Entanglement Effect on Folding Behaviors of Semi-crystalline Polymer during Melt-Crystallization

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In the earlier theoretical research, impact of entanglement on folding during crystallization was minimized. The combination of ^{13}C isotope labeling and NMR spectroscopy allows us to quantitatively determine stem to stem distance as well as chain folding distance, hence, we are able to probe chain-level structure. Our recent work indicated that polymer chains are possible to fold prior to crystallization. In this poster, we would like to investigate the folding structure of a semi-crystalline polymer in melt-grown crystals (mgc) by using solid-state NMR spectroscopy and SAXS measurement. First, various ^{13}C enriched poly(L-lactic acid) (PLLA) samples with different molecular weights (M_w = 2.5k – 300k g/mol) across critical entanglement length (M_c = 16k g/mol) were prepared in order to observe the molecular weight dependence of folding structure of PLLA. We revealed that entanglements influence the folding number during crystallization. Second, we attempt to observe the entanglement effect through diluting entanglement density, i.e., blending the PLLA above and below the M_c with different ratio and molecular weight. Based on the experimental results, we would like to highlight the impact of entanglements on folding of semicrystalline polymer in the melt-grown crystal.

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