and kept dry during site assembly, do not pose many painting problems, and fashion would require that they should be changed periodically. The greatest advances would be required in exterior finishes. The substrate would, perhaps, not be entirely free from dimensional changes, but could be a considerable advance on existing materials—lying somewhere between the tempered hardboard and plastic laminates used today. It would be uniform in texture and free from blemish.

The author believes that wood in one form or another will long continue to provide a substrate for surface coatings; solid wood and decorative veneers will continue to be used, even though they will become increasingly expensive; utility timbers, such as pine, will remain moderately priced and will improve due to modern silviculture and improved technology; and the biggest changes will occur in the application of reconstituted wood-based products to the field of building. This trend will lead to greatly expanded factory production of building components, giving rise to a demand for exterior finishes aiming at lifelong or at any rate very long-term protection.

[Received 17 April 1974]

Short Communication

The mechanism of the formation of crystalline bloom on paint films

By G. V. G. Hill

Paint Research Association, Waldegrave Road, Teddington, Middlesex TW11 8LD

Summary

Crystalline bloom on paint films has previously been attributed to the formation of ammonium sulfate from ammonia, sulfur dioxide and atmospheric oxygen in condensed droplets of moisture. Evidence is now presented of the deposition on to paint surfaces of

particulate ammonium sulfate and other salts from the atmosphere by a mechanism of thermal precipitation. The presence of water on the surface is unnecessary for the mechanism. Experiments with charged panels indicate that the particles carry electric charges.

Keywords

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

bloom

Le mécanisme de formation de la voile cristalline sur les feuillets de peinture

Résumé

On croyait auparavant que la voile cristalline qui se trouve de temps en temps sur les feuillets de peinture soit due à la formation, dans des gouttelettes d'humidité condensée, du sulfate d'ammoniac à partir d'ammoniac, d'anhydride sulfurique, et d'oxygène atmosphérique. On présente dans cet exposé certaine évidence indiquant que la déposition, à partir de l'atmosphère, des particules

de sulfate d'ammoniac et d'autres sels sur les feuillets de peinture est provoquée par un mécanisme de précipitation thermique. Le mécanisme n'exige pas la présence d'eau sur la surface. Les expériences avec des panneaux portant les charges électriques indiquent que les particules sont également chargées.

Der Mechanismus der Kristallhauchbildung auf Lackfilmen

Zusammenfassung

Bisher wurde die Kristallhauchbildung auf Lackfilmen der Entstehung von Ammoniumsulfat aus Ammoniak, Schwefeldioxid und Sauerstoff der Luft in kondensierten Feuchtigkeitströpfchen zugeschrieben. Es wird Beweismaterial vorgelegt für den Niederschlag von insbesondere Ammoniumsulfat und anderen

Salzen aus der Luft mittels eines Mechanismus thermalen Niederschlags. Für den Mechanismus ist die Anwesenheit an der Oberfläche von Wasser unnötig. Versuche mit aufgeladenen Tafeln deuten an, dass die Teilchen elektrisch geladen sind.

Introduction

Ref. 1-6, 4, 7

There is substantial evidence that the crystalline bloom which sometimes affects the gloss of paint or varnish films can be attributed to the presence of ammonium sulfate crystals.^{1, 2} Apart from causing a reduction in the gloss of finishing paints, these crystals can give rise to intercoat adhesion problems and are also of importance as stimulators of corrosion on ferrous metals.³ Early workers on bloom saw a connection between the water sensitivity of a varnish and its resistance to blooming, and it has been suggested that the mechanism of the formation of bloom involved deposition of moisture on the surface, followed by absorption of NH_3 and SO_2 from the atmosphere. Ammonium sulfate was considered to be formed after the oxidation of SO_2 by atmospheric oxygen.⁴ In another investigation,⁵ bloom was found to form more readily on nitrocellulose lacquers in the presence of light. On the other hand, the blooming of alkyd and oleosinuous films has been stated to be little affected by illumination levels,⁶ and a possible explanation put forward was that the drying oil components are a source of peroxides which can oxidise SO_2 , whereas with nitrocellulose and dammar varnishes ultra-violet radiation is required to produce photo-oxidation.

Investigations employing optical and electron microscopy have shown the shape and distribution of crystalline bloom.⁴

Most of the crystals are less than 2 micrometres in size. Under conditions of high humidity, ammonium sulfate deliquesces to form droplets of solution, a phenomenon frequently seen on the interior of glass window-panes. This process can give rise to the formation of larger crystals when the solution eventually recrystallises on drying out.

The mechanism of the formation of ammonium sulfate in the atmosphere has been discussed recently.⁷ It was considered that reaction occurred mainly in the water droplet phase of mist and fog, but that it could also occur on solid particulates (for example, soot or siliceous dust). The oxidation of SO_2 in the presence of NH_3 to give ammonium sulfate may be catalysed by metal ions from sea-salt, which is the main source of sodium chloride in the atmosphere. Traces of manganese, copper and other metals are present in sea salt. By the same reasoning, it may be conjectured that ammonium sulfate could be formed in condensed moisture droplets on paint films, where cobalt is often present as an oxidation catalyst.

Experimental work

Ref. 8-12

This work was carried out as part of a programme of research on dirt pick-up by paint films sponsored by the Department of the Environment. Many samples of soiled paint films

were taken from interior and exterior locations. Ammonium sulfate was found on all interior paint surfaces examined and on those exterior surfaces which had been sheltered from rain.

As earlier work had shown that a great deal of interior dirt is deposited on cold surfaces by a mechanism of thermal precipitation from warm air currents,^{8, 9} accelerated soiling experiments were carried out using painted panels supported over tubular electric convection heaters for periods up to six months. The surface temperature of the panels, after reaching equilibrium, was about 30°C, whilst the temperature of the air current was 34°C. Bearing in mind that under the conditions of the experiment it was unlikely that appreciable amounts of water could be present on the panels, it was surprising to find that, in addition to the expected deposit of dirt particles, a considerable amount of crystalline material up to 2 micrometres in diameter was observed on the paint surface. The appearance was similar to that of a paint film known to be affected by naturally-occurring crystalline bloom. However, where the panel had not been exposed to the warm air stream, but only to the ambient air, there was an insignificant amount of crystalline material. Qualitative analysis of the crystals from the exposed area showed the presence of ammonium, sulfate, sodium and chloride ions. The amount of crystalline material deposited was largely independent of the type of paint. Alkyds, epoxy resins, chlorinated rubber, polyurethanes and vinyl copolymer emulsions were included in the tests.

In another experiment, designed to investigate the effect of a uniform applied electric field on dirt pick-up, two painted steel panels were mounted facing each other 1 cm apart on insulated supports. When a potential difference of 500 V was maintained between the two panels, it was observed after 48 days that, in addition to dirt particles, crystalline material was deposited on both "negative" and "positive" panels (Fig.1).

