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How does cohesive breakdown occur in entangled polymeric liquids?

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Entangled polymers are strongly viscoelastic materials with a characteristic relaxation rate that is a sensitive function of molecular weight and its distribution. At high Weissenberg number, i.e., when the rate of external deformation is far greater than the relaxation rate of entangled chains, a well entangled polymeric liquid yields like a solid before being forced to flow plastically. Recent particle tracking velocimetric observations (PTV, which are available for downloading at http://www3.uakron.edu/rheology/) show that the elastic yielding and subsequent flow take place inhomogeneously in both shear and extension. Most remarkably, an entangled polymer would suffer "delayed" cohesive structural breakdown after a step deformation. The transient cohesion provided by chain entanglement due to inter-molecular interactions is found to be higher at a higher applied rate. This talk will enumerate various PTV studies of step shear, startup shear and large-amplitude oscillatory shear to show how these crucial experiments have produced a phenomenological level understanding (*J. Chem. Phys.* **2007**, 127, 064903) of various flow phenomena in entangled polymers.

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