

Unusual Crystallization Behavior of Diblock Copolymer/Homopolymer Ternary Blends Isothermally Crystallized Below the Typical Glassy Transition Temperature

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Abstract

The diblock copolymer/homopolymer ternary blends have received limited attention, mainly considering their complex self-assembly behavior, especially when involving the thermodynamic miscibility between the constituting block chains and the homopolymer chains and thus the unique crystallization behavior. In this study, we attempt to investigate the isothermal crystallization in the ternary blends of polystyrene-*block*-poly(methyl methacrylate) (SMMA), poly(L-lactide) (PLLA) and poly(ethylene oxide) (PEO), in which the SMMA diblock copolymer could offer the spatial confinement to localize the PEO and PLLA within the microdomains formed by the PMMA block. It was found that, when the blends were rapidly quenched to the temperatures far below the typical glassy transition point of PLLA (T_g^{PLLA}) for isothermal crystallization, interestingly, the PLLA could crystallize to the high extent of crystallinities. On the other hand, we further prepared the crystallized blends by firstly annealing at a high temperature and followed by quenching to the similar temperatures far below T_g^{PLLA} for isothermal crystallization; in this case, an ordered lamellar structure could be formed. However, such a lamellar structure underwent a thermally reversible transition to or from a peculiar phase upon heating or cooling, respectively.

Keywords - *spatial confinement, lamellar structure, crystallization behavior*