

multiplied in the crystal by symmetry operations, and as a result the dye molecules are not parallel (for example, in the trigonal and hexagonal systems when modification is on the basal plane), pleochroism of dye inclusions in the modified crystals cannot be expected. Where it has not been possible to obtain crystals with pleochroic adsorbed dye inclusions, the necessary coincidences between the polar groups of dyes and ionic sites of suitable planes to account for the observed habit modifications may be similarly demonstrated. It is perhaps noteworthy that a small minority only of the habit modifications examined appear to be capable of explanation by fitting the dye molecule directly into the habit-modified face (for example, potassium nitrate with acid magenta). In these cases the habit modification is apparently not so strong as that found when the same dye fits on to a plane perpendicular to a habit-modified face of another salt; close comparisons are not justifiable, however, when solubility differences exist.

Some attempts are being made to predict the structures of crystal-habit modifiers according to this theory. In a certain number of cases success has been achieved; but a difficulty has arisen, that it is impossible to predict the solubility of the dye, which depends just as markedly on the orientation of the polar substituent groups as does its crystal-habit modifying powers⁶. A full account of this work will be reported elsewhere.

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Contamination of Evaporated Films by the Supporting Material of the Source

IN studies of the properties of films produced by vacuum evaporation, it is important to know whether appreciable contamination by the material of the boat or filament occurs under the normal evaporation conditions. The mass of a film is usually very small, and some properties of films are very sensitive to minute amounts of contamination. A test of high sensitivity is therefore required. The radioactive tracer method possesses this necessary sensitivity when there is a suitable isotope of the material of the boat.

The mechanical properties of tantalum and its high melting point make it a suitable material for evaporation sources. It has an active isotope, tantalum-182, with a half-life of 117 days. Moreover, since the whole of natural tantalum consists of the 181 isotope, from which the active isotope is produced by neutron irradiation, a high specific activity is easily obtained. Experiments have been made with an active tantalum boat as evaporation source, the evaporated materials being tested for active tantalum in the usual way. Silver and germanium have been examined, the evaporation being carried out at several temperatures. One count per

minute above background corresponds to 2.3×10^{-10} gm. tantalum in the deposit. The masses of silver and germanium deposited on the test target were of the order 10^{-4} gm., so that contamination to the extent of a few parts per million was detectable.

The results with germanium showed that the tantalum content of the film ranged from 11 p.p.m. for an evaporation temperature of 1,120° C. to 26 p.p.m. at 1,800° C. For silver, the figures recorded were from 20 p.p.m. at 1,100° C. to 113 p.p.m. at 1,670° C.

The mechanism by which the tantalum is transported is not clear, since the two obvious processes, namely, direct evaporation and solution by the molten metal, would be much more temperature-dependent. From the practical point of view, however, it is seen that provided the temperature of the source is kept below about 1,200° C., the contamination does not exceed 10–20 parts per million. As an indication of possible contamination when films are evaporated very rapidly, it should be stated that on one occasion the boat temperature was raised to above 2,000° C. and that the resulting film contained 1 part in 7 of tantalum.

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Measurements of the Normal Stress Effect in Solutions of Polyisobutylene

Weissenberg¹⁻³, Garner and Nissan⁴, and Garner, Nissan and Wood⁵ have described a number of experiments which indicate that, in high-polymer solutions, steady-state laminar flow cannot be maintained by the action of shearing forces alone, even at low-velocity gradients for which centrifugal effects can be neglected. The effects observed in these experiments have been interpreted by Rivlin^{6,7} phenomenologically as due to the fact that the relations connecting the stress and strain velocity components for the steady-state laminar flow of such a solution involve a second physical parameter defining the flow properties of the fluid, in addition to the viscosity.

This parameter has been termed the 'normal stress coefficient', and effects which arise from its non-vanishing have been called 'normal stress effects'. From the phenomenological point of view, both the viscosity and the normal stress coefficient can depend on the state of flow through the flow invariants and, if the flow is inhomogeneous, can vary from point to point of the fluid.

It has further been shown⁸ that values of the normal stress coefficient sufficient to give rise to effects of the observed order of magnitude could probably occur in high-polymer solutions of a few per cent concentration as a result of the orientation of the dissolved molecules in the flowing solution.

The normal stress effect for solutions of polyisobutylene in *ortho*-dichlorobenzene has now been investigated using an experimental arrangement similar, in principle, to one described by Weissenberg, and by Garner, Nissan and Wood. The solution is contained between two coaxial cylindrical cups, as shown schematically in Fig. 1. The outer cup can be rotated at a variety of speeds and the distance between the disks forming the bases of the cups can be varied. The pressure which must be applied at these disks in order to maintain the solution in a steady state of laminar flow between them is measured automatically by a number of vertical tubes entering the base of the inner cup at various