Similar panels with no potential difference between them remained clean. The same result was obtained whether the experiment was conducted indoors or in a sheltered exterior

location, indicating a fairly general distribution of atmospheric contaminants. When the applied voltage was varied between 50 and 500 V, the amount of dirt deposited (mainly carbonaceous particles) was approximately proportional to the voltage, and the quantity of crystalline material, as far as could be judged by visual inspection under the microscope, increased in the same proportion. The crystals contained the same ions as in the previous experiment.

It was concluded that ammonium sulfate was present in the atmosphere as crystalline particles up to 2 micrometres in size. In fact, Junge has demonstrated the existence of such an aerosol in work reported in 1953.¹⁰ In the UK too, particulate ammonium sulfate has been identified in the natural aerosol.¹¹

A further conclusion was that both the dirt particles and the ammonium sulfate crystals carry either positive or negative charges when suspended in air—a view which is in general agreement with published work on other solid aerosols.¹² In the two types of experiment described above, deposition occurred by thermal precipitation in the first case and by electrostatic attraction in the second.

Discussion

In previous work on bloom formation, one factor which was not taken into account was the difference in temperature between the painted surface and the surrounding air. For a mechanism of thermal precipitation to operate as postulated above, the surface must be at a lower temperature than the air, and it has been found that even 1°C is a sufficient difference. The belief which was once held that bloom was in some way associated with the condensation of moisture can now be explained, for if the surface in question happened to be below the dew-point of the surrounding air, then moisture and ammonium sulfate would be deposited at the same time. On the other hand, it can be seen from the laboratory experiment with the convection heater that the deposition of moisture is not a necessary preliminary step for the formation of crystalline bloom on painted surfaces, although such a mechanism is not thereby precluded.

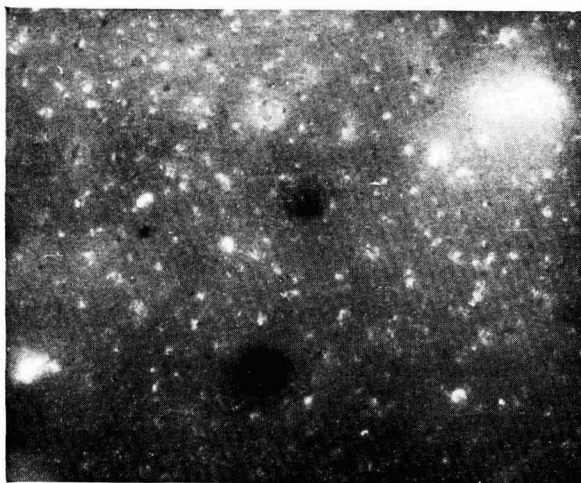


Fig. 1. Photomicrograph showing the distribution of crystals deposited from the atmosphere on to an alkyd paint film (Magnification $\times 1100$)

Thus, it appears that ammonium sulfate and (to a lesser extent) sodium chloride exist as solid contaminants in the atmosphere until they are washed out by rainfall or deposited by thermal precipitation. An electrostatic mechanism is less likely to be involved, considering the comparatively rapid dissipation of charge from paint films under the humidity conditions normally prevailing in the UK, but it may play a part in unusually dry locations.

Conclusions

Crystalline bloom has been shown to be produced on painted panels by the thermal precipitation of the naturally-occurring aerosol of particulate ammonium sulfate. The particles, which were mostly less than 2 micro-metres in size, could also be deposited by application of a uniform electric field, indicating that they are charged. The presence of droplets of condensed moisture on the surface is not required for bloom to be produced in either of these ways. It is considered that the major mechanism responsible for the deposition of bloom on painted or varnished surfaces is thermal precipitation.

Acknowledgements

This work formed part of a programme of research on dirt pick-up sponsored by the Department of the Environment.

The author wishes to thank the Director and Council of the Paint Research Association for permission to publish this paper.

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References

1. New, G. F., Paint Research Station Technical Paper No. 7.
2. Ames, J., and Gourley, S., *JOCCA*, 1953, **36**, 8.
3. Harrison, J. B., and Tickle, T. C. K., *JOCCA*, 1962, **45**, 571.
4. Holbrow, G. L., Paint Research Station Technical Paper No. 208.
5. Freeborne, A. S., *Paint Manuf.*, 1957, **27**, 267.
6. Bullett, T. R., *PRS Review*, 1965, **38**, 93.
7. McKay, H. A. C., *Chem. and Ind.*, 1969, **34**, 1162-5.
8. National Building Studies, Special Report No. 6, "Pattern Staining in Buildings", HMSO, 1949.
9. Holbrow, G. L., *Paint Oil and Col. J.*, 1965, **147**, 433-4.
10. Junge, C. E., *Tellus*, 1953, **5**, 1.
11. Heard, M. J., and Wiffen, R. D., *Atmos. Env.*, 1969, **3**, 337-340.
12. Green, H. L., and Lane, W. R., "Particulate clouds: dusts, smokes and mists," 1957, Spon, London, p. 70.

Next month's issue

The Honorary Editor has accepted the following papers for publication, and they are expected to appear in the November issue of the *Journal*:

Determination of the infinitesimal hardness behaviour (IHV) by interpolation and reduced extrapolation by *K. M. Oesterle*

Assessment of non-slip weatherdeck paints by *J. Gagliardi, L. A. Hill and F. Marson*

The dispersion of pigments and the rub-out properties of pigmented systems by *U. Kaluza*

Notes to authors on standardisation and the use of SI units

Uniformity of terminology, tense and units is desirable. A few years ago the Publications Committee decided that, as from 1 January 1975, all papers published in the *Journal* would be required to contain units specified in the Systeme International (SI) developed jointly by the International Organisation for Standardisation (ISO), the International Union of Pure and Applied Chemistry, and the International Union of Pure and Applied Physics. A description of SI units, listing those likely to be applicable to papers published in the *Journal*, appeared in its April 1971 issue; fuller treatments may be found in *Pure and Applied Chemistry*, 1970, 21, 2, and in BS 3763 (1970).

In a practical situation the use of the base SI unit or the SI derived unit may not be convenient. In such an instance it is permissible to employ one of the units referred to as "Decimal fractions and multiples of SI units having special names". For example, the derived unit of volume is the cubic metre, but where this seems inappropriate volume may be expressed as litres or, preferably, as dm³. (*JOCCA*, 1971, 54, 376)

It is appreciated that some difficulties may be caused to authors who have already completed papers using cgs or other units and, in the transitional period, it may be possible in some cases for assistance to be given in converting to SI. However, where this is not possible any paper containing units other than SI will be returned to the author for amendment.

The standard nomenclature for organic and inorganic compounds, as recommended by IUPAC, should be used. Authors requiring further information should consult "IUPAC rules on the nomenclature of organic chemistry", 1972, London: Butterworths.

Authors are particularly urged to adhere to the standardised forms for references and abbreviations. This often saves

library time wasted by taking down hastily a reference given in an unusual form. References should be made in the form of the following examples:

1. Scott, J. A., *JOCCA*, 1969, 52, 593.
2. Wright, W. D., "The measurement of colour", 4th Edition, 1969, London: Adam Hilger, p. 31.

The use of the first person should be avoided, the writer being referred to as "the author".

