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Building non-tortuous ion-conduction pathways using self-assembled block copolymers ONNURI KIM, MOON JEONG PARK, Pohang Univ of Sci Tech — Ion-containing polymers with self-assembled morphologies are becoming important ingredients of a wide range of electrochemical devices such as lithium-ion batteries, fuel cells and electroactive actuators. Although several studies have reported the relationship between morphologies and ion transport properties of such polymers, the most of quantitative analysis have been limited to two-dimensional morphologies as they occupy a large window of the phase diagrams. In present study, we investigated the effects of morphology on the ion transport efficiency with a focus on three-dimensional symmetry. A range of three-dimensional self-assembled morphologies, i.e., ill-defined cubic, orthorhombic network (O^{70}), and face-centered cubic phases (fcc) were achieved for a single sulfonated block copolymer upon the addition of non-stoichiometric ionic liquids. The type of three-dimensional lattice was found out to play a crucial role in determining the ion transport properties of composite membranes, where the most efficient ion-conduction was demonstrated for fcc phases with lowest tortuosity of 1 over orthorhombic networks phases (tortuosity:1.5). This intriguing result suggests a new avenue to designing polymer electrolytes with improved transport properties.

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