LETTERS TO THE EDITOR

Thermoelectric Power and Electrical Resistivity of Liquid Mercury-Gallium Alloys

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Some liquid mercury alloys show a minimum of the thermoelectric power when it is plotted as a function of concentration^{(1)~(3)}. Many authors have attempted to explain this phenomenon but no satisfactory explanation has been obtained. The minimum has been found only in the alloys with elements of one (Hg-alkali metals) or three valence (Hg-In and Hg-Tl). All these systems have a sort of intermetallic compounds stable up to their melting point as shown in Fig. 1(a)⁽⁴⁾. This suggests that a cluster may exist in the liquid state of these alloys. Some authors gave evidences for cluster formation in Hg-In⁽⁵⁾ and Hg-Tl⁽⁶⁾. On the other hand, the systems which do not show any minimum of thermoelectric power do not possess such compounds. These facts seem to suggest that the formation of a cluster in the liquid alloys might be responsible for the minimum of the thermoelectric power of these alloys. Gallium is three valence, while the Hg-Ga system has no intermetallic compound and yet shows a miscibility gap as can be seen from Fig. 1(b)⁽⁴⁾. Therefore, measurements of the thermoelectric power in Hg-Ga alloys will contribute to confirm the

idea that the cluster in the liquids causes the minimum. The resistivity has also been measured for the same alloys.

The specimen was contained in a glass vessel with two thermocouples which were composed of alumel and Pt · 10%Rh wires. To determine the thermoelectric power, the Seebeck e.m.f. was measured by keeping a small temperature difference between both junctions. When the resistance was measured, the alumel wires served as current leads and the Pt · 10%Rh wires as potential leads. The samples were prepared with mercury and gallium which were 99.999% in purity. More experimental details will be published elsewhere.

The results of the experiment show that the liquid Hg-Ga alloys also have a minimum of the thermoelectric power as shown in Fig. 2. The electrical resistivity decreases very rapidly with increasing concentration of gallium as shown in Fig. 3. From these figures it is seen that the concentration dependence of the thermoelectric power and the electrical resistivity for Hg-Ga alloys are similar to those for Hg-In and Hg-Tl alloys. From the present experiments, it can be concluded

Fig. 1 Phase diagrams of (a) Hg-In and (b) Hg-Ga⁽⁴⁾.

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Fig. 2 Thermoelectric power of Hg-Ga (present experiment), Hg-In⁽²⁾ and Hg-Tl⁽²⁾.

that the minimum of the thermoelectric power is not caused by cluster formation whether it really exist or not.

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Fig. 3 Electrical resistivity of Hg-Ga (present experiment), Hg-In⁽⁷⁾ and Hg-Tl⁽⁷⁾.

By T. Takeuchi* and S. Noguchi**

* Toyota Physical and Chemical Research Institute, Nagoya. Present address: Toyota Central Research and Development Labs., Inc., Nagoya, Japan.

** Department of Applied Physics, Faculty of Engineering, Nagoya University, Nagoya, Japan.