There is no objection to the use of trade names where the material cannot be adequately described by a chemical or trivial name. However, these shall not be used in any way which could be construed as advertising. Also, it should be remembered that trade names may not be familiar outside their country of origin. Therefore, where first mentioned, the material should be characterised fully, followed by the trade name and manufacturer in parenthesis. Later references to the material can be by the trade name alone, thus

"... were based on a 45 per cent oil length linseed/glycerol alkyd, of viscosity 50p (25°; 50 per cent in xylol) (Joccalkyd H69, from Prioryhouse Ltd.) . . . In the adhesion tests, formulations based on Joccalkyd H69 showed . . ."

The Hon. Editor reserves the right to delete trade names where these are felt to be superfluous.

A leaflet "Notes for authors, lecturers, reporters and reviewers" has been prepared by the Association and describes the recommended method for preparation of text, illustrations and diagrams intended for publication in the *Journal*. Copies of the leaflet are obtainable by sending a stamped, self-addressed envelope marked "Notes to authors" in the top left-hand corner to the Association's offices at the address on the contents page of this issue.

Reviews

Polymer Chemistry

By Bruno Vollmert (translated from the German by Edmund H. Immergut)

1973; Berlin, Heidelberg, New York: Springer-Verlag

Pp xv + 652. Price £11.52

This is a work of considerable pedigree, for both the author and his translator are well-known authorities, and when Mark himself confers the accolade of an approving Foreword, it behoves any reviewer to approach his task with respect. It is perhaps a measure of this reviewer's impudence that he feels obliged to express rather less approval than does Mark.

The work makes no concessions to scientific incompetence for, although there are occasional insertions of very elementary material (like the calculation of acid value and the basic principles of osmometry) it is addressed quite clearly to the honours graduate.

A brief introduction and a short section on structural principles present a broad picture of what polymer science is all about. This is followed by the longest section in the book (299 pages), on synthesis and reactions of macromolecular compounds, which deals successively with the formation of C—C polymers by free radical, ionic and co-ordination processes; polycondensation and polyaddition processes for heterochain polymers; enzymic and Merrifield syntheses of proteins; graft and block polymers; polymer purification; and polymer transformations and degradation. The third section (152 pages) is concerned with the properties of individual macromolecules (note: not individual types of macromolecules like nylon and polyethylene), embracing molecular weights (MW), molecular weight distribution, and a consideration of molecular shape with special attention to the various coil models. The final section (187 pages) is on states of aggregation and starts with a discussion of intermolecular forces. This leads neatly into solution theory, viscosity and the factors affecting it, gels, structures within structures, and the rubbery, glassy and crystalline states.

Some features which struck the reviewer as novel or particularly meritorious were the nice distinction drawn at an early stage between primary, secondary and tertiary structures, the critical discussion of the Q-e scheme in terms of the Hammett equation, the clever presentation of a generalised approach to anionic, cationic and co-ordination polymerisations, and the excellent account of biochemical aspects. These, however, cannot compensate for the lack of a clear presentation of functionality theory which would have unified much of the discussion on structure and MW distribution, the failure to clarify the picture of solution and transition phenomena via the CED concept, or the omission of reference to recent important work on charge transfer polymerisation and interpenetrating networks.

In his foreword, Mark approves of the author's "excursions into the intellectual clarification of somewhat complicated phenomena". Some of these are stimulating and quite brilliant. Others, unfortunately, seem to obscure the simpler picture which, one feels, should be clearly presented (when it is there) before it can sensibly be elaborated. For example, several pages on the role of the reverse reaction in polycondensation could have been decimated by an introductory reference to equilibrium shift in Mass Action terms.

Though few in number, some doubtful facts and unwarranted assumptions are to be found. Carothers was not

the first to make polyesters and polyamides by condensation processes. The explanation of alkyd formation leads the reader to conclude that these resins are inevitably cross-linked; the role of the fatty acid as chain stopper is not indicated. There is some dubious chemistry in the description of urea-formaldehyde resins, and it is surely misleading to describe melamine-formaldehyde resins as cross-linked polyamines. One can only be amused by the statement that, to get polycondensates of high MW, one must remove the water of reaction and "any other kind of moisture from the reaction medium and *also from the room where the reaction is carried out*" (reviewer's italics).

It is always difficult to judge how much licence should be allowed a translator; how far he can adapt to the new idiom before the sense of the original is lost; or what sacrifices in English style he should make for the sake of retaining the original form of argument. It is suggested that the standards appropriate to textbooks are not the same as those for original works intended to be read by informed experts well able to avoid the pitfalls associated with clumsy and stilted prose. This is a textbook and, even allowing for the indicated deficiencies of content, it is less than wholly successful in its educational function because deficiencies in style make it still less digestible than it should be. There are some quaint variations, such as the random use of "peroxyde" and "peroxide", the expression "not bystanding" referring to the non-existence of vinyl alcohol monomer, and (the old howler) "respectively" for the German "resp." when the correct translation is clearly "or". These, however, are less tiresome than the remaining vestiges of the uniquely Germanic participial construction and the repetitive slavish translation of, for example, "man geist . . ." as "one pours . . ." when the more common English usage would be ". . . is poured".

To sum up, this is a work original in concept, laboured in its thoroughness, nearly sufficient in its content and mostly accurate in its facts. No other attempts the same cross-section of the subject so, for those who do not mind hard work, it can be recommended despite its faults.

A. R. H. TAWN

The chemistry of organolithium compounds

By B. J. Wakefield

Pergamon Press, Oxford, England, 1974.

Pp. x + 335. Price £8.00

This work is a comprehensive account of the constitution and preparation of organolithium compounds and their use in organic and organometallic synthesis. In some properties, such as their reactivity to double bonds, the compounds are intermediate between Grignard reagents and organoboron or organoaluminium compounds. The main characteristic of the compounds likely to interest the paint chemist is their ability to initiate the polymerisation of vinyl monomers and dienes. The mechanism simply involves addition of the organolithium compound to a molecule of monomer, the adduct then adding to another molecule of monomer and so on. Ethylene, butadiene, vinyl chloride, styrene and acrylates and methacrylates have all been polymerised in this way. The book is essentially an organic chemistry textbook and does not deal with technical properties of the products, but would be desirable for workers in the organo-metallic or polymer fields. It is well produced and references run to nearly 2,000.

L. A. O'NEILL

Information Received

Anchor now marketing PVO curing agent

Following the recent agreement with PVO International Incorporated to form a joint company called Pacific Anchor Chemical Corporation, Anchor Chemical Company is now marketing PVO's "Sur-Wet R" curing agent in the UK.

Renamed "Ancamine R," this curing agent for epoxide resins can be used on wet surfaces and underwater, and further extends Anchor's Ancamine range of curing agents.

