In-situ Diffraction Study of C_{60} Polymerization under Highpressure High-temperature

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Polymerization in C₆₀ has been achieved using photochemical and high-pressure high-temperature (HP-HT) methods [1]. Both polymers have the same 2+2 cycloaddition polymeric bond but their crystal structures are very different. HP-HT polymers are ordered while photopolymers have a disordered fcc structure reflecting a random polymerization [2]. In order to understand the origin of bond order in HP-HT polymers and its absence in photopolymers we have performed in situ diffraction studies at the E.S.R.F. [3]. We have found that the applied anisotropic stress selects the bonding direction, which is crucial to obtain ordered polymeric structures since it avoids geometrical frustration inherent to 2+2 cycloaddition bonds in the fcc monomer lattice. The photochemical method having no symmetrybreaking field leads to a frustrated disordered fcc polymer. The highly anisotropic distribution of polymeric bonds in HP-HT polymers should be at the origin of the elastic anisotropy in the C_{60} -derived amorphous samples and the magnetic anisotropy in 2D-ordered polymerized C₆₀.

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