

MICROGRAVITY SCIENCES AND PROCESSES SYMPOSIUM (A2)
Microgravity Experiments from Sub-orbital to Orbital Platforms (3)

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FULLERIT C60 SINGLE CRYSTAL GROWTH ABOARD THE FOTON-M3 SPACECRAFT

Abstract

New form of solid carbon was found in 1990. Up to 1990, people knew two solid forms of carbon, graphite and diamond. Fullerenes are a new form of carbon. This is the main reason for their study. Our paper is devoted to the growth and study of two types of the fullerite C60 single crystals. The first one we call as a reference. These crystals have been grown on the Earth. In this case bulk fullerite C60 single crystals deform at growth temperature due to their own weight. As a result, defects of crystal structure appear. For example, dislocations, grain boundaries. The second type of crystals has been grown in the condition of microgravity during FOTON-M3 mission. Both types of crystals have been grown by the gas-transport method. X-ray diffractometer with CCD detector was used for elucidation of the crystal structure. Pronounced structure of twins has been observed in the reference sample. Essentially more perfect structure has been observed in single crystals grown under microgravity. IR absorption spectra were measured by Fourier-transform spectrometer. Vibrational modes 1182 and 1430 cm^{-1} have been analyzed. It has been found that full width at half maximum (FWHM) of these absorption lines is two times bigger in the reference crystals. It shows that crystal structure of crystals grown under microgravity is more perfect in comparison with the reference samples. Nevertheless, it should be pointed out that FWHM of the absorption lines in crystals grown under microgravity is 6 times bigger in comparison with that one in thin film of C60 grown on substrates on the Earth. Besides, out of the main system of the X-ray spots some weak spots were observed in diffractogram of these crystals. It indicates on existence of some minor twin components of another orientation in crystals. So, additional efforts are necessary for optimization of the growth conditions in the case of microgravity.