Letters to the Editor

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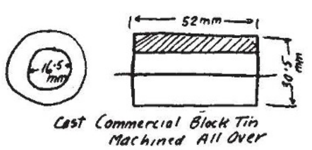
Magnetic Properties of Supraconductors

I SHOULD like to report the results of experiments which bear on the recent discovery of Meissner and Ochsenfeld, regarding the magnetic properties of matter in the supraconducting state. I feel that our results will add something to this original contribution and the further contribution made recently by Mendelssohn and Babbitt[1].

According to Meissner's results, if a supraconductor be lowered from a temperature above the transition point to a temperature below that point, with a constant magnetic field applied, we should expect to observe a change in flux in search coils placed in various positions relatively to the supraconductor and the field. A supraconducting body



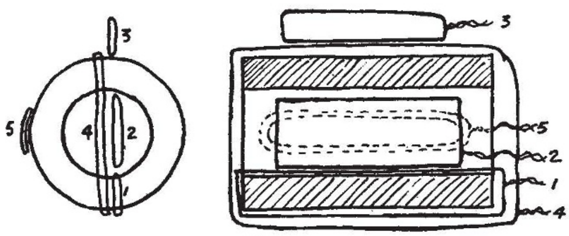


FIG. 1.

in the shape of a hollow cylinder of tin was used, and small coils wound about the tin or placed near the tin, as indicated in Fig. 1. Coil No. 1 was wound around one side of the cylinder. Coil No. 2 was placed inside the hollow cylinder. Coil No. 3 was placed near the surface of the cylinder tangential to the applied field. Coil No. 4 was wound so as to enclose the whole cylinder in the plane of the coil. No. 5 was placed at the outer surface of the cylinder perpendicular to the applied magnetic field. According to the results reported by Meissner, if one applies a magnetic field when the tin is above its supraconducting point, and leaves this field constant while the temperature of the sample is taken through its transition point to a temperature definitely below the supraconducting temperature, one should observe the following: In coil No. 1, decrease to zero flux; in coil No. 2, no change in flux; in coil No. 3, increase of twice the applied field intensity; in coil No. 4, decrease in flux due to wiping out of the flux in tin; in coil No. 5, decrease to zero flux.

In our experiments these search coils were arranged to be connected directly to a flux meter, and the deflections were read by means of a lamp and scale. Our preliminary results, which have been checked two or three times, are as follows: As the tin cylinder was taken from above the transition point to below, coil No. 1 showed a decrease of 90 per cent in the flux; No. 2 showed a slight increase up to 10 per cent; coil No. 3 showed an increase of 25 per cent; coil No. 4 a decrease of 30 per cent; and coil No. 5 a decrease of from 20 to 25 per cent in the flux. It should be noted that coil No. 3 projected about 5 mm. from the surface where there was undoubtedly a magnetic field of high gradient, and also that coil No. 5 of necessity enclosed a considerable space where the field was not theoretically zero, but only relatively weakened. The field strengths used were approximately 30, 150 and 200 gauss respectively. Repeated readings were carried out with the stronger field.

This work was carried out with the assistance of Mr. J. O. Wilhelm and Mr. F. G. A. Tarr.

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April 5.

[1] NATURE, 133, 459, March 24, 1934.

Constitution of Hafnium and other Elements

TAKING advantage of the exceptionally favourable setting of the anode discharge tube used in the analysis of the rare earths already reported[1], I have obtained further results of great interest.

Hafnium gives a mass-spectrum indicating five isotopes, a weak line at 176 and four strong ones, 177, 178, 179, 180, of which the even numbers are rather more abundant. Thorium appears to be simple 232; no line of higher mass number could be seen. Rhodium gave the feeblest effect of any element yet analysed; only one line, that expected at 103, could be clearly detected.

Very intense spectra were obtained from calcium, disclosing faint new isotopes, 42 and 43, in addition to 40 and 44 previously discovered by Dempster. It also appears very probable that a line at 41 was partly due to an isotope of calcium, but the difficulty of making an accurate estimate of its intensity and the impossibility of entirely excluding potassium are obstacles still in the way of a definite proof of this interesting conclusion.

Numerous attempts to analyse titanium in the past have yielded very inconclusive results. Satisfactory mass-spectra have now been obtained which show its main line, 48, flanked by four new faint lines, 46, 47, 49, 50, the whole forming a most striking symmetrical group. It is noteworthy that with the discovery of these isotopes and that of argon 38 recently reported by Zeeman, all the numbers from 9 to 56 are now filled.

New mass-spectra obtained from zirconium not only show an additional and fairly abundant isotope 91, hitherto overlooked owing to insufficient resolution, but also confirm the presence of the very rare and previously doubtful constituent 96, which is of particular interest as it forms with molybdenum and ruthenium the lightest known isobaric triplet.

Further work with samarium has disclosed two faint isotopes, 144 and 150.

Only four common elements, palladium, iridium, platinum and gold, still remain to be analysed; even with the present setting, all attempts with these have given negative results.

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April 21.

[1] NATURE, 133, 327, March 3, 1934.