

Hall Coefficient and Magnetoresistivity of Carbons and Polycrystalline Graphite:
Doping with Donors*

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Using the experimental arrangement developed by Inagaki, Komatsu and Zanchetta¹ for studies of galvanomagnetic properties of carbon in the temperature range 1.5 - 300°K, the temperature dependence of the resistance, magnetoresistivity and of the Hall constant was investigated for soft carbon samples heat treated in the range 1600 - 2800° after introduction of donors. Large amounts of sodium were introduced into samples HTT 1600 - 2200°C and smaller amounts of potassium into samples of HTT 2200 - 2800°C. Potassium had to be used for higher heat treated samples in view of the air instability of sodium², the amounts of potassium introduced having to be kept relatively small due to the expansion and disintegration of samples. The introduction of sodium was performed in vacuum by keeping the sample at slightly higher temperature than the metal³ and in case of potassium by direct evaporation of potassium on the surface of a cold sample and by subsequent heating of the sample.

In all cases a sufficiently large number of donors was introduced to obtain a negative Hall constant. The temperature dependence of relative resistivity is considerably reduced by the introduction of donors for higher and somewhat increased for low heat treatments. The Hall constant changes according to expectations for a Fermi level shifted up close to the band overlap or even above (becomes negative). On the other hand, for the magnetoresistivity the surprising result of Zanchetta³ that the magnetoresistivity remains negative if it is so for the original material is confirmed. The magnetoresistivity becomes more and more negative with decrease in temperature but at very low temperature turns around and tends towards positive values. All this shows that the negative magnetoresistivity is an electron scattering effect little depending on the position of the Fermi level, which is swamping the positive effect.

A few representative curves obtained are shown in two graphs. Other slides will be presented at the Conference.

