ANISOTROPY OF THE MAGNETIC-FIELD-INDUCED ANOMALY IN THE RESISTANCE VERSUS TEMPERATURE CURVE OF GRAPHITE

AYACHE C. and de COMBARIEU A.

Centre d'Etudes Nucléaires de Grenoble
Service des Basses Températures

The basal magnetoresistance of a highly oriented pyrolitic graphite has been measured as a function of temperature for the two configurations H // C and H ⊥ C - H // J. In both cases the anomaly previously observed [1] [2] is present but is very anisotropic.

As regard to the first configuration and when we consider the resistance variation versus magnetic field at a fixed temperature (see Fig.1a) we can distinguish essentially two regimes. In the first one -below 4 Teslas - we get a nearly H^2 law but there is as usually a neat departure from it and the results cannot be fitted to a H^n law with $1.5 < n < 2$. The second regime - above 4 Teslas - is nearly described by a H law but yet with a departure from the exact law. If we compare these results (valuable at any temperatures) with the low-temperatures ones where the quantum effects are sensitive, the separation between the two regimes seems to be closely correlated with the oscillation usually attributed to the n = 1 hole - level crossing. Let us notice too that, below a determined temperatures, the isotherms all cross on the same range of temperature and magnetic field (about 250 oersteds). Considering now the temperature variations at fixed magnetic field (see Fig.1b) we observe the already mentionned anomaly which consist in an important enhancement of resistance at low temperatures (about 2000 at 4.2 K and 7.3 T) and the appearance of a maximum. As the magnetic field is increased the maximum temperature raises up to a limit of about 27 K for magnetic fields above a value comprised between 3 and 4 Teslas.

In the second experimental configuration and for the same range of magnetic fields (see Fig.2a) there is only one regime corresponding to the nearly H^2 law. The departure from the exact law is not exactly the same as in the first configuration. Below a certain temperature all the isotherms still cross in the same magnetic field range but this range is quantitatively different from the previous one (about 7000 oersteds).

The low-temperature enhancement (see Fig.2b) is much lower than in the former case (about 90 at 4.2 K and 7.3 T) and there is no evidence for any maximum.

However from this differences (different range of isotherms crossing, different enhancement) we have been able to evaluate a scaling factor for the magnetic field (about 25-30) between the behaviour of the second configuration and the the first regime of the first one.

1. KREPS L., DEVATY R. and WOOLLAM J.A. *12th Biennal Conference on Carbon (Extended Abstracts and Program)* p9 (1965)

2. WOOLLAM J.A., KREPS L.W., ROJESKI M., VOLD T. and DEVATY R., *Technical paper presented at the March 1976 Meeting of the America Physical Society, Atlanta, Georgia, March 29-April 1* (1976).

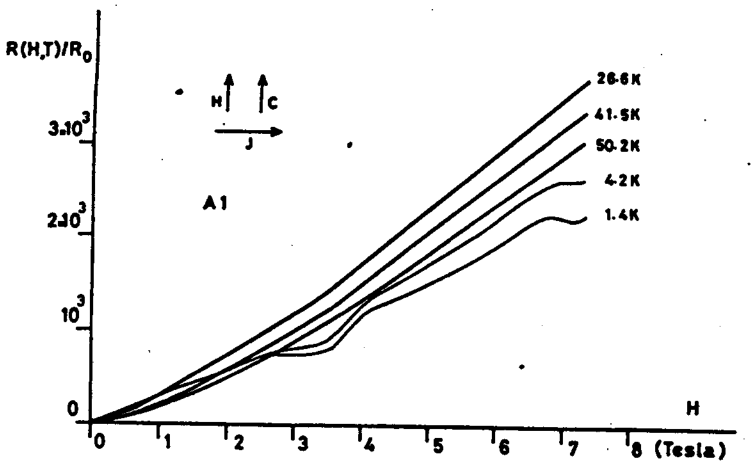

FIG. 1a

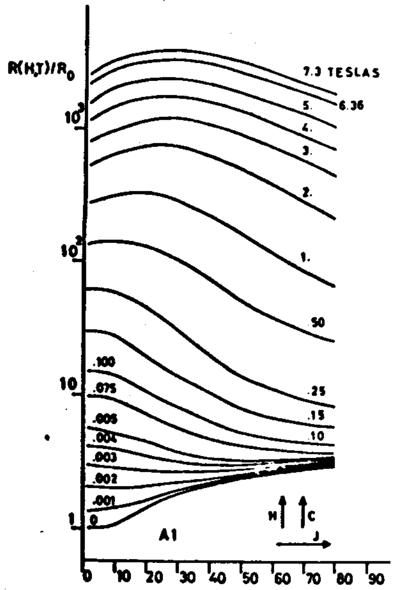

FIG. 1b

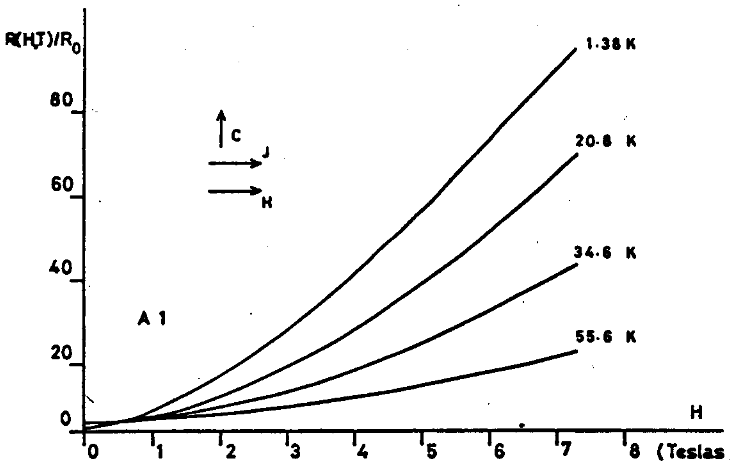

FIG. 2a

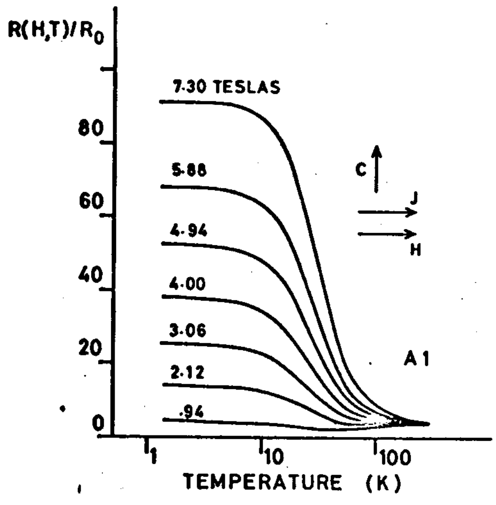

FIG. 2b