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Design of Co-Continuous Nanostructured Polymer Blends by Solid-State Shear Pulverization. YING TAO, JUNGKI KIM, JOHN M. TORKELSON, Northwestern University, Evanston, IL 60208 — Achievement of co-continuous nanostructured polymer blends is of interest as such materials may have enhanced properties (e.g., toughness, stress at break, and creep resistance) in comparison to conventional blends with a micron-scale dispersed phase in a matrix phase. Leibler and co-workers (Nature Materials 1, 54 (2002)) recently produced co-continuous nanostructured blends via reactive melt blending in which irregular graft copolymers were made in situ. Here we demonstrate that achievement of such blends is possible in the solid state by use of solid-state shear pulverization (SSSP). During SSSP, polymers are mixed by exposure to high shear and compressive forces in the absence of melt processing. The morphology of the blended SSSP output is obtained by forming a consolidated sample using a cold platen press and then analyzing by scanning electron microscopy. In the case of polystyrene (PS)/poly(methyl methacrylate) (PMMA) blends, the PMMA phase can be etched with acetic acid, revealing the presence of a 3-D, nanostructured ($\sim$ 100 nm length-scale), irregular morphology. Studies are underway to determine whether such a blend nanostructure can be maintained during subsequent, limited melt processing into a final product via addition of block copolymers or gradient copolymers to the blend during SSSP. Studies are also underway with other blend systems.

John M. Torkelson
Northwestern University

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