Abstract Submitted
for the MAR13 Meeting of
The American Physical Society

Cavitation in block copolymer modified epoxy[1] CARMELO DECLET-PEREZ, LORRAINE FRANCIS, FRANK BATES[2], Department of Chemical Engineering and Materials Science, University of Minnesota — Today, brittleness in epoxy networks limits most commercial applications. Significant toughness can be imparted by adding small amounts of micelle forming block copolymers (BCP) without compromising critical properties such as high use temperature and modulus. Curing the network locks in the self-assembled BCP micellar structures formed in the monomer resin providing control of the resulting morphology. Despite significant research over the last decade, a complete description of the parameters influencing toughness in block copolymer modified epoxies is still lacking. In this presentation we compare the ultimate mechanical behavior of epoxies modified with spherical micelle forming BCP's containing rubbery and glassy cores using real-time in-situ small-angle X-ray scattering (SAXS) performed during tensile deformation. Striking differences in the 2D SAXS patterns were documented for epoxies modified with rubbery (PEP) versus glassy (PS) micelle cores. Rubbery cores dilate by 100% in volume upon specimen yielding, while the glassy micelle cores deform at approximately constant volume. These results provide direct evidence of a cavitation mediated mechanism for toughness in block copolymer modified epoxies. We further interpret characteristic butterfly features in the 2D SAXS patterns in terms of epoxy network deformation.

[1]Support was provided by the NSF sponsored MRSEC at the University of Minnesota
[2]To whom correspondence should be addressed (bates001@umn.edu).

Carmelo Declet-Perez
Department of Chemical Engineering and Materials Science,
University of Minnesota

Date submitted: 25 Nov 2012 Electronic form version 1.4