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Jamming and Unjamming of the Rigid Amorphous Fraction PEGGY CEBE, QIAN MA, Tufts University, GEORGI GEORGIEV, Assumption College — Semicrystalline polymers obey a three-phase model comprising crystalline, mobile amorphous (MAF), and rigid amorphous fractions (RAF) as an interphase. Using quasi-isothermal temperature modulated differential scanning calorimetry (QI-TMDSC), we investigate the formation behavior of these fractions in poly(trimethylene terephthalate), PTT. PTT was quasi-isothermally cooled step-wise from the melt which causes its crystalline fraction to be fixed below 451K, and RAF is determined as a function of temperature. For PTT, most of the RAF vitrifies between 451K and T_g step-by-step during QI cooling. With lamellar crystals acting as topological constrains, a model is proposed in which the vitrification and devitrification of RAF are interpreted using the concepts of "jamming" and "unjamming." Constraints of the crystal surfaces reduce the mobility of the highly entangled polymer chains attached to the lamellae, and the layers which constitute RAF are formed one after another in the manner of successive jamming. In this way, several features of the RAF temperature dependence are explained for the first time, with implications in other research areas, such as topological constraints exerted on the polymer melt through effects of inclusions in polymer-based nanocomposites.

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Qian Ma
Department of Physics and Astronomy, Tufts University

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