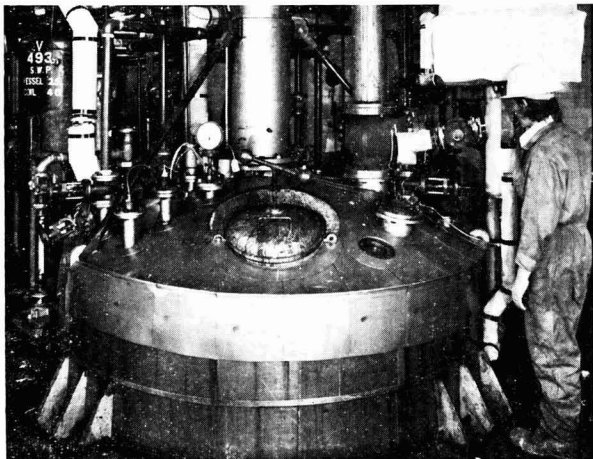
The arrangement for Anchor to market Ancamine R is with the full cooperation of Jacobson Van Den Berg, the former UK agents. Pacific Anchor Chemical Corporation, in which Anchor and PVO each have a 50 per cent interest, was set up earlier in the year to manufacture and market the Anchor range of curing agents in the United States and Canada.

Hoechst reorganisation

As a result of reorganisation of the Hoechst Group in the United Kingdom, the activities of Hoechst-Cassella Dyestuffs Limited has been taken over recently by the newly-formed Colour and Surfactants Division of Hoechst (UK) Limited.

New polyester production facilities at SRL

Synthetic Resins Limited has commissioned new facilities for the manufacture of polyester resins at its Speke factory near Liverpool. The new plant will give SRL additional production capacity of 10 000 tonnes per year. In order to handle the resulting increased output of unsaturated polyester resins from the Speke plant, a new compounding, dispersion, and filtration plant has been designed and installed, which feeds the finished product to a mechanised drum handling and automatic weighing system.



The new polyester reactor at the SRL plant, Speke, Liverpool

New resin plant for Donald MacPherson

Following a serious fire in 1973 at its factory at Bury, Lancashire, Donald MacPherson & Co Ltd has placed a £300 000 order with Hygrotherm Engineering Limited, Manchester, for a complete synthetic resin plant to replace the section destroyed by fire. The new plant will be designed for the manufacture of general purpose alkyds, decorative and industrial and acrylic resins.

NL Industries' expansion in Europe

NL Industries has announced a 20 000 tonnes per year expansion at its Nordenham titanium pigment plant in West Germany. This is the first in a series of planned expansions by NL Industries of its world wide titanium pigment operations to meet the growing demand for both the rutile and anatase grades. The expansion of the Nordenham plant, which has a present capacity of 40 000 metric tonnes per year, is scheduled for completion in 1976. NL originally opened the plant in 1969; it is operated by Kronos Titan GmbH, a wholly-owned German subsidiary.

New products

New constant feeder and continuous mixer

Russell Finex Limited has announced the availability in the UK and Europe of the Funken Auto Feeder and Flow Jet Mixer range of units. These provide for the continuous mixing of both powder/powder and powder/liquid materials, in extremely accurate ratios to a completely homogeneous condition, with wide range of products.

Paint additives

Two new water-soluble paint additives which enhance the characteristics of water-based and conventional solvent-based coatings have been introduced in Europe by Dow Corning International Limited. The

company claims that the products, designated "Dow Corning 14" and "15" are effective at low concentrations and offer improved mar resistance, slip, flowout, gloss, and levelling characteristics, and reduce peel and cratering.

Paint additive 14 is especially effective when used to reduce pinholing, whilst Dow Corning 15 is designed specifically to increase mar resistance.

Literature

Analytical services

A booklet is now available from Technical and Analytical Services, a division of Titanium Intermediates Limited, describing the range of facilities which the division's laboratories can provide for analysis and related projects. The service is backed by the extensive resource of the British Titan Group of companies of which Titanium Intermediates is a member.

Ciba-Geigy in the UK

A 36-page full-colour booklet has been published by Ciba-Geigy, introducing the group's present activities in the United Kingdom. It sketches the history of the companies of the group, shows how they came together, and describes their present world-wide activities and interests.

Data sheet for organic solvents

The first volume of "Raw Materials Data Handbook" consisting of 123 separate data sheets for organic solvents has been published by the National Printing Ink Research Institute under the sponsorship of the National Association of Printing Ink Manufacturers in the USA. The purpose of the handbook is to evaluate the potential hazards from raw materials in industrial operations, so that effective preventative measures might be taken. Information contained in the book includes fire hazard data, health hazard data and a summary of hazards as well as physical properties.

Kronos information

Kronos Titanium Pigments Limited has published four new information leaflets as follows: 49E Hiding power of emulsion paints; 50E Kronos information publications; 51E Improving the opacity of plastics films containing titanium dioxide; and 52E Titanium and its importance today.

Courses, etc.

Printing and photography

"Some aspects of colour in printing and photography" is the title of a lecture to be given by Mr F. Pollak at the Royal Institution on Monday 7 October for the Technical Training Board of the printing ink and roller making industry. Admission is free by ticket obtainable from the Society of British Printing Ink Manufacturers, Alembic House, 93 Albert Embankment, London SE1.



OCCA—XXVII Exhibition

Olympia, London. 22-25 April 1975

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Many applications to exhibit received from overseas

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General information

At the beginning of September, when this report was compiled, a considerable number of applications to exhibit had already been received from overseas and among the countries represented were Finland, France, Germany, Holland, Italy, Norway, Switzerland and the United States of America. The closing date for receipt of applications is **1 October 1974** and the Exhibition Committee will be meeting early in October to allocate the space available; exhibitors will be notified of the allocation made in November.

At the time of going to press it is not known if there will be any space available for late applications, but any organisation which has still not sent in an application and wishes to do so should contact the Director & Secretary immediately by *Telex* (922670 *OCCA Wembley*) or telegram (Code *OCCA Wembley*) notifying the number of units required based on a unit size of 4.32m².

Motif of Exhibition 1975

The motif for 1975, designed by Robert Hamblin, continues the theme of OCCA-26, when attention was drawn to the European Economic Community, by extending it to show the world-wide interest aroused by the association's annual exhibitions in London, which in recent years have attracted visitors from more than 50 overseas countries. The motif has been printed in colour in the August and September issues, and these colours (two shades of blue and one of green) will be used throughout the publicity material for the exhibition. Two (cascade blue and leaf green) will be incorporated in the fascias of the stands, thus giving both an entity to the design and pleasing changes of colour to visitors as they move from corridor to corridor. A feature of OCCA exhibitions has always been the provision of special seating areas, where visitors can meet friends and discuss problems—and these areas continue the colour theme chosen for each particular exhibition.

The OCCA Exhibition and the raw material shortages

At the 1974 exhibition, when the acute shortage of raw materials was causing so many problems, the value of this annual technical display and the opportunity which it gives for the free interchange of ideas between suppliers and manufacturers in a relaxed atmosphere was especially evident, and new exhibitors at that exhibition were delighted with the response achieved and

the goodwill built in a period of the most adverse of conditions in the industry. Indeed, the 1974 exhibition demonstrated the great strength of this unique and remarkable exhibition in weathering the frustrating problems and difficulties, such as the three-day working week in the United Kingdom at the beginning of the year, which severely handicapped so many other functions and caused the cancellation of others. The Council of the Association is convinced that the enthusiastic support which it received from exhibitors was reflected in the interest aroused by visitors and augurs well for the 1975 and future exhibitions. As an example one exhibitor at OCCA-26 reported "no less than 345 genuine technical visits—one every six minutes throughout the four days of the show" (reproduced by courtesy of *Compass*—Scott Bader Limited).

