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Temperature Effects on Interlamellar Chain Entanglement and Structural Changes in Isotactic Polypropylene during Uniaxial Tensile Deformation BENJAMIN HSIAO, FENG ZUO, JONGKAHK KEUM, XUMING CHEN, Stony Brook University, HONGYU CHEN, JING LI, The Dow Chemical Company — *In-situ* small-angle x-ray scattering, wide-angle x-ray diffraction and *ex-situ* atomic force microscopy techniques were carried out to investigate the structural and morphological changes of isotactic polypropylene (iPP) films during uniaxial tensile deformation at varying temperatures (i.e., room temperature, 60°C and 160°C). The mass fractions of amorphous, mesomorphic, and crystal phases were determined. Results indicate that at room temperature, the dominant deformation-induced transition occurs between the crystal and mesomorphic phases, while at high temperature (> 60°C), the dominant transition occurs between amorphous and crystal (i.e., monoclinic α-form) phases. This behavior can be explained by the concept of chain mobility, and the relative strength between the interlamellar entangled amorphous network and the surrounding crystal lamellae. It appears that at low temperatures, the interlamellar entanglement network is stronger than the adjacent lamellae, resulting in lamellar fragmentation and formation of oriented mesomorphic phase. In contrast, an opposite scenario occurs at high temperatures, resulting in disentanglement of amorphous chains and the growth of crystalline lamellae.

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