Bead-to-Fiber Transition in Electrospun Polystyrene

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Abstract:
The morphological transition, namely bead-to-fiber transition, of electrospun polymer was examined for polystyrene with molecular weight ranging from 19,300 to 1,877,000 g/mol. Tetrahydrofuran (THF) and N,N-dimethylformamide (DMF) were used as the solvents to examine the effects of solvent properties on the morphological variations. Polymer molecular weight and solvent properties had a significant effect on the morphology of beads as well as fibers. Observation of fiber diameter and its distribution suggested that the effect of molecular weight and solvent may be independent. The critical concentrations at which incipient and complete fibers were observed were found to decrease significantly with molecular weight, as can been expected. The effect of solvents on these critical concentrations was minimal for moderate to high molecular weight (>100,000 g/mol). For low molecular weight solutions, the transition occurred at concentrations much lower than those predicted by a model based exclusively on chain entanglements. Rapid solidification of jet which is expected to occur with concentrated solutions may play a vital role in establishing stable fibers during electrospinning.

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