EPR study of depolymerization processes of C_{60} polymerized phases

Zhilinskaya E.A.*[1], Rakhmanina A.V.[2], Davydov V. A.[2], Agafonov V.[3]

[1]*Université du Littoral Côte d'Opale UCEIV-EA 4492, MREI 1, 59140, Dunkerque, France*
[2]*Institute for High Pressure Physics of the RAS, 142190 Troitsk, Russia*
[3]*LEMA, UMR CNRS-CEA 6157- LRC CEA M01,Université de F.Rabelais, 37200 Tours, France*
**e-mail: jilinska@univ-littoral.fr*

The monomer, tetragonal (T) and rhombohedral (R) polymerized phases of C_{60} have been studied by the EPR method under increase of temperature from 295K up to 650K, that is, from temperatures below to above the limits of thermal stability of the polymerized phases. Previous EPR study of the T and R phases in the temperature range of 77–295K [1] allowed identifying two (doublet and triplet) types of paramagnetic centers (PC) in these materials. The behavior of these paramagnetic centers during thermal depolymerization of high-pressure polymerized C_{60} phases have been analyzed and compared with the behavior of PC of the monomer C_{60} phase at the same conditions. Comparative analysis of PC in the initial and treated samples after high temperature treatment has been made within 77–295 K temperature range.

EPR measurements have been realized in air and in a vacuum. Several stages of destruction of the polymerized phases can be separated according to EPR data for T and R polymeric phases under both conditions. These stages are qualitatively similar for two polymeric phases under the same conditions, but their quantitative parameters are different. The presence of the air significantly changes the behaviour of PC at $T \geq 530K$. Complete destruction of the triplet PC in the T and R phases is observed at $T \approx 500K$.

EPR study of the monomer C_{60} phase shows the appearance of a new triplet PC in the temperature range 580–650K. This triplet PC is rather different from the triplet PC observed in T and R polymeric phases.

This work was supported by the CNRS, the Region Nord-Pas de Calais, the European Community, and the Russian Foundation for Basic Research (Grant N 09-03-00750)

[1] E.A. Zhilinskaya, A.V. Rakhmanina, V.A. Davydov, V. Agafonov, *Phys Status Solidi A* **207**(10), 2364 (2010).