Abstract Submitted
for the MAR13 Meeting of
The American Physical Society

Predicting inhomogeneous water absorption in an ionic diblock polymer membrane[1] DANIEL HERBST, THOMAS WITTEN, University of Chicago Physics Department and James Franck Institute — Fuel cells convert fuel directly into electrical power. Their performance depends on a permeable (yet strong) membrane to allow ion conduction (while preventing combustion). Anion-exchange membrane fuel-cells are especially economical to produce, but technological hurdles currently limit durability and OH^- conductivity of the membrane. One solution to these problems is a diblock morphology. Layers of stiff hydrophobic polymer provide structure, while interspersed layers of polyelectrolyte provide avenues for conduction. Previously, little was known about the structure within the conducting layer. We adapted Scheutjens-Fleer polymer-brush theory to a lamellar geometry. The calculation tells where the polyelectrolytes congregate within a lamella, and hence how conduction occurs. This talk focuses on a new diblock material, PMB-PVBTMA. We show how the features of the material determine the intra-lamellar structure. We conclude that at low humidity, the bulkiness of PVBTMA causes it to adopt a near-uniform distribution within the conducting block. At high humidity, however, a phase separation may induce abrupt water channels. Understanding the architecture within the conducting layer will help guide research into better anion-exchange membranes materials.

[1]The authors would like to thank the Army Research Office for support of this research under the MURI #W911NF-10-1-0520.

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Date submitted: 18 Nov 2012 Electronic form version 1.4