

Supplementary Information for

High Performance Electrospun Bipolar Membrane with a 3D Junction

C. Shen¹, R. Wycisk² and P. N. Pintauro^{3*}

¹ School of Material Science & Engineering, Wuhan University of Technology, Wuhan, Hubei 430070, P.R. China

² Department of Chemical and Biomolecular Engineering, Vanderbilt University, Nashville, TN 37235, USA.

*Correspondence to: pn.pintauro@vanderbilt.edu

Membrane Durability and High Current Density Membrane Degradation

The durability/degradation of a 3D junction BPM was evaluated by performing three water splitting polarization experiments on the same film. In the first experiment, i-V data was collected up to a current density of 1,100 mA/cm² (curve A in Fig. S1). A photograph of this membrane after data collection is shown in Fig. S2 (right side photograph); no physical damage was found. A second water splitting polarization curve was obtained with the same BPM where the maximum current was raised to 1,800 mA/cm² (Curve B in Fig. 1). Curves A and B are essentially identical, indicating no membrane degradation during the collection of curve A data. A third water splitting i-V plot (curve C) was obtained after the collection of curve B data. . As can be seen, after passing a current density of 1,800 mA/cm², the 3D junction BPM exhibited severe degradation, as indicated by the high transmembrane voltage drop for a modest current density. Between repeated polarization experiments, the membrane was allowed to soak in a 0.5 M Na₂SO₄ solution at room temperature (four months between curves A and B; 24 hours between curves B and C).

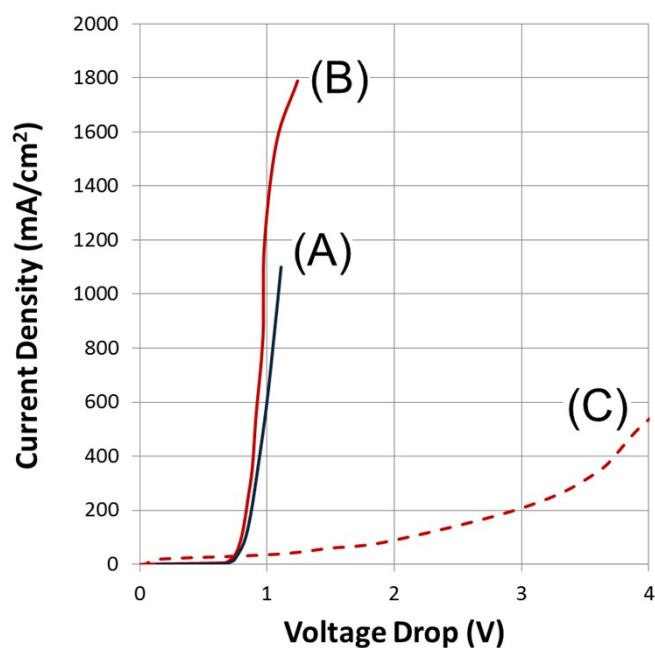


Figure S1. Water splitting i-V plots for the same electrospun bipolar membrane with a 3D junction. Curve A – initial polarization curve; Curve B polarization curve after collecting Curve A data and after soaking the membrane in 0.5 M Na_2SO_4 for four months; Curve C polarization curve after collecting Curve B and after soaking the membrane in 0.5 M Na_2SO_4 for 24 hours.

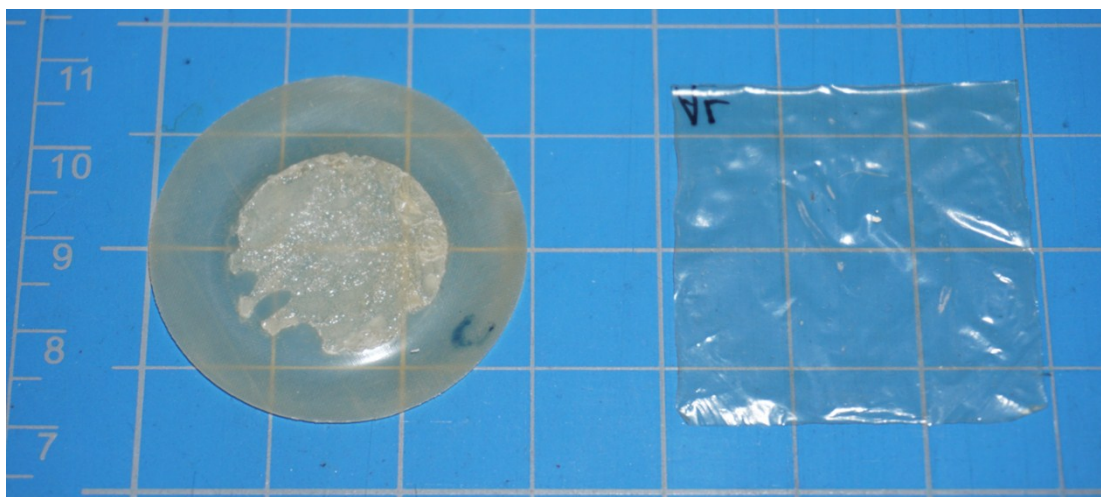


Figure S2. Visual photographs of bipolar membranes after a high current density water splitting polarization experiment, where the maximum current density was 1,100 mA/cm^2 . A Fumasep® FBM membrane from Fumatech GmbH (left) showing blistering/degradation and a 3D junction electrospun membrane, shown after collecting Curve A i-V data in Fig. S1 (right).