Electron Spin Resonance in Nearly Amorphous Carbon

K. Antonowicz, S. Orzeszko, F. Rozploch and T. Szczurek
Department of Physics, Nicholas Copernicus University, Toruń, Poland

Abstract

Amorphous carbon was produced by arc evaporation of spectroscopic pure graphite in argon atmosphere. The electron spin resonance measurements were performed on deposits obtained at argon pressures between $2.5 \times 10^{-2}$ and $5 \times 10^{-1}$ mm Hg. Experiments were carried out in such a way that amorphous carbon could be collected without contact with the air atmosphere, heat treated in vacuum, and the ESR absorption measured. Measurements were repeated with amorphous carbon after admission of air and the results compared.

For all samples the original spin concentration was found to be of the order of $10^{20}$ spins per gram and the line width about 4 gauss. Both line width and the spin concentration change slightly with argon pressure showing a maximum spin concentration and a minimum line width at a pressure of about $7 \times 10^{-2}$ mm Hg. The line shape is precisely Lorentian and the $g$-value is very close to that of free spin.

Heat treated deposits show rapid decrease in spin concentration and broadening of the ESR line. The most striking effect is, however, the strong difference in behavior between unexposed samples and those exposed to the air atmosphere and subsequently outgassed. After HT at $700^\circ$C the line for the exposed sample is 5 times as broad as that of the unexposed sample.