Venue

As in 1974, the exhibition will be of four

days' duration and will open on the Tuesday morning at 09.30 and will close on the Friday at 16.00. The exhibition of raw materials, plant and equipment used in the paint, printing ink, colour, and allied industries will take place at the Empire Hall, Olympia, London.

Special visits by overseas trade delegations

Following the great success of the delegation from Osaka, Japan, on the occasion of OCCA-26 when special arrangements were made for works visits etc, requests have already been received for similar facilities for a delegation from Czechoslovakia and for a further Japanese party.

Any company wishing to be placed on the list of those willing to accept such delegations should write to the Director & Secretary as soon as possible, setting out the countries in which they are interested and the scope of the activities which would be displayed.



A view of part of the Empire Hall during the period of OCCA-26 when visitors travelled from fifty countries and from around the UK to see the new developments in the industry and to discuss informally with suppliers the steps which these exhibitors were personally taking to help manufacturers during a worldwide shortage of raw materials. Many exhibitors have since expressed themselves as more than satisfied with the response they encountered and the goodwill built up at this unique event in the calendar of the surface coatings industry.

Arthur Willis Blenkinsop, FTSC—1909-1974, President 1971-73



Newcastle Section Vice Chairman 1959-61,
Chairman 1961-63, and Hon. Treasurer
1965-68

Association Vice President 1963-65

Association Hon. Treasurer 1968-70

President designate 1970-71

AN APPRECIATION BY MR GEORGE WEATHERSTON

OCCA and many branches of the chemical industry suffered a great loss with the passing of Arthur Blenkinsop. He was probably the best-known and best-liked man in North-East England throughout the industries that he served. His friends ranged from managing directors to laboratory assistants and from this group Arthur never received

“no” for an answer. His extensive knowledge of the chemical field and his knowledge of current and future developments was available to all. One could discuss business matters with him in the strictest confidence and know that there was never any danger of that confidence being broken, such was the integrity of the man. His benign and happy countenance, no matter how trying the circumstances, was a strong characteristic in days of raw material shortages and unofficial rationing; he was always able to placate the most irate customer and leave him with the conviction that he was getting a fair deal. During the many years he served in the area he saw quite a few small “backyard” businesses develop into national companies—no customer was too small for Arthur to visit, and they received equal attention to the larger consumers. This attention to duty paid off handsomely over the years.

Arthur was a staunch Yorkshireman, and despite opportunities of financial advancement constantly refused to move away from his lifetime base. Show him the beauty of the Northumberland countryside and on your next visit he would delight in proving that behind industrial Tees-side lay some equally beautiful country of which he was very proud. Boast about the Newcastle Quayside market and he would retaliate by showing you the markets of Stockton and Northallerton. He was a “died in the wool” Yorkshireman and had no desire to change. He loved what he was and where he was.

He became active in the Newcastle Section of OCCA after the war and did an excellent job in producing new members via his many contacts. Because of this most of us knew our counterparts in competitive companies and others from a wide variety of industries who had common

problems to share. His work for the local section and, subsequently, for the parent body was always carried out with enthusiasm and being a perfectionist was always well done. It was unfortunate that his initial health problems developed just prior to him being appointed President of the Association. Some of the activity he was committed to was only carried out with some difficulty, but it would be done regardless, and done well. Unlike most people, he had virtually no enthusiasm for his first visit to the USA as President and was greatly relieved to be back home again. We will never know what his efforts as President cost in regard to the state of his health, but it was a personal honour to him and also to the Newcastle Section and nothing would prevent him doing the job in worthy style.

Two days before he died, he indicated that he again had hotel reservations in Scarborough for the cricket festival week and as had been his custom for many years, all the appropriate tickets for the matches to be played, but he was not his cheerful self when conveying this information and appeared to doubt the possibility of his enjoying this year what I think was his only sporting outlet.

Norah and Arthur enjoyed the company of young people and it was a matter of great regret that they had no family of their own. As most members know, Norah was a pillar of strength to Arthur at all times and particularly during his presidency, and we should be grateful to her for that assistance. Life will be lonely for Norah, but many of Arthur's countless friends will be around to comfort and assist her. Our sympathy is extended to her, she has lost a fine partner and we have lost a dear friend and worthwhile business associate.

Jordan Award

This award was instituted by the late Mrs M. R. Jordan in memory of her husband Dr L. A. Jordan, who was President of the Association 1947-49 and an Honorary Member, and who died in December 1964. The Committee invites applications for the third 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 coating by a Member of any nationality working in either the academic or industrial field who is under the age of 35 at the date of application.

2. The final date for submission of applications will on this occasion be 27 December 1974 and it is hoped to present the award at the Scarborough Conference in the following June.

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

4. There will be two methods of application. First, by the 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 by 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.

Register of Members

The following elections to Membership have been approved by Council. The Section to which new Members are attached is given in italics.

Ordinary Members

CHAN, CHUNG-MING, 108 Man Shun House, Tai Hang Sai Estate, Kowloon, Hong Kong. (*General Overseas*)

CRASKE, ANTHONY JOHN, 36 Harford Drive, Watford, Herts. (*Thames Valley*)

FROLICH, PER, BSc, Syenittveien 21, Fredrikstad, Norway. (*General Overseas*)

JONES, GRAHAM TREVOR, W. G. Hitchens Ltd., PO Box 13, Renwick, Marlborough, New Zealand. (*Wellington*)

QUINN, STEPHEN JOSEPH, Berger Paints Nigeria Ltd., PMB 1052, Ikeja, Lagos State, Nigeria. (*General Overseas*)

SAVILLE, WARNER MAURICE, BSc, W. G. Hitchens Ltd., PO Box 13, Renwick, Marlborough, New Zealand. (*Wellington*)

SCOTT, JOHN FRANCIS, BSc, The Walpamur Co. Ltd., Darwen, Lancashire. (*Manchester*)

WAGENVoort, MARINUS, BSc, W. G. Hitchens Ltd., PO Box 13, Renwick, Marlborough, New Zealand. (*Wellington*)

Associate Members

McKEE, MICHAEL JAMES, Flat 4, 30 Ottawa Road, Ngaio, Wellington, New Zealand. (*Wellington*)

Registered Students

GOLDSACK, ALISTAIR GEORGE, W. G. Hitchens Ltd., PO Box 13, Renwick, Marlborough, New Zealand. (*Wellington*)

WALL, PETER HOWARD, W. G. Hitchens Ltd., PO Box 13, Renwick, Marlborough, New Zealand. (*Wellington*)

OCCA Biennial Conference 1975

Scarborough

The performance of surface coatings—does the reality match the theory?

