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Rheology and structure of concentrated multi-walled carbon nanotube dispersions under shear flow WESLEY BURGHARDT, SASWATI PUJARI, Northwestern University, SAMEER RAHATEKAR, JEFFREY GILMAN, National Institute of Standards and Technology, KRZYSZTOF KOZIOL, ALAN WINDLE, University of Cambridge — We describe measurements of flow-induced orientation in concentrated multi- walled carbon nanotube (MWNT) suspensions using x-ray scattering techniques, and its manifestation in bulk rheology. Measurements were conducted on a sample with 2wt% MWNTs dispersed in a Newtonian uncured epoxy matrix. Steady shear rheology exhibited shear thinning behavior, with a viscosity close to that of the matrix at the highest shear rates. This is accompanied by increased MWNT orientation towards the flow direction in the 1-2 and 1-3 planes of shear flow. Transient rheology during step down tracked the dynamics of the increase in viscosity upon decreasing shear rate. MWNT orientation in both planes decreased during step down at time scales similar to the rheological measurements. The transient behavior is attributed to shear induced break up/ reformation of a spanning MWNT network. Cessation experiments showed slow, prolonged growth of solid modulus at rest, accompanied by rapid partial recovery of anisotropy in structure. This is attributed to fast, elastic recoil of MWNT clusters at short times, leading the drop in anisotropy, followed by slow "sticking" of MWNT clusters over prolonged time, leading to network reformation.

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