Abstract Submitted
for the MAR10 Meeting of
The American Physical Society

Multi-Scale Morphologies of Poly(ethylene glycol) - Based Sulfonated Ionomers WENQIN WANG, University of Pennsylvania, GREGORY TUDRYN, SHICHEN DOU, RALPH COLBY, The Pennsylvania State University, KAREN WINEY, University of Pennsylvania — A series of Li, Na, and Cs-neutralized sulfonated polyester ionomers with well-defined poly(ethylene glycol) (PEG) spacer lengths have been investigated by *in situ* X-ray scattering from 25 °C to 150 °C. At room temperature, the "ionomer peak" (q=1-5 nm^{-1}) is absent in Na and Cs-neutralized ionomers, while Li-neutralized ionomers shows a peak at q = 2-3 nm^{-1}, reminiscent of conventional ionomers. As the length of the PEG segment increases, the PEG segments crystallize as evidenced by multiple crystal reflections that are identical to pure PEG. In addition, the crystallization produces periodic low-angle peaks, which correspond to crystal thickness controlled by the well-defined PEG spacer length. As the temperature increases, a new X-ray scattering peak at q = 2-3 nm^{-1} gradually appears in Na and Cs-neutralized ionomers, while Li-neutralized ionomers exhibit a similar peak across the entire temperature range studied (25 °C - 150 °C). The peak intensity in all ionomers increases with temperature and the angular position shifts very slightly to the lower angle. The appearance of an ionomer peak at high temperature is attributed to the increasing extent of microphase separation of ionic groups due to the decreased ability of PEG to solvate ions.

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Date submitted: 23 Nov 2009 Electronic form version 1.4