Thermoelectric Power of Cold-worked Copper at Low Temperature

THE influence of cold-working on the thermoelectric power has been measured by a number of workers[1]. At room temperature we carried out measurements on copper and silver wires. For a certain amount of cold-working it is found that the relative increase of the absolute thermoelectric power is greater than the relative increase of the resistivity. These results do not agree with the theoretical prediction of T. Hirone and K. Adachi[2].

So far as we know, no measurements have been carried out at low temperatures.

We measured the thermoelectric force between a wire, drawn at room temperature, and an annealed wire as a function of the temperature of the hot junction. The cold junction was always kept at liquid air temperature (83° K.) (Fig. 1).

Each curve reaches a minimum at a certain temperature which is dependent on the amount of cold-working. At the minimum the thermoelectric power (in 10^{-8} V. per deg. C.) is zero; it is positive above but negative below the corresponding temperature. So the absolute thermoelectric power increases above and decreases below the temperature mentioned.

Fig. 2 shows the temperature of the minimum, shown in Fig. 1, as a function of the percentage reduction of the area of the wire. In the same temperature-range we found cold-worked silver wires always had a positive thermoelectric power relative to annealed material.

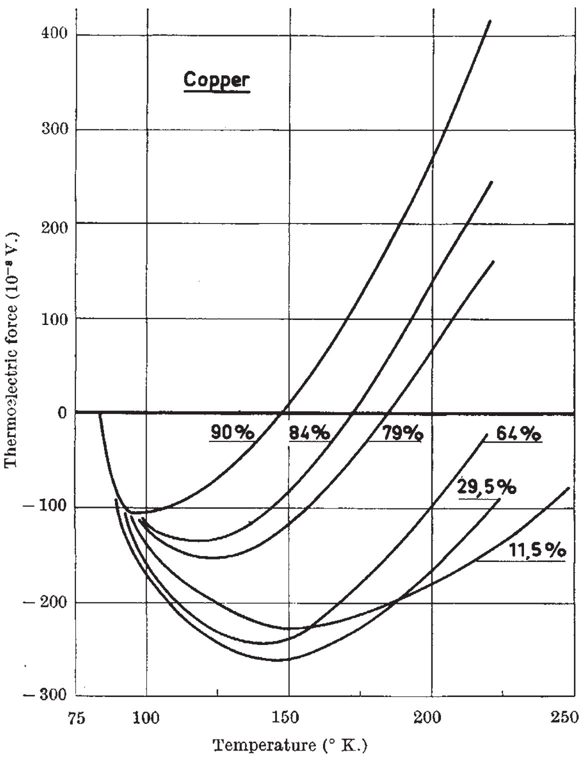

Fig. 1. The thermoelectric force plotted against the temperature of the hot junction for various percentage reductions by drawing. The cold junction is continually kept at 83° K. The thermoelectric force is always measured with respect to the same annealed copper wire

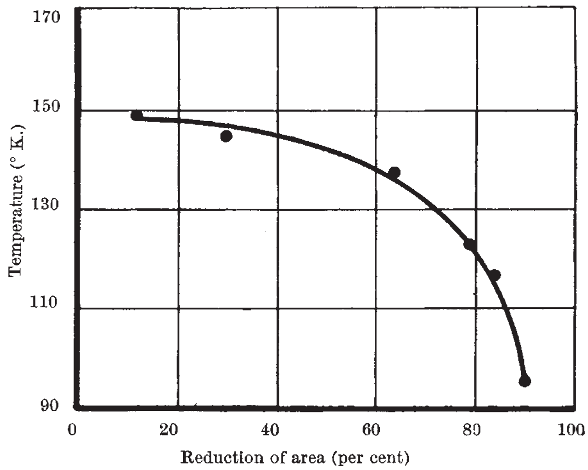

Fig. 2. The temperature of the minimum of a curve of Fig. 1 plotted against the corresponding percentage reduction of the area of the wire.

As usual we call a metal A positive with respect to a metal B if at the cold-junction the (positive) current flows from A to B. So far as we know the results for copper do not agree with any theory on the thermoelectric power.

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[1] For example, Brindley, G. W., Report of a Conference on Strengths of Solids, Bristol, 95 (1948).

[2] Hirone, T., and Adachi, K., *Sci. Rep. Res. Inst. Tôhoku Univ.*, A, 3, 454 (1951).

Measurement of the Hall Coefficient of α- and β-Brass

THE measurements described herewith were undertaken in order to find out whether any pronounced change in the Hall coefficient takes place when passing from α- to β-brass.

The well-known method employing d.c. was used, and the specimens were cut from thin sheets of brass. Small blocks of the materials were produced from thin copper wire and small pieces of zinc by melting in vacuum in a quartz tube, and the sheets were then produced by rolling from these small blocks. (The specimen of 52 per cent copper was milled down from a cast block.) The rolling was carried out at room temperature; but due to work-hardening after a number of operations, it was found necessary to anneal the work once by heating in an inert atmosphere (nitrogen). The specimens were then cut out in rectangular pieces about 48 mm. by 17 mm. The thickness, measured directly, varied from $0{\cdot}0778 \pm 0{\cdot}0004$ mm. to $0{\cdot}156 \pm 0{\cdot}0005$ mm. The d.c. was applied to the specimens through two circular contacts (2 mm. diam.) placed symmetrically with a distance between centres of 40 mm. To exclude errors due to a fixed current direction, the polarity was reversed now and then.

A correction[1] for the short-circuiting of the Hall field by the contacts for the primary current has