

g-anisotropy in Nearly Amorphous Carbon as Studied by ESR

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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 2.5×10^{-2} and 5×10^{-1} mm Hg. 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 7×10^{-2} mm Hg. The line shape is precisely Lorentian.

For all such samples the g-value is very close to that of free electron and does not change during heat treatment. However, when deposit is produced at low pressure of argon and is made pretty thick, flakes of few mm² can be easily broken off. At room temperature the g-value seems independent of orientation of the flake relative to the magnetic field, but at liquid nitrogen temperature an anisotropy in g-value is easily detectable. When the sample was oriented so that its surface was perpendicular to the magnetic field the g-value was 2.0023 but it decreased when the sample was rotated. For the surface of the flake parallel to the magnetic field "g" dropped down to the value of 2.0015. g anisotropy in thin layers of deposit was studied in details. Thin layers were produced on small, thin glass plates which fit to the resonance cavity. It appeared that g-anisotropy is in complicated way dependant on the amount of air adsorbed. The anisotropy disappears in samples kept for long time in high vacuum even when degassification is performed at room temperature. Admission of air atmosphere induces the anisotropy again. Excess of air broadens the line and cancels the anisotropy of g.