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Reversible melting of extended-chain and folded-chain polymer crystals[1] RENE ANDROSCH, Martin-Luther-University Halle-Wittenberg, Institute of Material Science, BERNHARD WUNDERLICH, University of Tennessee, Knoxville, HANS-JOACHIM RADUSCH, Martin-Luther-University Halle-Wittenberg, Institute of Material Science — The reversibility of crystallization and melting of crystals of polytetrafluoroethylene (PTFE) and polyethylene (PE) of extended-chain and folded-chain morphology has been investigated by temperature-modulated differential scanning calorimetry (TMDSC). The total and average specific reversibility of folded-chain crystals is considerably larger than in the case of extended-chain crystals. This experimental observation can be attributed to a different number of points of possible decoupling between crystallized and amorphous sequences along individual, partially crystallized molecules within the globally semi-crystalline superstructure in extended-chain and folded-chain crystals. Due to incomplete melting of the macromolecules, the morphology of the folded-chain crystal allows molecular segments to reversibly melt and crystallize as a function of temperature. The extended-chain conformation, in turn, inhibits reversible melting due to the required molecular nucleation after complete melting of a single molecule. The experimental findings support both, the concepts of lateral-surface activity and molecular nucleation presented earlier.

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