Center for Molecular and Engineering Thermodynamics

CMET Seminar

- **Monday, January 28, 2008**
- **9:30 A.M.**
- **366 Colburn Laboratory**

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"The Dynamic Behavior of Non-Brownian Glass Fiber Suspensions"

Glass fibers have been used for decades to improve the mechanical, thermal and insulative properties of polymers. These property improvements are highly dependent on the orientation distribution of the glass fiber. This makes it desirable to not only be able to predict the rheological behavior of a composite fluid but the orientation of the fibers generated during processing to optimize the mechanical properties of the final part. Concentrated glass fiber suspensions are notorious for exhibiting a relatively large overshoot in both the shear stress and first normal stress growth functions when compared to the rheology of the neat suspending medium. Interestingly, this behavior is not reversible. Mechanisms have been proposed that account for such behavior but no thorough analysis to confirm the relationship between fiber orientation and the transient stresses that occur in start-up of flow has been reported. In an attempt to understand this trend we compare the rheological behavior of a 30 wt% short glass fiber-filled polybutylene terephthalate to its associated microstructure. Samples at rest are deformed at a constant shear rate for a specified time (i.e. strain) that correlates to various points of interest on a stress growth vs. strain plot. The sample temperature is then lowered below the suspension melt temperature "freezing" the fiber orientation which is then characterized using confocal laser microscopy. The experimental results are compared to predictions from current theory for fiber suspensions.

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