High Pressure XRD Studies of Conjugated Polymers

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We have launched a scientific initiative to extend modern high pressure X-ray scattering studies to conjugated polymers. An essential part of this work is conducted at the Extreme Conditions Beamline P02.2 in Hamburg. In one example, we present X-ray scattering data from helical poly[9,9-bis(2-ethylhexyl)fluorene-2,7-diy1] (or PF2/6) by mapping the sample with 10 μm spatial resolution at pressures up to 31 GPa. Neon is used as pressure transmitting medium. Reduction of torsion angle between adjunct monomer repeats is observed during compression and found to be reversible upon decompression. Polymer conformation does not depend on lateral position of sample in the pressure range from 1 to 7 GPa but depends significantly when pressure is increased from 7 to 31 GPa (see Figure 1). Crystallite orientation does not depend on pressure or lateral position. The radiation damage is studied optically \textit{ex situ} and proved to be insignificant [1-2].

Figure 1: Photos of compressed PF2/6 at (a) 1.1, (b) 7.3amd (c) 31 GPa. Maps of the peak positions for the strongest 00\textit{l} reflection (a-c) and preferred orientation direction (d-f) shown as a function of lateral position within the gasket hole [2].

References