As already announced in the *Journal*, the next biennial Conference of the Association will take place at Scarborough from 17 to 21 June 1975. The headquarters will be the Grand Hotel, with overflow accommodated at the St. Nicholas Hotel. These two hotels are situated opposite each other on St. Nicholas Cliff.

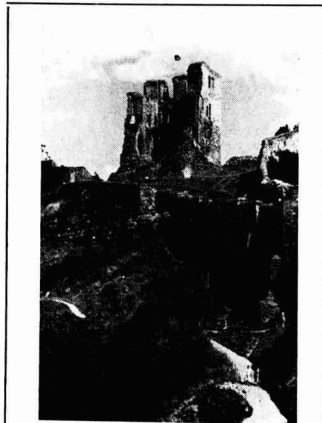
The title of the Conference will be "The performance of surface coatings—does the reality match the theory?" and it is intended that as on previous occasions, full preprints will be published for despatch to delegates in advance of the Conference. It

is important, therefore, that any person, whether or not a member of the Association, who feels that a report of his work could form the basis of a suitable technical paper, should contact immediately the Honorary Research & Development Officer of the Association (Mr A. R. H. Tawn, 34 Crest View Drive, Petts Wood, Kent BR5 1BY, England).

Forms for registration will be despatched to all members of the Association attached to the Sections in the United Kingdom, Ireland and the General Overseas Section early in 1975.



Peace reigns over the harbour at Scarborough; towering in the middle distance is the Grand Hotel, headquarters for the 1975 Conference.



In June next year, the Conference setting will be a scenic coastal town in northern England. The photograph shows Scarborough Castle and some of the pleasant walks around its perimeter. It was from this view that Robert Hamblin made a sketch which forms the basis for the Conference motif (and which is reproduced elsewhere in this issue). It is a most effective symbol, with the staunch bare walls of the castle providing as great a challenge to the surface coating specialist as will the wealth of information to be gleaned from technical and workshop sessions and from informal discussion at the forthcoming Conference.

Obituary

H. F. Clay

Mr H. F. Clay, a prominent figure in the world of anti-corrosive pigments, passed away at his home on 1 August 1974 after a period of illness. He worked all his life at the Cromford Colour Company, rising from laboratory assistant through chief chemist to factory manager—the post he held until his death.

Bert Clay, as he was known to everyone, was noted for his academic approach to the subject of corrosion prevention. He helped to develop zinc phosphate, and collaborated with a number of noted specialists in this field, including Dr Mayne, Mr Timmins, and Dr Harrison; and he introduced zinc chromate phosphate as a product for protection against corrosion.

He was an active member of the Association, being Hon. Treasurer (1960-62) and Chairman (1964-66) of the Manchester Section, as well as helping to found the Trent Valley Branch of the Midlands Section. He gave a number of lectures on corrosion prevention and control to the various Sections, his last being at Hull in March of this year.

Mr Clay was an Associate of the Royal Institute of Chemistry and an Associate member of the Institute of Chemical Engineers.

He leaves a widow, two sons and a daughter and our condolences are passed to them.

Forthcoming Events

Details are given of meetings in the United Kingdom up to the end of the month following publication, and South Africa and the Commonwealth up to the end of the second month.

October

Wednesday 2 October

Manchester Section—Student Group: "Titanium dioxide—its manufacture and properties" by Mr D. Charlton of Tioxide International Ltd., to be held at the Manchester Literary and Philosophical Society, Manchester, at 4.30 p.m.

Thursday 3 October

Newcastle Section: "Some examples of electrophoretic coatings for cathodic deposition" by Dr H. Verdino, Vianova, Austria, to be held at the Royal Turks Head Hotel, Grey Street, Newcastle upon Tyne, at 6.30 p.m.

Thames Valley Section—Student Group: "Polymers" by Dr Clarke, to be held at Slough College in the main Lecture Theatre at 4.00 p.m.

Friday 4 October

Hull Section: Annual Dinner Dance to be held at Cave Castle, South Cave, Nr. Hull.

Saturday 5 October

Scottish Section—Student Group; Joint meeting in Edinburgh with Eastern Branch: "Modern phthalocyanine pigments" by Mr J. B. Blackburn, Ciba-Geigy (UK) Ltd., to be held at Three Pigeons, 573 Sauchiehall Street, Glasgow at 10.15 a.m.

Monday 7 October

Hull Section: "The protection of structural steel" by Mr J. R. Bourne, Mebon Ltd. Joint meeting with the Institution of Chemical Engineers at the Haven Inn, Barrow Haven, Lincs at 6.30 p.m.

Tuesday 8 October

West Riding Section: "Amide-imide resins" by a speaker from May and Baker Ltd.

Thursday 10 October

Midland Section—Trent Valley Branch: "Economic use of titanium dioxide in paint" by Mr J. G. Balfour of Tioxide International Limited, to be held at the British Rail School of Transport, London Road, Derby at 7.00 p.m.

Scottish Section: "The colour of azo pigments" by Dr K. Hunger of Farbwerke Hoechst AG. Joint meeting with Society of Dyers and Colourists to be held at Beacons Hotel, 7 Park Terrace, Glasgow G3 at 6.00 p.m.

Friday 11 October

Manchester Section: "High-performance violet, red, orange and yellow pigments for automotive and industrial finishes" by Dr P. Lutz, supervisor of automotive formulations, Du Pont, USA, to be held at the Manchester Literary and Philosophical Society, 36 George Street, Manchester at 6.30 p.m.

Wednesday 16 October

London Section: "High-performance violet, red, orange and yellow pigments for automotive and industrial finishes"

by Dr P. Lutz, supervisor of automotive formulations, Du Pont, USA to be held at the Polytechnic of the South Bank, Borough Road, London SE1 at 7.00 p.m.

Friday 18 October

Irish Section: "Industrial finishes" by Mr D. Pountain of Berger Paints (Ireland) Ltd., to be held at the Clarence Hotel, Dublin at 7.45 p.m.

Manchester Section: Annual Dinner Dance, Piccadilly Hotel, Piccadilly Plaza, Manchester at 6.30 p.m.

Midlands Section: "Water or what?" by Mr K. O'Hara, Cray Valley Products Ltd., to be held at the Birmingham Chamber of Commerce and Industry, PO Box 360, 75 Harborne Road, Birmingham B15 3DH at 6.30 p.m.

Wednesday 23 October

Manchester Section—Student Group: "Powder coatings" by Mr N. H. Seymour of Sterling Varnish Co. Ltd., to be held at the Manchester Literary and Philosophical Society, Manchester at 4.30 p.m.

Thursday 24 October

Thames Valley Section: "Strategy of modern purchasing" by Dr Finch, Croda Inks Ltd., to be held at the Beech Tree Hotel, Maxwell Road, Beaconsfield, Bucks at 7.00 p.m.

Friday 25 October

Bristol Section: "Design for wallcoverings" by Mr G. R. Marks of ICI Ltd. Ladies' Evening; Royal Hotel, Bristol at 7.15 p.m.

