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Processing-driven morphology development and crystallization behavior of immiscible polylactide/poly(vinylidene fluoride) blends

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ABSTRACT:

Processing-driven morphology development and crystallization behavior of immiscible polymer blends are of high significance for the development of polymeric materials with controllable properties. This study correlates processing-induced morphology alterations of different polylactide/poly(vinylidene fluoride) (PLA/PVDF) blends with their crystallization behavior, showing that blending can benefit the crystallization of both phases. X-ray diffraction analysis reveals the facile formation of ß-PVDF crystals upon 10-min blending of a 30/70 (w/w) PLA/PVDF ratio, which is ascribed to the more uniform distribution of smaller PLA droplets in the PVDF matrix observed for this composition and processing time. On the other hand, dispersion of smaller PVDF droplets inside the PLA matrix increases the crystallinity of the latter, while the crystallinity of PVDF droplets is increased by their coalescence. The results of differential scanning calorimetry (DSC) analysis confirm that PVDF promotes the crystallization of PLA by improving its crystallization enthalpy in blends, whereas no such effect is observed for crystallization of neat PLA from the

melt. Finally, nonisothermal DSC analysis of a 50/50 PLA/PVDF blend at different cooling rates reveals that slow crystallization results in enhanced blend crystallinity.