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Morphological Effects on Proton Transport in Self-Assembled Anhydrous Polymers[1] SCOTT CHRISTENSEN, YANGBIN CHEN, MICHAEL THORN, CRAIG VERSEK, AMBATA POE, MARK TUOMINEN, S THAYUMANAVAN, RYAN HAYWARD, University of Massachusetts - Amherst — A critical component of fuel cell technology is efficient proton exchange membranes with the ability to selectively transport protons over micrometer length scales. For polymer membranes, the industry standard Nafion suffers from the need for humidification, preventing efficient operation above the boiling point of water. It would therefore be beneficial to use a solvent free membrane that allows for operation at high temperatures, thus increasing efficiency, lowering cost, and preventing catalyst poisoning. We describe the design and characterization of comb polymers containing amphoteric proton transfer functionalities that self-assemble into organized supramolecular structures. Comparison with analogous polymers lacking organization reveals that these self-assembled structures yield a two- to three-order of magnitude increase in proton conductivity, presumably due to the locally-increased concentration of proton-transport functionalities within the nano-phase separated domains.

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Scott Christensen
University of Massachusetts - Amherst

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