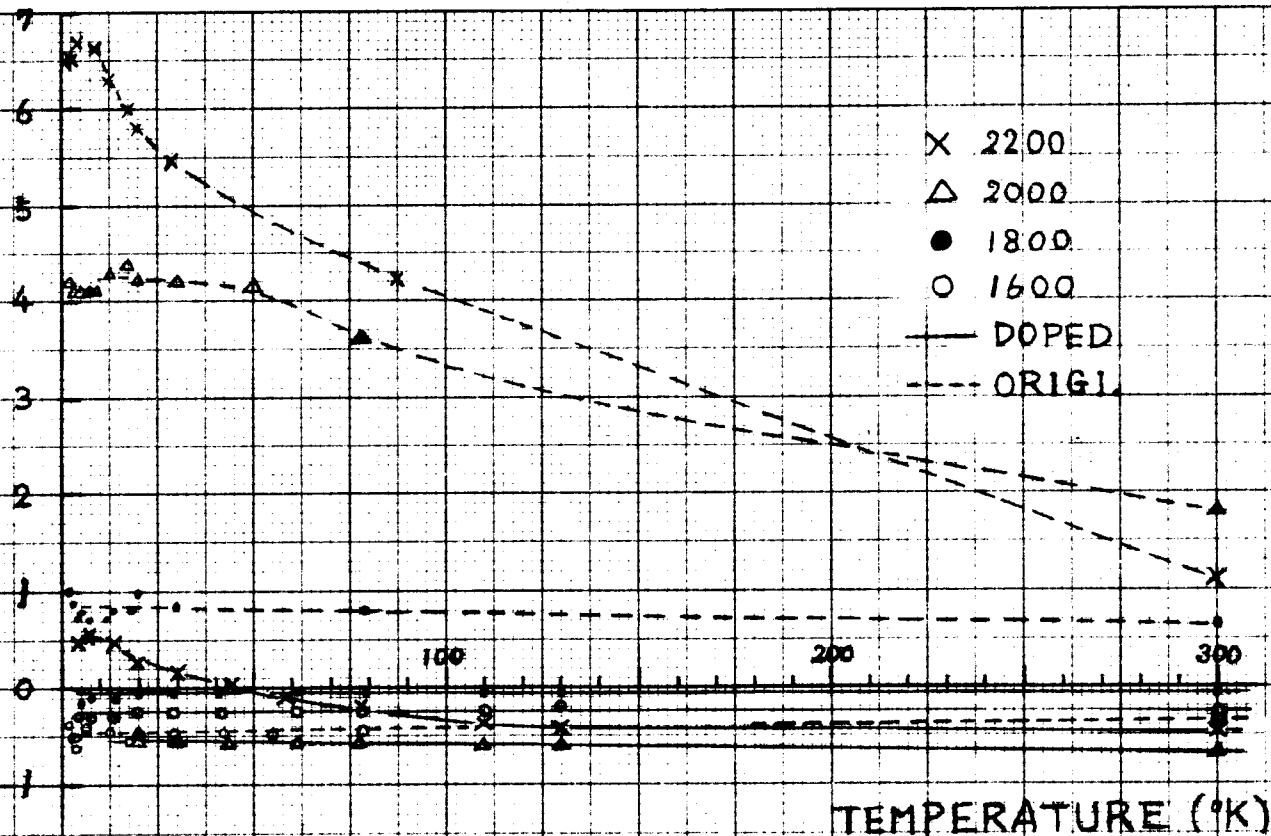
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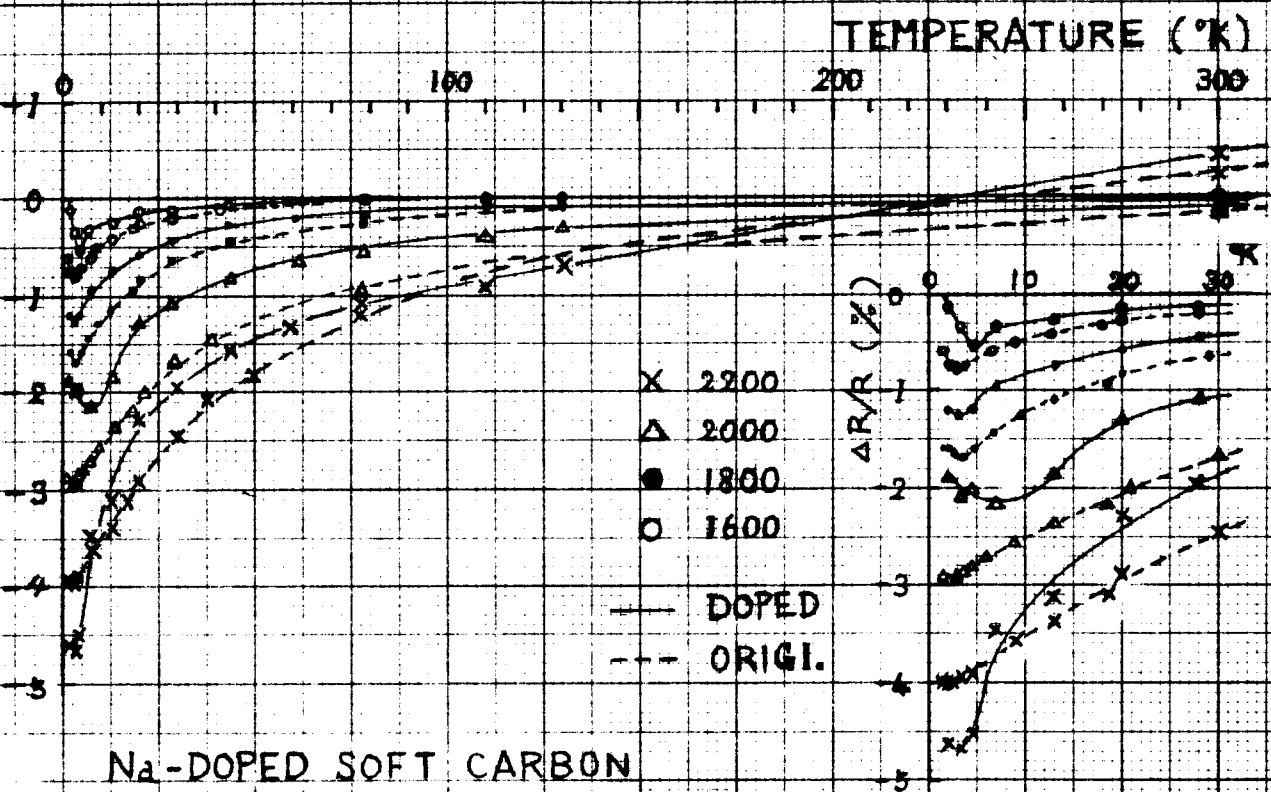
1. Previous paper at this Conference

2. S. Mrozowski, Carbon 4, 227, 1966

3. Previous paper at this Conference by J.V. Zanchetta on sodium doping

HALL COEFFICIENT A (e.m.u.)

Na-DOPED SOFT CARBON

MAGNETO-RESISTANCE $\Delta R/R$ (%)

Na-DOPED SOFT CARBON