mechanical forces acting in the system from the energy function (2) when **E** and **D** are linearly related or by use of the formula (1) in the general case. Strange and elaborate expressions for the force acting on the dielectric are obtained[8]. Larmor and Livens reject the Helmholtz method and the results obtained by its means, and propose instead an elementary formula for the force acting on the dielectric derived directly from the notion of a polarized medium. I have shown that the deformation method leads to the formula of Larmor and Livens provided the work done in the deformation is calculated from (3) instead of from (1) or (2).

Finally, I have shown[7] for the case of a fluid dielectric how to derive the equation sought by Stoner and Guggenheim to express the first law of thermodynamics. The method has since been extended to obtain the corresponding equation for solids.

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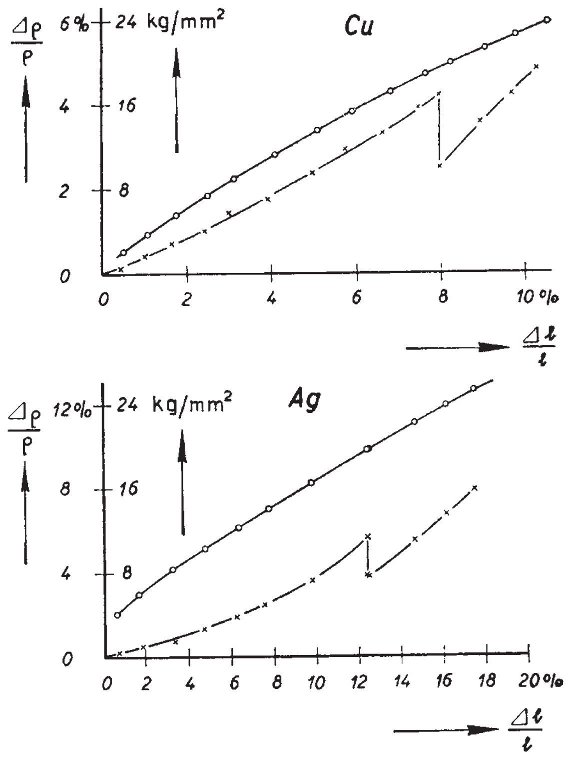
Change of Resistivity by Cold Working at Liquid-Air Temperature

THE relative change of resistivity ($\Delta\rho/\rho$) with plastic deformation at liquid-air temperature has been measured on several materials. Wires of copper, silver and aluminium which had been soft-annealed were stretched. The tension producing the extension as well as the resistivity were measured. The tension was removed after extension, and the resistivity was measured when there was no stress on the wire. The tension was then applied and increased so as to produce further plastic deformation. At an extension of approximately 10 per cent, the wire was removed from the liquid air and allowed to warm up to room temperature or heated to a higher temperature. The wire was then again placed in liquid air and the resistivity measured. The tension required to produce further plastic deformation was then determined as well as the resulting change of resistivity $\Delta\rho/\rho$.

It can be seen from the accompanying graphs that there is a discontinuity in the $\Delta\rho/\rho$ versus $\Delta l/l$ curve at the point where the temperature of the specimen was increased for a short while. There is no corresponding discontinuity in the tension versus $\Delta l/l$ curve. The minimum time for which the specimen was kept at room temperature was 10 min. No further decrease in $\Delta\rho/\rho$ was observed if the specimen was kept at room temperature for longer periods (up to 18 hr.).

For aluminium the relative decrease in $\Delta\rho/\rho$ was considerably larger than for copper or silver. The effect of keeping the specimen at higher temperatures up to 150° C. was investigated for copper and silver. No further decrease in $\Delta\rho/\rho$ was observed.

As the curves of tension versus $\Delta l/l$ are continuous, whereas there are discontinuities in the $\Delta\rho/\rho$ versus $\Delta l/l$ curves, the experiments show that the mechanism producing hardening by cold work is at least in part different from that producing the change of resistivity. This might explain the discrepancy between the observed values of $\Delta\rho/\rho$ and those calculated from the work done in producing dislocations[1].



Above: Copper drawn at −183° C. to 8 per cent extension, allowed to warm up to 20° C. and kept there for 3 hr., then drawn further at −183° C. to an extension of 11 per cent
Below: Silver drawn at −183° C. to 12 per cent extension, heated to 140° C. and kept there for 10 min., then drawn further at − 183° C. to an extension of 17 per cent
x—x, $\Delta\rho/\rho$ versus $\Delta l/l$; o—o, tension versus $\Delta l/l$.

The magnitude of $\Delta\rho/\rho$ depends to a very great extent on the annealing temperature, slightly different heat treatments changing $\Delta\rho/\rho$ by a factor of 2. The previous history of the specimen may also be important. The discontinuity in the $\Delta\rho/\rho$ versus $\Delta l/l$ curve, however, always occurred.

The investigation is being continued. These measurements were made under the direction of Prof. M. J. Druyvesteyn (Delft), to whom we express our thanks. One of us (W. H. A.) also wishes to thank the South African Council of Scientific and Industrial Research for a research grant which made it possible for him to attend the Technische Hogeschool, Delft.

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Absorption Spectrum of Tin Vapour in the Schumann Region

As part of a programme of studies of absorption spectra of vapours of metallic elements in the far ultra-violet[1], exploratory observations have now been made for tin, with the results here described.

The Sn I emission spectrum has been subjected to careful study by Meggers[2], who made new observations from λ1,697 to the end of the photographic infra-red, and also embodied bolometer measurements