Abstract Submitted
for the MAR09 Meeting of
The American Physical Society

Orientation Dynamics in Multi-Wall Carbon Nanotube Dispersions under Shear Flow SASWATI PUJARI, Northwestern University, SAMEER RAHATEKAR, JEFFREY GILLMAN, National Institute of Standards and Technology, KRZYSZTOF KOZIOL, ALAN WINDLE, Cambridge University, WESLEY BURGHARDT, Northwestern University — We report studies of the orientation state of multi-walled carbon nanotubes (MWNTs) dispersions in steady and transient shear flows. Uncured epoxy was used as a viscous, Newtonian suspending medium, and samples were prepared from 'aligned' MWNTs. Orientation was studied in both the flow- gradient (1-2) and flow-vorticity (1-3) plane of simple shear flow using in-situ x-ray scattering techniques. Steady state measurements in the 1-2 plane indicate that the MWNT orientation is shear rate dependent, with the MWNTs orienting closer to the flow direction at higher shear rates. In steady shear, anisotropy was measured to be higher in the 1-2 plane than in the 1-3 plane, demonstrating that the nanotube orientation state is not unaxially symmetric in shear. The steady state MWNT orientation is governed by a rate-dependent state of nanotube aggregation/ disaggregation, which was separately characterized by optical microscopy. A partial relaxation of flow-induced anisotropy was observed following flow cessation, despite the very small rotational diffusivity estimated for these nanotubes. Long transients are observed in step-down experiments, as the orientation state changes in response to the slow tube aggregation process.

Wesley Burghardt
Northwestern University

Date submitted: 21 Nov 2008 Electronic form version 1.4