Gyromagnetic Ratio of Pyrrhotite

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The gyromagnetic ratio of pyrrhotite was determined by measurements of the Einstein–de Haas effect. The value obtained for g' is 1.9±15%.

INTRODUCTION

THE gyromagnetic ratio of pyrrhotite was measured in 1935 by Coeterier[1] who obtained a magnetomechanical factor of 0.63. This extraordinary value for g' is unexplainable on the basis of recent models which account for the ferrimagnetism of this material.[2] Hence, it was thought that a new measurement of the Einstein–de Haas effect for pyrrhotite would be of considerable interest.

The apparatus used for making the present measurement is located at Dayton, Ohio, and has been previously described by one of us.[3]

The sample used was fabricated at the University of Strasbourg. Natural crystals were crushed into particles having grain sizes between 0.25 and 0.70 mm, and a magnetic method of selecting those grains having the highest possible permeability was used. These grains were placed in a thin-walled brass tube and fixed in paraffin. The magnetic axes of the individual grains were oriented at random. Originally, favorable orientation of the individual grains was attempted. However, this led to excessive field coupling due to difficulty in making the easy magnetization directions coincide exactly with the axis of rotation of the cylinder.

This cylinder produced a gyromagnetic torque about 1/400 of that produced when Fe was used in the same equipment. Also, due to the anisotropic nature of pyrrhotite, disturbing torques were relatively much larger.

The apparatus described in reference 3 was varied for these experiments on pyrrhotite by adding a diffracting slit and microscope in the optical system so that deflections of 1/100 mm could be estimated. The experimental procedure was otherwise unaltered.

RESULTS

Readings were taken on five different days, and nine independent values for g' were obtained. The average of these readings gave a g' value for pyrrhotite of 1.9±15%.

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[1] F. Coeterier, Helv. Phys. Acta **8**, 522 (1935).
[2] L. Néel, Revs. Modern Phys. **25**, 58 (1953).
[3] G. G. Scott, Phys. Rev. **119**, 84 (1960).