details, proving that the electron microscope can give reliable pictures.

With further development the instrument might be used as a microhardness tester. The breadth of the lines passing through different parts of the specimen can give an idea of the relative hardness of the grains.

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Viscosity of Metallic Liquids

The viscosity of metallic liquids has been comparatively little studied, mainly due to the experimental difficulties characteristic of viscosity measurements at higher temperatures. The interest in viscosity data is, however, considerable. On the theoretical side, such data would provide further information towards the understanding of the liquid state, while, in the field of applied metallurgy, the viscous nature of liquids is tied closely with the flow behaviour of metals in filling moulds. The paucity of data in these fields can be appreciated from the fact that even such important problems as the variation of viscosity as a function of temperature close to the melting point of a metal, and the variation of viscosity as a function of composition in binary alloy systems, have not been fully studied experimentally.

Viscosity measurements which have been recently carried out in this Department show that certain views normally held on these points are not supported by experiments. For example, it is generally assumed[1] that the relationship of viscosity to temperature is given by:

$$\eta = A \exp B/RT,$$

and that this expression holds true to the melting point of the metal. The experimental results we have

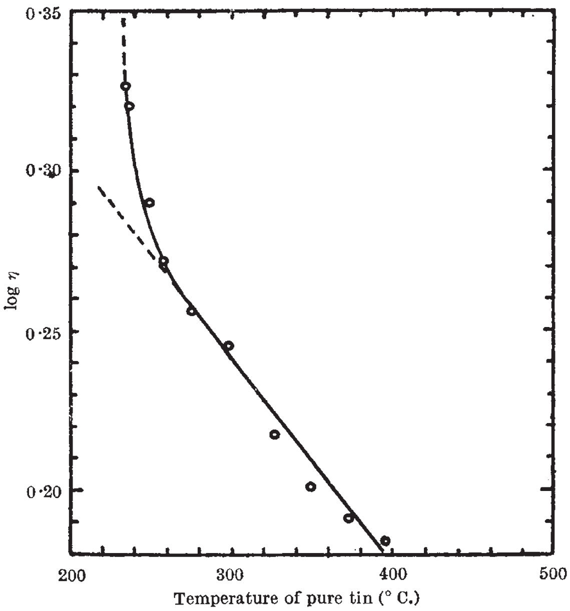

Fig. 1

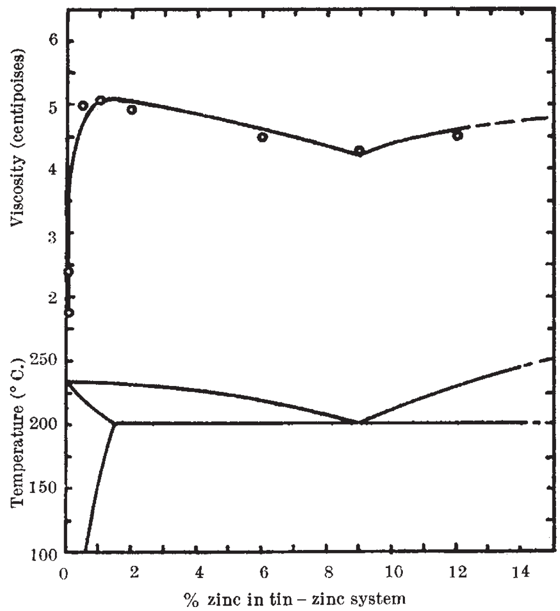

Fig. 2

obtained with tin, lead and certain binary alloys, however, show the relationship indicated in Fig. 1. It is clear that the absolute viscosity changes rather markedly a few degrees above the melting point.

On the question of the relation of viscosity to the composition of simple binary alloy systems, it is generally taken that viscosity is an additive property of the mixture of the two metals[2], and that deviations from this rule are only obtained in the presence of strong intermetallic compounds in the system. Our experimental results, which were carried out over a considerable range of temperature and composition, show, on the other hand, that the viscosity of simple systems, for example, tin–zinc, is represented by the relationship indicated in Fig. 2. It is interesting that such correlation of viscosity with constitution is only obtained when viscosity is plotted at a constant temperature above the liquidus for the system, rather than at a constant absolute temperature. A similar relationship was observed by Poliak[3] with aluminium–silicon alloys.

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May 19.

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A Resonant Circuit with a Time-Variant Resistive Element

Much attention has been devoted to a study of the effects associated with periodic variation of inductive and capacitive elements (the energy-storage elements) of resonant circuits. The present communication is concerned with two closely related phenomena arising from periodic variation of the resistive element of a series or parallel circuit.