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Nonlinear Flow Behavior of Model Branched Polymers

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Stress relaxation dynamics of entangled long-chain branched (LCB) polymers are investigated using model symmetric stars, asymmetric stars, and multiarm (pom-pom), polymer liquids subject to small-amplitude oscillatory shear and nonlinear step and steady shear deformations. This talk focuses on the effect of molecular architecture on chain stretching, tube dilation, convective constraint release, and interfacial slip processes. It is shown that even small degrees of arm length asymmetry leads to large differences in the nonlinear relaxation dynamics of branched molecules. Specifically, while symmetric stars manifest greater strain softening characteristics and much lower degrees of chain extension than entangled linear chains, asymmetric stars and pom-poms with even small levels of arm length asymmetry display nonlinear rheological properties that are in most respects identical to those of entangled linear polymers with comparable terminal times. Consequences of these observations on tube-based constitutive models for branched polymers are discussed.