It is assumed in the derivations of equations 1, 2, and 3 that the inclusions are fixed in space and that their intersections with grain boundaries are purely random. The real situation is unlikely to be as simple as this, so that the numerical predictions are subject to an unknown degree of uncertainty. It would be expected that the equations would be affected equally by departures from the situation assumed, so that the general conclusion that some boundaries may be inhibited from movement while others are still relatively free remains valid, and is in fact more reliable than the numerical predictions.

Some observations of our own, to be reported elsewhere, on the effect of the particle size of magnesia additions on grain growth in dense alumina appear to support the idea that the number of second-phase particles per boundary is of some significance in grain growth phenomena, and it is hoped that other workers will find these ideas useful.

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References

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Letters

Anodising in a Gas and in Methyl Cyanide – an Analogy

The results of Jackson [1] on the gaseous anodisation of tantalum show a striking analogy to results obtained in attempts to anodise tantalum in electrolytes based on methyl cyanide.

The experiments were carried out in a conventional Hull cell, with a tantalum foil anode and a platinum gauze cathode. Methyl cyanide to which a few drops (per litre) of concentrated aqueous HCl had been added to increase the conductivity and serve as a source of oxygen, was used as the electrolyte. The tantalum foil was degreased with trichloroethylene, flushed with chromic-sulphuric acid solution and distilled water and dried, the anodising was carried out at room temperature at a constant voltage.

No change in the appearance of the tantalum foil was observed below ~10 V, even with anodising times of 2 h or more. The interference colours characteristic of anodic oxide films appeared at higher voltages, but the process was extremely slow and only a fraction of the surface was anodised even after 12 h. The current density was low (e.g. 0.02 mA per centimetre of *total* surface) and did not increase significantly when the electrolyte was stirred. Only the surface facing the cathode was oxidised at the part closest to the cathode. The back side of the tantalum foil remained unchanged in appearance. The appearance of the anodised part was uniform, except for a narrow band of different colour (i.e. of lower thickness) at the boundary between oxidised and non-oxidised surfaces. However, such uniformity was obtained only with carefully cleaned samples, and any traces of contamination (e.g. finger marks) prevented oxidation of the contaminated area.

The current efficiency, determined by measuring the weight increment, integrating the current and calculating on the basis of Faraday's laws, was of the order of 40%.

As in the case of anodising in a gas, the relatively low conductivity of the electrolyte interferes with the creation of a high field at the oxide. In addition, the low initial oxygen concentration in the electrolyte results in rapid depletion of the oxygen in the layer adjacent to the anode and slows down the oxidation process.

Thus, except for the fact that a high temperature is developed at the anode in gas anodising, an analogy is observed between the oxidation of tantalum in methyl cyanide and in a gas. The author believes that this analogy is due to the fact that both media are of relatively low conductivity and low oxygen content (in terms of the absolute amount of oxygen per unit volume).

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