November

Monday 4 November

Hull Section: "The industrial application of organic titanates—with particular emphasis on surface coating applications" by Dr D. W. Brook, Titanium Intermediates Ltd., to be held at 6.30 p.m. at the George Hotel, Land of Green Ginger, Hull.

Wednesday 6 November

Scottish Section—Eastern Branch: Joint lecture with the BPBI, "The laser zee meter" by Mr J. G. Penniman Jr. of the Pen Kem Company, Croton on Hudson, New York, USA, to be held at 7.15 p.m. at the Carlton Hotel, North Bridge, Edinburgh.

Thursday 7 November

Midlands Section—Trent Valley Branch: Social event.

Newcastle Section: "Patent law, with particular reference to the EEC" by Dr Wild, Berger Jensen & Nicholson Ltd., to be held at 6.30 p.m. at the Royal Turks Head Hotel, Grey Street, Newcastle upon Tyne.

Thames Valley—Student Group: "Dispersion of titanium dioxide in modern paint-making machinery" by Mr D. Craig, Tioxide International Ltd., to be held at 4.00 p.m. at Slough College in the main Lecture Theatre.

Friday 8 November

Manchester Section: "Water thinable coatings" by Mr R. H. E. Munn, Cray Valley Products Ltd., to be held at 6.30 p.m. at the Manchester Literary and Philosophical Society, 36 George Street, Manchester.

Saturday 9 November

Scottish Section—Student Group: Mr L. H. Silver (President), "Twenty-five years in the paint industry", to be held at 10.15 a.m. at the Three Pigeons, 573 Sauchiehall Street, Glasgow.

Tuesday 12 November

West Riding Section: "Automation in the paint laboratory" by W. A. Straw and D. S. Briggate, to be held at 7.30 p.m. at the Griffin Hotel, Leeds.

Thursday 14 November

Irish Section: Annual Dinner Dance.

Midlands Section—Trent Valley Branch: "Salary or job satisfaction" by Mr I. S. Moll (consultant), to be held at 7.00 p.m. at the British Rail School of Transport, London Road, Derby.

Scottish Section: "Printing inks—developments to meet modern requirements" by Mr G. H. Hutchinson of Croda Inks Ltd., to be held at 6.00 p.m. at the Beacons Hotel, 7 Park Terrace, Glasgow G3.

Midlands Section: "An individual's thoughts on paint—past, present and future" by Mr H. J. Clarke, Postans Paints Ltd., to be held at the Apollo Hotel, Hagley Road, Birmingham.

Wednesday 20 November

London Section: "Coatings for immersed conditions". One-day joint Colloquium with the Institute of Corrosion Technology at Thames Polytechnic, Woolwich, commencing at 9.30 a.m.

Manchester Section—Student Group: "Metal pretreatment" by Mr C. Pearson of Pyrene Chemical Services, to be held at 4.30 p.m. at the Manchester Literary and Philosophical Society, Manchester.

Thursday 28 November

Thames Valley Section: "Forensic examination of inks and paints" by Mr R. M. Kevern, to be held at 7.00 p.m. at the Beech Tree Hotel, Maxwell Road, Beaconsfield, Bucks.

Friday 29 November

Bristol Section: "Precious metals for surface coatings" by Mr D. Blower of Engelhard Industries Ltd., to be held at 7.15 p.m. at the Royal Hotel, Bristol.

London Section: Ladies' Night at the Cafe Royal.

West Riding Section: Dinner Dance to be held at the Crown Hotel, Harrogate. Tickets at £5.00 each, inclusive of VAT, and application forms obtainable from the Hon. Secretary, N. Cochrane, 19 Rutland Road, Harrogate, Yorkshire HG1 1PY.



Oil and Colour Chemists' Association

President: L. H. SILVER



General

The Oil and Colour Chemists' Association was formed in 1918, to cover paint, printing inks, pigments, varnishes, drying and essential oils, resins, lacquers, soaps, linoleum and treated fabrics, and the plant, apparatus and raw materials useful in their manufacture. In 1924 it absorbed the Paint and Varnish Society. The stated purpose of the Association is to promote by discussion and scientific investigation the technology of the industries concerned with the above-mentioned products, and to afford Members opportunity for the interchange of ideas. This is achieved by the regular holding of ordinary meetings at which papers are presented, and the organisation of annual technical exhibitions, biennial conferences, educational activities and practical co-operative experimental work. Details of these activities are given in the *Journal of the Oil and Colour Chemists' Association*, which is published monthly, and whose pages are open to receive communications and other pronouncements on scientific and technical matters affecting the Members of the Association and the industries concerned. The Association's meetings also afford opportunities for Members to meet informally and socially.

Sections

There are Sections of OCCA in Auckland, Bristol, Hull, Ireland, London, Manchester, the Midlands (with a Trent Valley Branch), Newcastle upon Tyne, Scotland (with an Eastern Branch), South Africa (with Branches in the Cape, Transvaal and Natal), Thames Valley, Wellington, and the West Riding, and these are responsible for the conduct of their own local affairs. There is also a General Overseas Section. There is also a close alliance between the Association, the Federation of Societies for Paint Technology in the United States, and the Fédération d'Associations des Techniciens de l'Industrie des Peintures, Vernis, Emaux et Encres d'Imprimerie de l'Europe Continentale (FATIPEC). The Association also maintains cordial relations with the Scandinavian Federation of Paint and Varnish Technicians (SLF).

The five Sections previously maintained by the Association in Australia formed (1.1.68) the Oil and Colour Chemists' Association Australia, having the same aims and activities as, and working in close liaison with, the parent body.

Membership

Ordinary Membership is granted to scientifically trained persons, and Associate Membership to others interested in the industries covered. An optional Professional Grade, conferring designatory letters, is open to Ordinary Members. Student membership is open without restriction to persons under the age of 21 and to those up to 25 who are following a course of technical study. An entrance fee of £1 (plus VAT) is payable by Registered Students and £5 (plus VAT) by Ordinary and Associate Members. Applications for membership are invited from suitably qualified persons who are engaged or otherwise interested in the industries noted above. Applications, which should be supported by two Members of the Association (one of whom must be an Ordinary Member), should be forwarded to the Director & Secretary at the address given below. Application forms and full details of membership may be obtained from the offices of the Association.

Professional Grade

The Association recently introduced (1971) an optional professional grade for its Ordinary Members, giving the designatory letters FTSC (Fellow in the Technology of Surface Coatings), ATSC (Associate in the Technology of Surface Coatings), and LTSC (Licentiate in the Technology of Surface Coatings). Full details are available upon request from the Association. Where Membership has lapsed, previous periods of Ordinary Membership count towards

the total required under the regulations, as set out in the July 1974 issue of *JOCCA*.

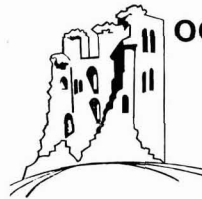
Exhibitions

A technical exhibition is held annually at Olympia; Members are sent copies of the *Official Guide* several weeks in advance, in order to plan their itineraries. A charge is made to non-members for admission and for copies of the "Official Guides." Non-members should apply, in writing, to the Director and Secretary for copies of the *Official Guide* and admission ticket.

