

## TRANSIENT MICROSTRUCTURE OF THERMOPLASTIC POLYURETHANE NANOCOMPOSITES UNDER UNIAXIAL DEFORMATION

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Microstructure evolution of a low hard segment (<10 mol %) thermoplastic polyurethane (LHSTPU) has been followed by in-situ wide-angle X-ray (WAX) and small-angle X-ray scattering (SAX) with a focus on elucidating peculiar microstructural changes during uniaxial deformation ( $\lambda=1-3.5$ ) of polymer and its corresponding nanocomposites. For the LHSTPU, the hard segments, due to their low content, do not crystallize but form glassy regions that act as physical cross-links. Two types of soft segment crystallites are resolved upon elongation via DSC, SAX, and WAX experiments. Both phases coexist over a small strain window ( $\lambda=1.9-2.5$ ), demonstrating the independent nature of the two crystalline phases. This morphology evolution underlies the strain induced shape memory performance of these materials. Consequently, if nanofiller addition modifies the strain induced crystallization of the nanocomposite system, it also impacts shape memory properties. ZnO and CNF addition will be contrasted to demonstrate the critical role of the resulting crystallite morphology on mechanical and shape memory properties.