A. THE ANISOTROPY RATIO OF ELECTRICAL CONDUCTIVITY
IN GRAPHITE

Anantamahidol Foundation Fellowship
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This research, conducted in collaboration with the M.I.T. Center for Materials Science and Engineering, has been completed, and the results submitted to the Department of Physics on January 22, 1974, in partial fulfillment of the requirements for the degree of Doctor of Philosophy. A summary of the thesis follows.

The electrical conductivities in the c-direction of well-oriented pyrolytic graphite have been measured at zero frequency and at 23 GHz, at room temperature, 77°K and 4.2°K. The results of these measurements, interpreted according to band theory, indicate that the average relaxation time in the c-direction ($\tau_c$) is very small at all these temperatures. An upper bound value for $\tau_c$ at 4.2°K is estimated to be $6 \times 10^{-13}$ s. Similar measurements were also performed on the basal plane of pyrolytic graphite. From these measurements the average relaxation time in the basal plane ($\tau_a$) at 4.2°K is determined to be $6.3 \times 10^{-12}$ s.

The analysis of the scattering mechanisms for carriers in graphite due to both electron-phonon interactions and small-scale lattice defects shows that the value of $\tau_c$ and $\tau_a$ should be comparable at 4.2°K. The difference of the value of $\tau_c$ and $\tau_a$ at 4.2°K obtained from the measurements indicates that the pyrolytic graphite has a structural defect that reduces the motion of the carriers in the c-direction.