compounds such as aliphatic alcohols, amines, acids and esters were pyrolysed and analysed in the way described. From all these compounds characteristic chromatograms of the pyrolysis products were obtained which made it possible to differentiate between compound groups, individual members of homologous series and between isomers such as normal- and iso-alcohols.

It is believed that a valuable technique for identification of the small amounts of material eluting from gas chromatographic columns can be based on this method of pyrolysis.

The method does not seem to be restricted to volatile compounds[1].

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[1] Janak, J., in *Gas Chromatography*, 1960. Proc. Third Symp., edit. by Scott, R. P. W., 309 (Butterworths, London, 1960).

A Coating with Antifouling Properties from the Reaction between Cuprous Oxide and Sodium Silicate

Films prepared from dispersions of zinc dust in sodium silica media of a high silica ratio of about $Na_2O : SiO_2/1 : 3{\cdot}8$ by weight (Pass, A., and Meason, M. J. F., private communication) have been reported to become substantially insoluble in water within a few hours without the aid of curing agents previously needed to produce satisfactory air-drying zinc silicate paints[1]. The mechanism of the formation of these films is only partially understood, and in the course of work undertaken to elucidate it, changes in viscosity occurring when zinc and other pigments are dispersed in silicate media are being examined.

Various pigments were dispersed in aqueous solutions containing 16·6 per cent of sodium silicate having an $Na_2O : SiO_2$ ratio of $1 : 3{\cdot}55$ by weight, and the changes in viscosity of the dispersions with time were measured at a shear-rate of 54 $sec.^{-1}$ using a Couette co-axial cylinder type viscometer.

Fig. 1 shows curves which illustrate the viscosity/time relationships characteristic of the two main groups of pigments which were studied. Dispersions of non-reactive pigments such as talc, micaceous hæmatite, titanium dioxide and iron oxide decrease in viscosity with time due to an improvement in dispersion brought about by the action of the viscometer. Films produced from these dispersions will only become insoluble in water on long exposure in air or by the application of heat or curing agents. In contrast, the viscosity of dispersions of some other pigments including zinc dust, cuprous oxide and mercuric oxide increases gradually with time evidently because the pigments react with or cause a reaction in the medium. Of particular interest was the indication that, as with zinc, films of cuprous oxide in sodium silicate media of a high silica ratio might cure unaided at room temperature and this has been confirmed by experiment.

The proportion of cuprous oxide in the dispersion and the $Na_2O : SiO_2$ ratio in the medium can be varied over quite a wide range, and the film will still become insoluble in water within, at most, an overnight drying period. Methyl cellulose, bentonite, micronized mica and similar viscosity control agents can be included to improve the application and film-forming properties of the dispersion. A typical composition having satisfactory film forming and curing

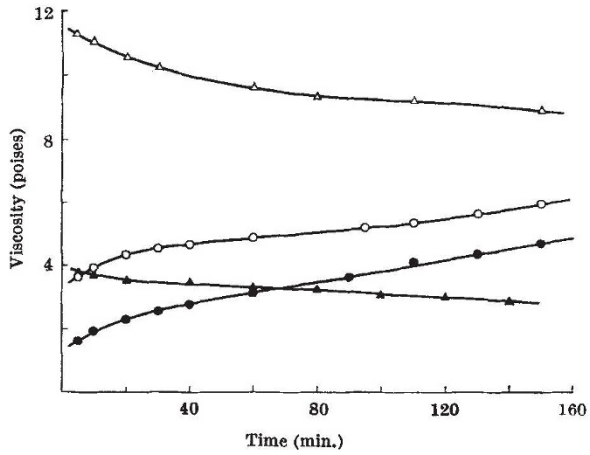

Fig. 1. Viscosity at constant shear-rate as a function of time. △, Talc; ○, cuprous oxide; ●, zinc dust; ▲, micaceous hæmatite. The quantities of pigment added to 120 ml. of sodium silicate solution were 56 gm., 225 gm., 450 gm. and 300 gm. respectively

properties is made by dispersing 225 parts by weight of cuprous oxide and one part of methyl cellulose in 140 parts of an aqueous solution containing 18·6 per cent of sodium silicate having an $Na_2O : SiO_2$ ratio of $1 : 3{\cdot}8$.

Films of this composition and of variants of it have shown no fouling during a period of 95 weeks immersion in Sydney Harbour, Australia. The most abundant macrofouling organisms recorded at this severe exposure site are: *Balanus* (*Balanus*) *amphitrite* var. *cirratus* Darwin; *Bugula avicularia* L., *Bugula neritina* L.; *Hydroides norvegica* Gunnerus, *Spirorbis* sp.; *Watersipora cucullata* (Busk), *Conopeum reticulum* (Linne); *Mytilus planulatus* Lamarck and *Crassostrea commercialis* Iredale and Roughley, and settlement of at least three of these species took place on inert control panels during each month of the immersion period (ref. 2 and Wisely, B., private communication). The average fouling-free life of 46 commercial paints immersed along with the silicate compositions was 26 weeks (Laurie, H. A., private communication).

There are indications that the inclusion of zinc dust up to the extent of about 10 per cent of the cuprous oxide content of such dispersions may prolong the fouling-free life of the film by depressing the solution-rate of the copper in the early stages of immersion.

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[1] U.S. Patent 2,509,875.
[2] Wisely, B., *Austral. J. Mar. Freshwater Res.*, **10**, 30 (1959).