MAR14-2013-002814

Abstract for an Invited Paper
for the MAR14 Meeting of
the American Physical Society

Kinetics of nucleation and crystallization of poly(epsilon-caprolactone) - multiwalled carbon nanotube composites

CHRISTOPH SCHICK, Univ Rostock

The nucleation efficiency of multi-wall carbon nano-tubes (MWCNT) in poly(ε-caprolactone) (PCL), as an example, was tested for a wide range of temperatures and cooling rates and compared to the efficiency of homogeneously formed nuclei. The temperature range below the maximum of crystallization rate is generally not accessible for non-isothermal cooling experiments because the sample becomes amorphous at the needed cooling rates. Isothermal experiments after fast quenches extend the temperature range down to and below the glass transition. The employed differential fast scanning calorimeter (DFSC) allows cooling at rates up to 100,000 K/s and precise adjustment and control of isothermal conditions in the time range from 10^{-4} to 10^{4} s and longer. As shown in previous work, heterogeneous crystal nucleation dominates at low supercooling, revealing a significant dependence of crystallization rate on MWCNT concentration. Nevertheless, no saturation of the nucleation activity at a MWCNT loading of 0.2 to 0.5 wt% as seen in slow DSC experiments was observed at the much higher cooling rates employed here. At high supercooling, where homogeneous nucleation is prevalent, the addition of MWCNT does not enhance neither reduce the crystallization rate. At the temperature of maximum homogeneous nucleation rate, formation of homogeneous nuclei always dominates crystallization.

E. Zhuravlev, J.W.P. Schmelzer, B. Wunderlich, C. Schick, Kinetics of nucleation and crystallization in poly(epsilon caprolactone) (PCL) Polymer, 52 (2011) 1983-1997.