Letters to the Editor.

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Constitution of Chromium.

THE first mass-spectra of chromium were obtained by means of accelerated anode rays. The results were very feeble and only showed one line of mass number 52 (NATURE, Sept. 22, 1923, p. 449). I have now been able to make experiments with a volatile compound of this metal, the solid carbonyl, $Cr(CO)_6$, kindly prepared for me by Dr. A. v. Grosse, of Berlin. The vapour pressure of this is low but sufficient for use in the ordinary discharge tube when suitable arrangements are made. The intensity of the beam of mass-rays has been so increased that not only has it been possible, by the use of fine slits, to obtain a value for the packing fraction of Cr^{52} but also, by the use of coarse slits and long exposures, to reveal no less than three new isotopes, and to determine their relative abundance photometrically as follows:

Mass number	50	52	53	54
Percentage abundance	4·9	81·6	10·4	3·1

The packing fraction of Cr^{52} is -10 with a maximum possible uncertainty of ± 3 (pts. per 10,000, $O^{16}=0$) a large negative value, as was expected from the curve. Correcting for this and for the change to the chemical scale we get

Atomic weight of Cr $= 52{\cdot}011 \pm 0{\cdot}006$,

a value identical with that in use.

It will be noticed that the lightest isotope is isobaric with the doubtful Ti^{50} and the heaviest with Fe^{54}.

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Cavendish Laboratory,
Cambridge, July 26.

Hydrogenised Iron of High Magnetic Permeability.

SINGLE crystals of iron produced some time ago in this laboratory by high temperature treatments in hydrogen [1] were found to have higher permeabilities than crystals grown by other methods.[2, 3, 4] Experiments soon showed that these high permeabilities were not the result of the large crystal size, but of the hydrogen treatment at the high temperature. As a result of further experiments great improvements in the permeability of iron have been obtained by heat treatments in hydrogen not resulting in large crystals, and values of initial and maximum permeabilities now repeatedly obtainable are 6000 and 130,000 respectively. For such specimens the coercive force is 0·05 gauss and the hysteresis loss for $B_m = 14{,}000$ is 300 ergs/c.c./cycle. The magnetisation curves and hysteresis loop are shown in Figs. 1 and 2. For comparison, similar curves for ordinary annealed iron are also shown. Mechanically, this is the softest iron yet produced, having a hardness about the same as that of annealed copper.

These results have been obtained in cylindrical specimens of Armco iron one inch in outside diameter, $\frac{3}{4}$ inch in inside diameter and $\frac{1}{4}$ inch high, heat treated in moist hydrogen at between 1400° C. and 1500° C. for 12 hours. The specimens are then cooled to 880° C. or to room temperature, after which they are annealed at 880° C. for 2 hours. As a result of this treatment the specimens are etched as if by evaporation and have a grey colour probably due to a thin film of oxide. The grain diameter ranges from 0·1 to 2 mm. The magnetic properties are quite sensitive to mechanical strain but it has been found that deleterious effects due to overstrain, occurring at any time after the high temperature treatment, may be wiped out by a subsequent annealing at 880° C. This fact has been used to advantage where mechanical operations are desirable in the preparation of the specimens, the low temperature annealing being given after severe hard working of the material already treated at the high temperature. Experiments have also shown that the hydrogenising process may be applied in the melt.

Various experimenters have reported improvements in the magnetic properties of iron by heat treatments in hydrogen,[5, 6, 7] but the results obtained have not been so good as for specimens treated in vacuum [8, 9, 10] or nitrogen [6] or slightly oxidising atmospheres.[11] Such improvements as have been obtained have usually been ascribed to the removal of absorbed gases, reduction of the oxides, or decarburisation. Recently Yensen [12] reported high permeability in a specimen of carefully purified and vacuum treated iron. More recently Zeigler [13] reported similar results for a specimen consisting of several large crystals, from which he concludes that high permeability in iron is obtained only in single crystal specimens. Rogers has obtained

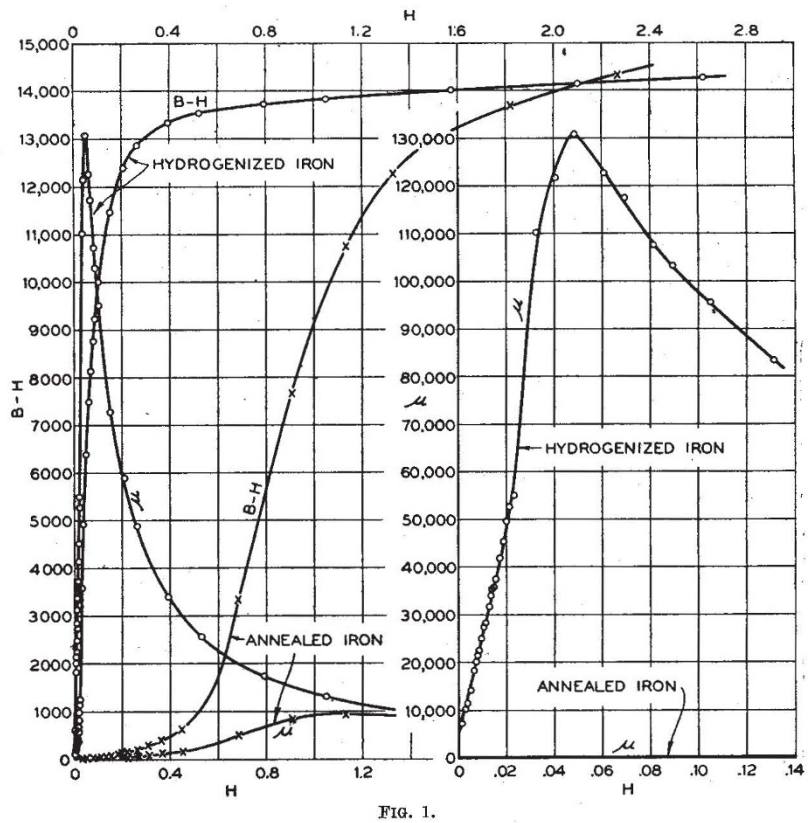

FIG. 1.