

High Temperature Working Group

May 19, 2006

Advanced Materials for Proton Exchange Membranes

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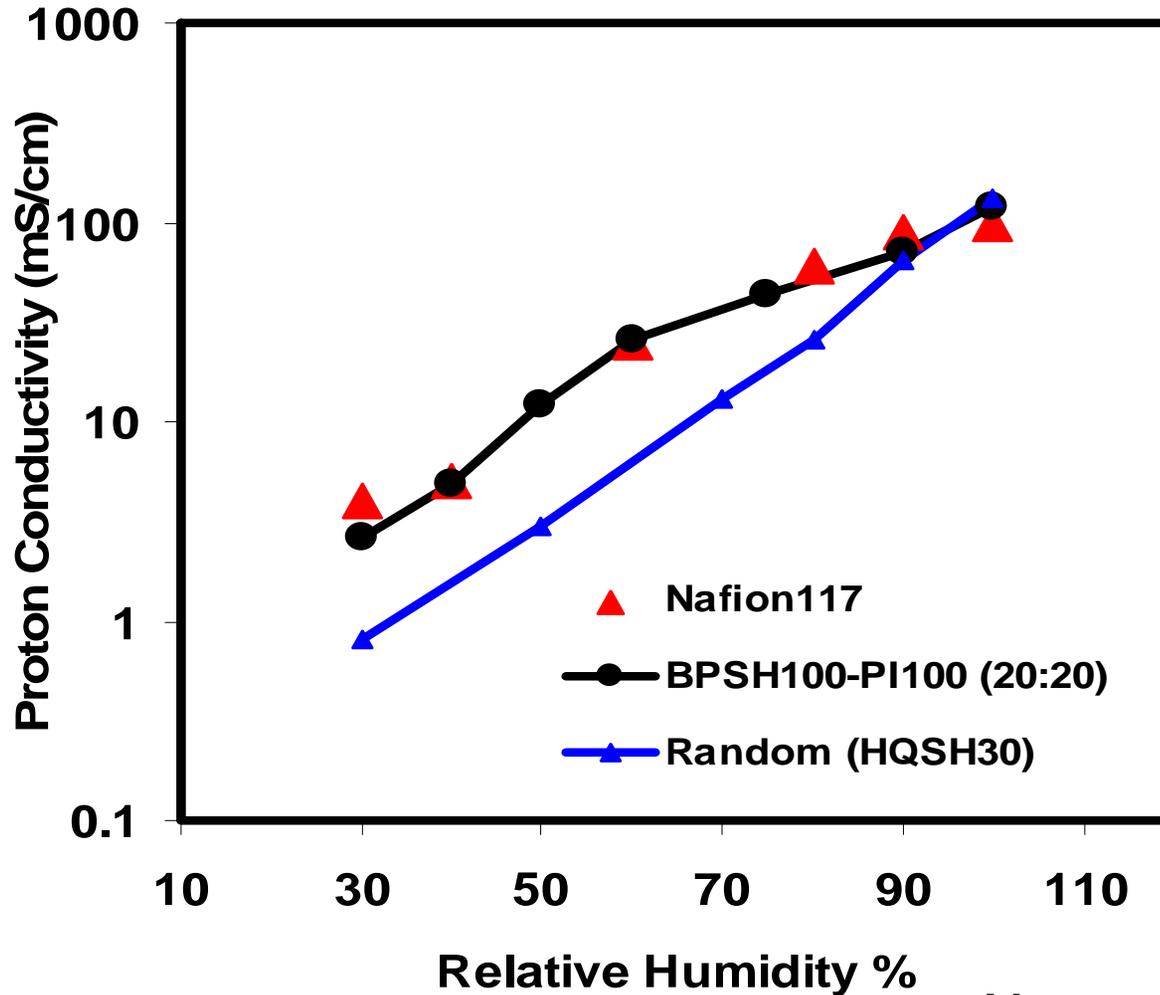
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Research Approach/Hypothesis

