

Abstract Submitted  
for the MAR15 Meeting of  
The American Physical Society

**Tensile Deformation and Morphological Evolution of Precise Acid Copolymers**<sup>1</sup> LURI ROBERT MIDDLETON, STEVE SZEWCZYK, ERIC SCHWARTZ, University of Pennsylvania , JASON AZOULAY, DUSTIN MURTAGH, JOSEPH CORDARO, Sandia National Laboratory, KENNETH WAGENER, University of Florida, KAREN WINEY, University of Pennsylvania — Acid- and ion-containing polymers have specific interactions that produce complex and hierarchical morphologies that provide tunable mechanical properties. We report tensile testing and in situ x-ray scattering measurements of a homologous series of precise poly(ethylene-co-acrylic acid) copolymers (pxAA). Upon variation of the number of backbone carbons ( $x = 9, 15, 21$ ) between pendant acrylic acid groups along the linear polyethylene chain, these materials exhibit pronounced changes in both their tensile properties as well as their morphological evolution during deformation. The hierarchical layered acid aggregate structure coincides with the onset of a strain hardening mechanism and was observed in both a semi-crystalline sample (p21AA) as well as an amorphous sample (p15AA). The polymer with the shortest spacing between acid groups (p9AA) maintains a liquid-like distribution of acid aggregates during deformation, exhibiting low tensile strength which we attribute to facile acid exchange between acid aggregates during deformation. Our results indicate that the formation of the hierarchical layered structure, which coincides with polymer strain-hardening regime, originates from the associating acid groups cooperatively preventing disentanglement.

<sup>1</sup>NSF-DMR-1103858

Luri Middleton  
University of Pennsylvania

Date submitted: 14 Nov 2014

Electronic form version 1.4