

Abstract Submitted
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Nucleation and Crystallization in nucleated Polymers

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University of Rostock — Crystallization is commonly considered as nucleation followed by a growth process. Here we apply the recently developed technique, differential fast scanning calorimetry (DFSC), for a unique, new look at the crystal growth of poly(epsilon-caprolactone) (PCL) and PCL carbon nanotube composites from 185 K, below the glass transition temperature, to 330 K, close to the equilibrium melting temperature. The DFSC allows temperature control of the sample and determination of its heat capacity during temperature treatments by employing cooling and heating rates from 50 to 50,000 K/s. First, the crystal nucleation and overall crystallization half times were determined simultaneously in the range of temperatures where crystallization of PCL occurs. After attempting to analyze the experiments with the classical nucleation and growth model a new methodology is described, which addresses the specific problems of crystallization of flexible linear macromolecules. The structures seem to range from having practically unmeasurable latent heats of ordering (nuclei) to being clearly-recognizable, ordered species with rather sharp disordering endotherms at temperatures from the glass transition to equilibrium melting (increasingly perfect and larger crystals). The mechanisms and kinetics of growth (if any) involve a detailed understanding of the interaction with the surrounding rigid amorphous fraction (RAF) in dependence of crystal size and perfection. E. Zhuravlev, J.W.P. Schmelzer, B. Wunderlich and C. Schick, Kinetics of nucleation and crystallization in poly(epsilon-caprolactone) (PCL), Polymer 52 (2011) 1983-1997.

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