# Steady Shear Flow Alignment and Rheology of Lamellae-Forming ABC Triblock Copolymer Solutions: Orientation, Defects, and Disorder

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ABSTRACT: The effect of steady shear flow on the morphology and rheology of two lamellae-forming polystyrene-*block*-polybutadiene-*block*-poly(methyl methacrylate) copolymer solutions has been studied using time-resolved Rheo-SAXS experiments. The main effect of shear flow is to reversibly align the ordered lamellae in perpendicular orientation with long-range order at low shear rates and in parallel orientation at high shear rates. The crossover from low to high shear rates behavior occurs at $\dot{\gamma}_c \approx \tau^{-1}$, where $\tau$ is the single chain relaxation time. Both orientations coexist in the vicinity of $\dot{\gamma}_c$ without any apparent drift toward a well-defined state. Whereas a high degree of perpendicular alignment is achieved at low shear rates, the parallel alignment above $\dot{\gamma}_c$ is highly defective, and it is progressively destroyed by the flow. Upon flow cessation, the fraction of disordered material rearranges into lamellae in transverse alignment. These results highlight the specificity of strong shear flows with respect to oscillatory shear flows commonly used to align block copolymers and of ABC mesophases with respect to other block copolymers mesophases.