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Role of Semi-Crystalline Morphology on Proton Conduction Pathways in a Precise Sulfonic Acid Polyethylene EDWARD B. TRIGG, Univ of Pennsylvania, MANUEL MARECHAL, CNRS, HAKIMA MENDIL-JAKANI, CEA-INAC-SPrAM, TAYLOR W. GAINES, Univ of Florida, DEMI E. MOED, Univ of Pennsylvania, KENNETH B. WAGENER, Univ of Florida, PATRICE RANNOU, CNRS, MARK J. STEVENS, Sandia National Laboratories, KAREN I. WINEY, Univ of Pennsylvania — Linear polyethylenes with precisely periodic functional groups (precise polyethylenes) have been shown to exhibit unusually well-defined semi-crystalline morphologies containing layers of functional groups. These layers may be useful for protonic, ionic or molecular transport. Recently, a precise polyethylene was synthesized with sulfonic acid groups bonded to every 21st carbon. We have studied the proton dynamics in this polymer using broadband dielectric spectroscopy at various hydration levels and thermal histories to evaluate the utility of these self-assembled pathways for improving transport. To understand the effect of structure on proton dynamics, detailed characterization has been carried out including X-ray scattering and atomistic molecular dynamics simulations. Comparable proton conductivities are measured in the semi-crystalline and amorphous states, showing that the greatly reduced chain mobility in the semi-crystalline state does not lead to a commensurate reduction in conductivity. This suggests that the proton pathways within the crystallites play a role in enhancing transport.

Edward Trigg
Univ of Pennsylvania

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