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Molecular Mobility in Phase Segregated Bottlebrush Block Copolymer Melts¹ BENJAMIN YAVITT, YUE GAI, DONGPO SONG, H. HENNING WINTER, JAMES WATKINS, University of Massachusetts Amherst — We investigate the linear viscoelastic behavior of poly(styrene)-block-poly(ethylene oxide) (PS-b-PEO) brush block copolymer (BBCP) materials over a range of vol. fractions and with side chain lengths below the entanglement molecular weights. The high chain mobility of the brush architecture results in rapid micro-phase segregation of the brush copolymer segments, which occurs during thermal annealing at mild temperatures. Master curves of the dynamic moduli were obtained by time-temperature superposition. The reduced degree of chain entanglements leads to a unique liquid-like rheology similar to that of bottlebrush homopolymers, even in the phase segregated state. We also explore the alignment of phase segregated domains at exceptionally low strain amplitudes ($\gamma = 0.01$) and mild processing temperatures using small angle X-ray scattering (SAXS). Domain orientation occurred readily at strains within the linear viscoelastic regime without noticeable effect on the moduli. This interplay of high molecular mobility and rapid phase segregation that are exhibited simultaneously in BBCPs is in contrast to the behavior of conventional linear block copolymer (LBCP) analogs and opens up new possibilities for processing BBCP materials for a wide range of nanotechnology applications.

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