Formation of a new phase of C_{60} under combined action of high-pressure and X-ray radiation

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In a recent work [1], the further high-pressure photo-induced polymerization of the orthorhombic [O] 1-D phase of C_{60} was demonstrated using Raman scattering. The pressure of the transition involved is about 0.3 GPa at 300K.

In the present work [see also 2], a similar further induced polymerization process is now and for the first time established using X-ray irradiation as well as in-situ high-pressure X-ray powder diffraction in a diamond anvil cell. The transformation to a new phase through the simultaneous action of pressure and X-rays is observed between 0.2 and 1.66 GPa, in agreement with the Raman results reported in [1]. Moreover, a further increase in pressure leads gradually to the irreversible formation of a disordered phase.

By contrast to the Raman experiment, which merely reveals a qualitative lowering of symmetry trough a very distinct spectrum, the in-situ X-ray powder diffraction experiment demonstrates that the ambient-pressure symmetry Pmnn of the pristine O phase is definitely lowered above 0.2 GPa and that higher pressure diffraction data are now compatible with a new orthorhombic phase of lower P mmm symmetry.

The possible structure of this new phase will be discussed.

This work was supported by the Russian Foundation for Basic Research (Grant N 06-03-32050)

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