where the neutron diffraction experiment indicates an antiferromagnetic Curie point. However, at the highest temperatures reached, around 1150°K, the specific heat was observed to be rising rapidly, in a manner to suggest an anomaly at some still higher temperature.

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Some Magnetic and Electrical Properties of Gadolinium, Dysprosium, and Erbium Metals*

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Measurements of the ferromagnetic properties of the rare earth transition metals have been reported by Trombe[1,2] and Klemm and Bommer.[3] Further measurements on these metals are currently under way at the Ames Laboratory and this report presents results of some of the preliminary work.

In the case of gadolinium metal, which has the h.c.p. structure, a ring wound torus has been used for determining the Curie point and the magnetization as a function of field intensity for low fields. The torus was machined from a vacuum-cast cylinder of metal and had a rectangular cross section with an outer diameter of 2.58 cm, an inner diameter of 2.00 cm, and a thickness of 3.3 mm. The Curie point data are shown in Fig. 1, where the value indicated for the Curie point is 16±1°C in good agreement with the 16±2°C reported by Trombe.[1]

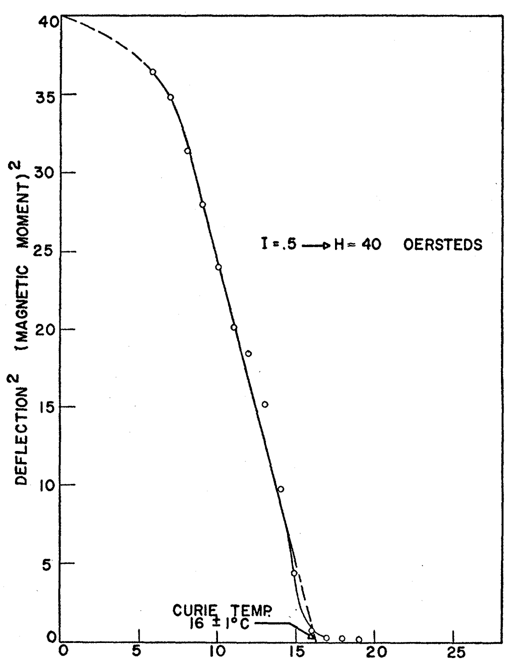

Fig. 1. Curie temperature of gadolinium.

Magnetization curves obtained with the torus are shown in Fig. 2. The data have been corrected for leakage through the pick-up coil. For the 77°K data, it is believed that an additional small correction should be made because of the oxygen content of the nitrogen bath, but it is difficult to estimate the magnitude of the correction. The results reported here indicate much higher magnetizations at low fields than those indicated by Trombe's[1] data. His lowest field intensity measurement was at 3000 oersteds at which the specific magnetization σ was about 195 cgs units. In the data of Fig. 2 this value of σ is obtained at the same temperature with an applied field of the order of 500 oersteds.

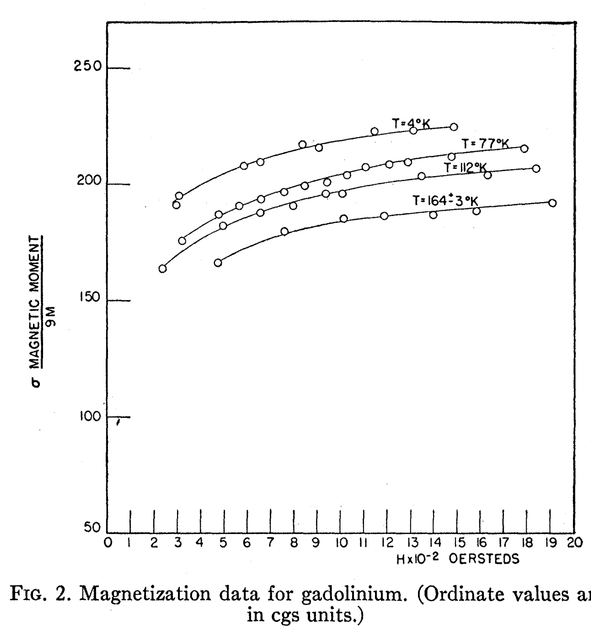

Fig. 2. Magnetization data for gadolinium. (Ordinate values are in cgs units.)

* Work was performed in the Ames Laboratory of the U. S. Atomic Energy Commission.

[1] M. F. Trombe, Ann. phys. **7**, 383 (1937).

[2] M. F. Trombe, Compt. rend. **221**, 19 (1945).

[3] W. Klemm and H. Bommer, Z. anorg. u. allgem. Chem. **231**, 138 (1937).

TABLE I. Data on samples (spectrographic analysis).

