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Control of Domain Orientation in Block Copolymer Electrolyte Membranes at the Interface with Humid Air MOON JEONG PARK, SUHAN KIM, ANDREW M. MINOR, NITASH P. BALSARA, Department of Chemical Engineering, Materials Sciences Division, Lawrence Berkeley National Laboratory, University of California, Berkeley, USA — Access to ion transporting channels in polymer electrolyte membranes depends crucially on the orientation of hydrophobic and hydrophilic domains at the surface. We demonstrate that domain orientation of polymer electrolyte membranes made from poly(styrenesulfonate-b-methylbutylene) (PSS-PMB) copolymers can be tuned by controlling sulfonation level and moisture content of the air. At low sulfonation levels, highly ordered hydrophobic PMB cylinders oriented perpendicular to the film surface are obtained, when the film is contacted with humid air. Increasing the sulfonation level results in a transition from perpendicular to parallel orientation. Our conclusion is based on three-dimensional characterization of membranes using electron microscopy of samples prepared by the shadow focused ion beam technique, grazing incident small angle x-ray scattering, and electron tomography.

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