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Segmental dynamics and cross-linking in ion containing polymers

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We present Quasi Elastic Neutron Scattering (QENS) data for characterizing proton dynamics in ion containing polymers (ionomers) with varying ion content and ion identity. The anion is immobilized by covalently bonding it to the PEO backbone through an 'ionizable' isophthalate co-monomer unit and only the cation contributes to the conductivity, thereby isolating cation-polymer interaction for study. The ion content is varied in two ways: changing the ratio of neutral to ionized co-monomer units, and changing the length of the PEO spacer separating the co-monomer units. In neutral ionomers, we observe two segmental processes: PEO segments in the spacer midpoint are one order of magnitude faster than those near the isophthalate groups. In ionized samples, cross-linking between ionic groups considerably slows the dynamics of PEO segments near the isophthalate group. This effect is ion dependent, which indicates that cations have different binding capacities and formation of this complex determines the availability of free cations for conduction.

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