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Large Strain Requirements for Shear Induced Crystallization of Isotactic Polypropylene[1] H. HENNING WINTER, AADIL ELMOUMNI, DEEPAK ARORA, University of Massachusetts Amherst — Strain effects on the crystallization of a series of isotactic polypropylenes (iPP), with various molecular weights, were studied using rheology, light transmission, birefringence, differential scanning calorimetry, and wide-angle X-ray diffraction. Transmitted light intensity measurements demonstrate that the effect of pre-shear on crystallization rate keeps increasing up to very larger strain levels, much beyond strains that are required to reach steady shear flow (at given We). Crystal orientation sets in at a total strain of about γ_0 =600 or higher. WAXD and DSC analyses corroborated the light transmission results. The samples were pre-sheared and then crystallized at constant temperature. Total shear strains γ_0=200 to 1000 were applied to the iPP samples at the beginning of a crystallization experiment, after the samples had reached the crystallization temperature of 145^{o}C (under-cooled state). A constant Weissenberg number We=1 (We, defined as the product of shear rate and a relaxation time) was maintained throughout the study. We=1 corresponds to the onset of shear thinning in steady shear. Deborah number values were low, De<<1, indicating that steady shear flow had been reached in all pre-shearing runs.

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