The motif shown above for the twenty-seventh Technical Exhibition of the Association OCCA XXVII, designed by Robert Hamblin, continues the theme of OCCA-26 (when attention was drawn to the European Economic Community) by extending it to show the world-wide interest aroused by the Association's annual Exhibitions in London, which in recent years have attracted visitors from more than 50 overseas countries.

Conferences and Symposia

The Association organises large, biennial technical conferences, the papers for which (together with discussions) are published in this *Journal*. Sections of the Association in the UK and abroad hold symposia and these, too, are reported in *JOCCA*.



OCCA CONFERENCE

Scarborough

17-21 JUNE 1975

Publications

Journal of the Oil and Colour Chemists' Association (JOCCA) is published monthly and includes a yearly index in the December issue. The subscription rate to non-members is £15.00 p.a. (\$38) post free; payable in advance. Single copies may be purchased for £1.50.

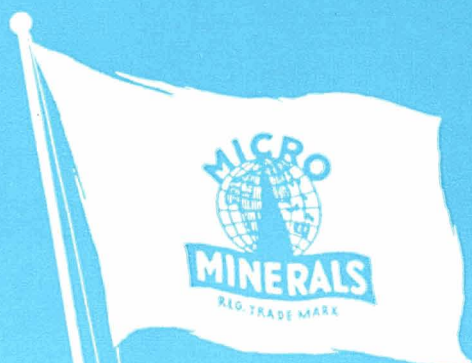
Introduction to Paint Technology (Second Edition with additional chapter). With illustrations, 187 pages and index £2.00 (including postage).

Paint Technology Manuals (Parts 1, 2, 4, 5 and 6 at present out of print).

- Part 1 "Non-convertible Coatings"
- Part 2 "Solvents, Oils, Resins and Driers"
- Part 3 "Convertible Coatings," Second Edition, pp. 350, £2.80
- Part 4 "The Application of Surface Coatings"
- Part 5 "The Testing of Paints"
- Part 6 "Pigments, Dyestuffs and Lakes"
- Part 7 "Works Practice," pp. 218, £3.00

Director & Secretary: R. H. Hamblin, MA, FCIS,
Priory House, 967 Harrow Road, Wembley, Middlesex,
England HA0 2SF.

Tel. 01-908 1086; Telex 922670 (OCCA WEMBLEY)



In our Technical Bulletin No. 181

THE USE OF MICRO-MINERALS IN WATER-BASED SYSTEMS

are demonstrated the advantages of using **Microdol**, **Micro-Talc** and **Micro-Mica** as extenders in such products

The bulletin will be sent you on request

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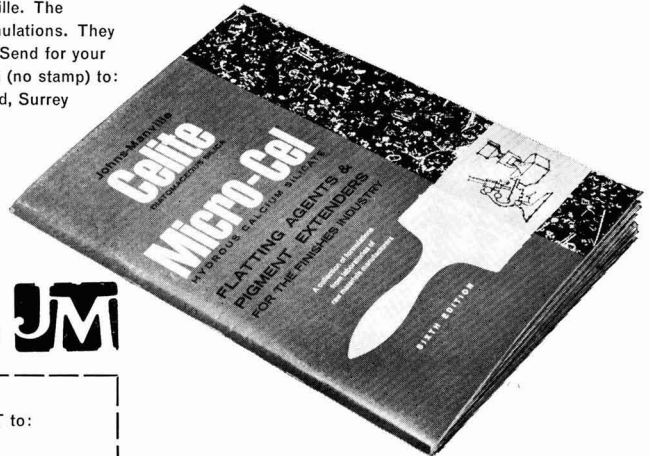
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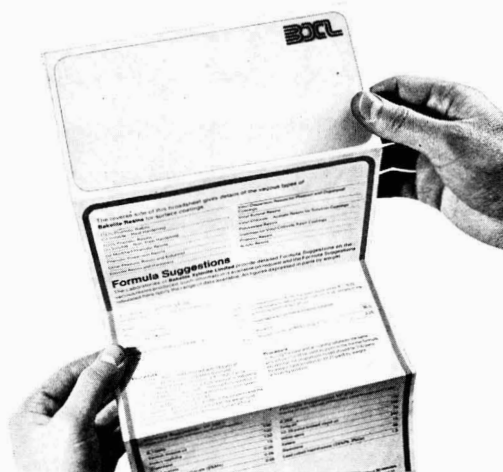
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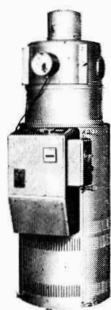
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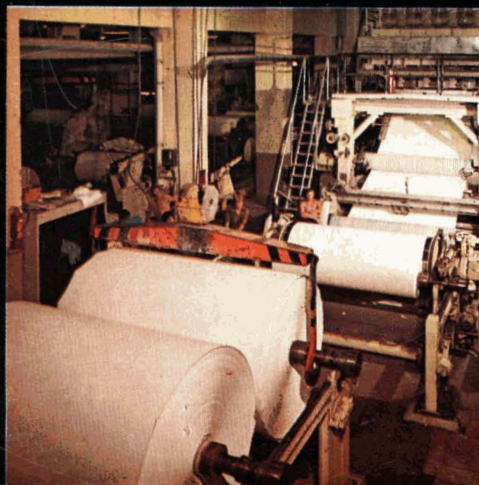
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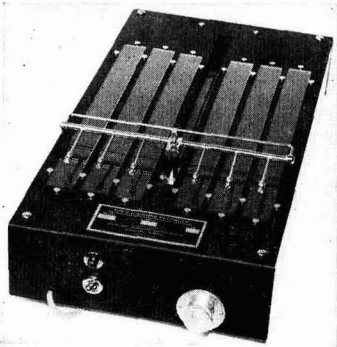
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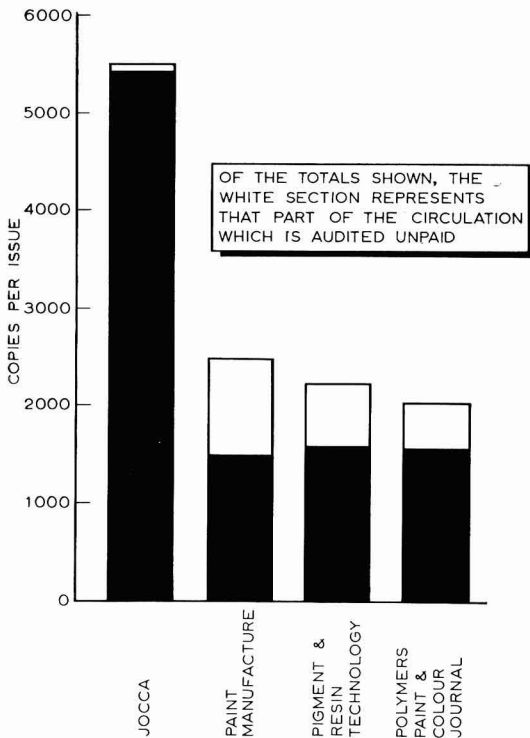
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