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Transient Molecular Orientation Distribution during Injection Molding of Liquid Crystalline Polymers: Experiment and Simulation JUN FANG, WESLEY BURGHARDT, Northwestern University, ROBERT BUBECK, Michigan Molecular Institute — We report a coordinated experimental and computational study of molecular orientation development during injection molding of commercial thermotropic liquid crystalline polymers. Three "short shots" were purposely produced to represent intermediate stages (∼40%, 60%, 100% filled) during the mold filling. Two-dimensional wide-angle x-ray scattering (2D-WAXS) in transmission mode was used to map out the detailed transient molecular orientation distribution along the centerline and three representative cross-sectional regions. Three distinct zones of orientation states were observed due to the complex spatial variations of the extensional flow effects (dominant near the flow front region) and the shear flow effects (dominant close to the centerline region). The experiments are used to test process simulations performed using commercial molding processing software. An analogy between the Folgar- Tucker fiber orientation model and the Larson-Doi polydomain model for textured liquid crystalline polymers is exploited to allow for the first tests of Larson-Doi model predictions against the transient molecular orientation development during injection molding processing. The numerical predictions successfully capture many features in the orientation distribution across the sample plaque.

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