

Some Magnetic Properties of Finely Divided Ferric Oxides and Hydroxides

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Measurements of magnetization between 20°K and room temperature have been made on samples of α -Fe₂O₃ and α -, β - and δ -FeOOH using the balance method. Some of the results are described in another paper read at this conference at the special meeting on rock magnetism (Creer (1962)) and those for α -Fe₂O₃ show many of the characteristics discussed in the two preceding papers (Néel (1962) and Cohen et al. (1962)). In Fig. 1 are shown χ , T curves for samples of haematite

of different grain size, this having been estimated from the broadening of the (110) and (104) x-ray diffraction rings. A mean value has been taken but the effect of the shape of the grains is yet to be investigated. Grains of size less than 100 Å can be given a thermo-remnant magnetization below a blockage temperature which is lower than 100°K. Fine grains of α - and β -FeOOH of less than 50 Å are found almost to obey a Curie law although in the massive state the susceptibility shows little variation with temperature. δ -FeOOH is ferrimagnetic in large grains but very fine grains show similar properties to fine grained haematite. These measurements were made at Institut Fourier, Grenoble with the kind cooperation of Prof. L. Néel and Dr. J. Cohen. Mr. I. G. Hedley of King's College prepared many of the α -Fe₂O₃ samples and made some of the measurements. Some samples of β - and δ -FeOOH were prepared by Dr. A. L. Mackay of Birkbeck College, London.

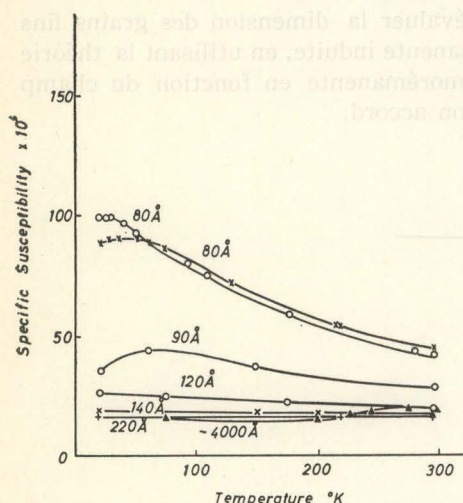


Fig. 1. Specific susceptibility vs. temperature for finely divided haematite. The two samples of average size 80 Å were made by different methods and the grains are of different shape.

References

- 1 K. M. Creer: J. Geomag. Geoelect. **13**, No. 3~4 (1961), Proc. Spec. Meeting on Rock Mag. Kyoto, 1961.
- 2 J. Cohen, K. M. Creer, R. Pauthenet and K. Srivastava: J. Phys. Soc. Japan **17**, Suppl. B-I (1962) Proc. Int. Conf. Mag. Cryst. **1** (1961) 685.
- 3 L. Néel: J. Phys. Soc. Japan **17**, Suppl. B-I (1962).Proc. Int. Conf. Mag. Cryst. **1** (1961) 676.

DISCUSSION

K. KOBAYASHI: Could you develop the size of the fine particles of ferromagnetic oxides by keeping them in a temperature lower than about 300°C?

The problem is important in my research of chemical remanent magnetization. I have made many trials to obtain such situation, but without success.

K. M. CREER: Very fine particles of α -FeOOH and δ -FeOOH have been prepared by Hedley by heating the carbonate at about 100°C. The grains so obtained have mean size of about 20-30 Å. β -FeOOH of about 10 Å-20 Å grain size has been prepared by hydrolysis of FeCl₃ at 100°C, the solid being separated and washed by ultra-centrifuging. Small grains of α -Fe₂O₃ have been prepared by dehydrating finely divided α -FeOOH prepared from the carbonate by heating at 150°C or higher according to grain size desired.