	Mg	Ca	Tb	Fe	Sm	Ho	Y	Ta
Gadolinium[a]	<0.02%	<0.03%	Faint trace	~0.02%	<0.15%			
Dysprosium[b]	Weak line (No quant. methods)	Strong line		Faint trace		~0.1%	~0.07%	Faint trace
Erbium[c, d]		<200 ppm		<300 ppm				Faint trace

[a] Cast under vacuum, rolled to shape, and annealed 7 hours at 550°C.
[b] Cast under argon atmosphere, turned to size, and annealed at 500°C for 66 hours.
[c] Free of all other rare earth metals.
[d] Cast under vacuum, filed to shape, unannealed.

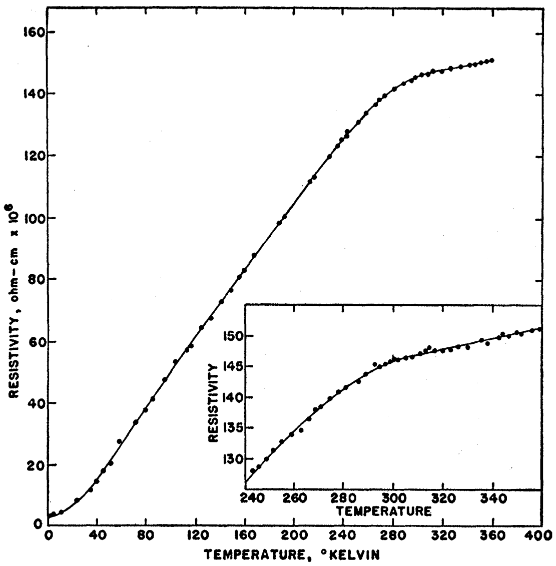

FIG. 3. Electrical resistivity of gadolinium metal.

Further measurements at higher field intensities are under way.

The electrical resistivities of gadolinium, dysprosium, and erbium rods have been determined from room temperature down to 2.2°K to ascertain the temperatures at which anomalies in the properties of the metals occur. The purities and methods of preparation of the rods are shown in Table I.

In Fig. 3 it is seen that there is an abrupt change in the slope of the resistivity curve for gadolinium at about 300°K. This we consider evidence of the influence of the magnetic properties of the metal on the conduction process at this temperature. The break occurs some ten degrees above the Curie point reported above.

For dysprosium a behavior similar to that for gadolinium is observed in the neighborhood of 155°K. See Fig. 4. Here, however, there is a long temperature interval over which the resistivity is nearly constant. Magnetic susceptibility measurements of Trombe[2] suggest a basis for understanding the effect. A slight peculiarity in the curve was also noticeable (and repeatable on different samples) at 73°K.

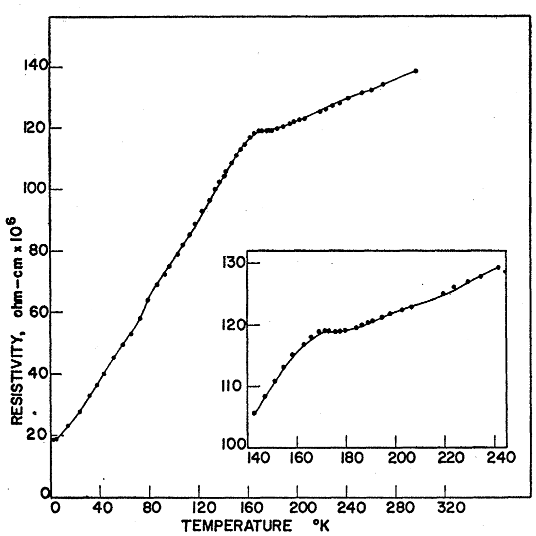

FIG. 4. Electrical resistivity of dysprosium metal.

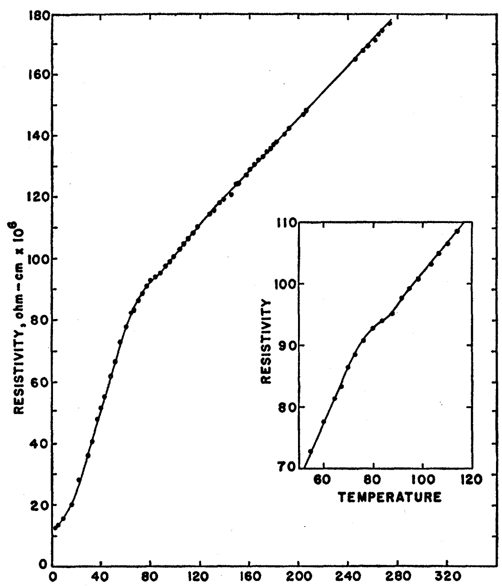

FIG. 5. Electrical resistivity of erbium metal.

Contrasted with dysprosium, the curve for erbium (Fig. 5) shows just a moderate change in the conduction process at about 80°K. Magnetic susceptibility measurements of Klemm and Bommer[3] indicate that the magnetic properties of this metal may be associated with this resistivity anomaly. It may be noted that erbium has an extremely high resistivity for a pure metal at room temperature.