Abstract Submitted for the MAR13 Meeting of The American Physical Society

Ionic Block Copolymers for Anion Exchange Membranes¹ TSUNG-HAN TSAI, Department of Polymer Science and Engineering, University of Massachusetts-Amherst, DAN HERBST, University of Chicago, GUINEVERE A. GIFFIN, VITO DI NOTO, Department of Chemical Sciences, University of Padova, TOM WITTEN, University of Chicago, E. BRYAN COUGHLIN, Department of Polymer Science and Engineering, University of Massachusetts-Amherst — Anion exchange membrane (AEM) fuel cells have regained interest because it allows the use of non-noble metal catalysts. Until now, most of the studies on AEM were based on random polyelectrolytes. In this work, Poly(vinylbenzyltrimethylammonium bromide)-b- (methylbutylene) ([PVBTMA][Br]-b-PMB) was studied by SAXS, TEM and dielectric spectroscopy to understand the fundamental structure-conductivity relationship of ion transport mechanisms within well-ordered block copolymers. The ionic conductivity and the formation of order structure were dependent on the casting solvent. Higher ion exchange capacity (IEC) of the membranes showed higher conductivity at as IEC values below 1.8mmol/g, as above this, the ionic conductivity decreases due to more water uptake leading to dilution of charge density. The humidity dependence of morphology exhibited the shifting of d-spacing to higher value and the alteration in higher characteristic peak of SAXS plot as the humidity increase from the dry to wet state. This phenomenon can be further explained by a newly developed polymer brush theory. Three ionic conduction pathways with different conduction mechanism within the membranes can be confirmed by broadband electric spectroscopy.

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