Study of low-frequency Raman spectrum in carbon phases prepared from C_{60} under pressure

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Carbon phases prepared from C_{60} powder under high P,T parameters attract significant interest, since these phases demonstrate unique properties, including high values of hardness combined with a very high plasticity, ferromagnetisms behavior in some cases. Recently, we have found that the hardness of carbon phases prepared from C_{60} and nanosized diamonds under pressure of 6 GPa at different temperatures have a maximum at synthesis temperature of ~1100K [1]. Study of Raman spectra demonstrated that the temperature of the hardness maximum corresponds to the temperature at which the C_{60} cage collapses. Raman spectrum in the range 1200-1700 cm^{-1} looks similar for all samples of carbon phases with the synthesis temperature above 950K, revealing two wide peaks typical for disordered graphite phases.

The key question is what peculiarity of the structure is responsible for different hardness of the carbon phases with the synthesis temperature above 950K? It is believed that the answer is related to the peculiarity of the nanometer structure of the carbon phases. The nanometer structure can be inspected by low-frequency Raman spectra. The present contribution is devoted to investigation of the carbon phases, synthesized in [1], by the low-frequency Raman scattering. Similarities and differences in Raman spectra of the carbon phases with different hardness are discussed and the role of the nanometer structure is revealed in this study.

[1] N.V. Surovtsev, A.A. Kalinin, V.K. Malinovsky, Yu.N. Pal'yanov, and A.S. Yunoshev, *Carbon* **44**, 2027 (2006).