

Control of Morphology and Crystallization in Polyelectrolyte/Polymer Blends

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ABSTRACT: The type and amount of counterions present in a polyelectrolyte component of a blend with a fluorinated polymer are shown to affect the bulk morphology. Cast films display large-scale phase separation when the polyelectrolyte is in acid form, whereas the blends containing polyelectrolyte fully neutralized with organic counterions are homogeneous. At intermediate ratios, miscibility is controllable, and the blend is partially miscible when cast at 170 °C but fully miscible when cast at 70 °C (LCST behavior). Blend miscibility favors the formation of the β crystalline polymorph of the poly(vinylidene difluoride) component (PVDF). For macrophase-separated systems, the crystalline polymorph depends on the temperature of casting: at 170 °C, the incompatible polymers separate during solvent evaporation and PVDF crystallizes from the melt into the α phase. At 70 °C, PVDF crystallization occurs from a miscible blend during the solvent evaporation and the β phase is obtained, giving rise to crystalline lamellae swollen by the polyelectrolyte.