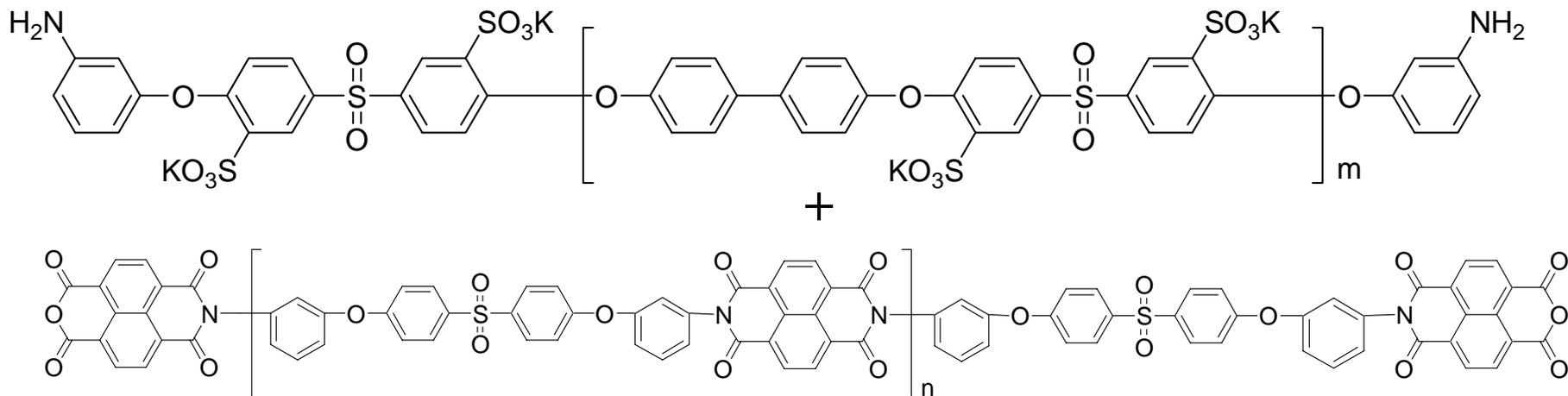
- Thermally, hydrolytically, and oxidatively stable aromatic ionomers with high T_g , ductility, and controlled hydrophilicity are required
- Synthesis
 - Linear and crosslinked statistical hydrophobic/hydrophilic copolymers
 - Linear multiblock hydrophobic/hydrophilic copolymers (current & future)

Why We Are Interested in Block Copolymers as PEMs?



Measured at 80°C

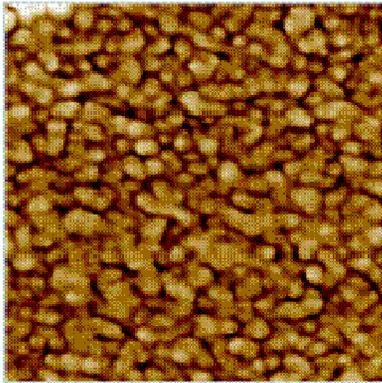
Synthesis of High MW Multiblock Copolymers Employing Mixed Solvent Systems



- 1) Benzoic Acid
- 2) NMP (80 °C 4hr)
- 3) m-Cresol
- 4) Extra NMP
- 5) 180 °C 12hr
- 6) Isoquinoline
- 7) 180 °C 12hr

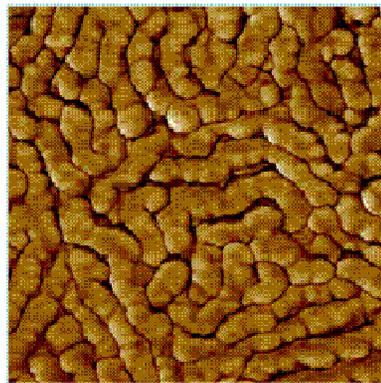
AFM Images of Multiblock Copolymers

100 nm



BPSH 5 – PI 5

100 nm



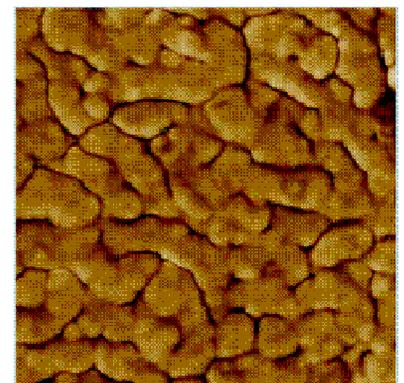
BPSH 10 – PI 10

100 nm

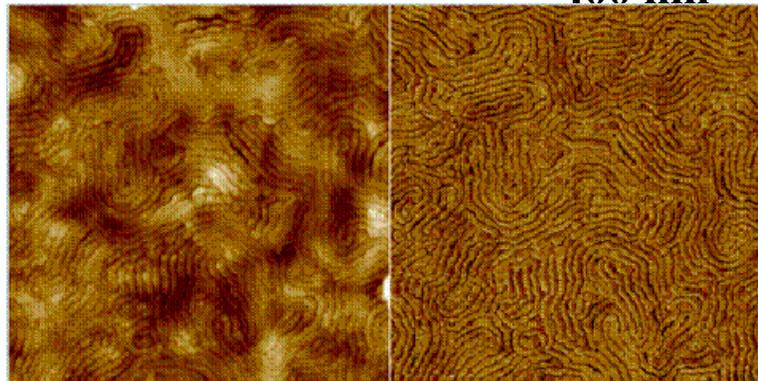


BPSH 15 – PI 15
400 nm

100 nm

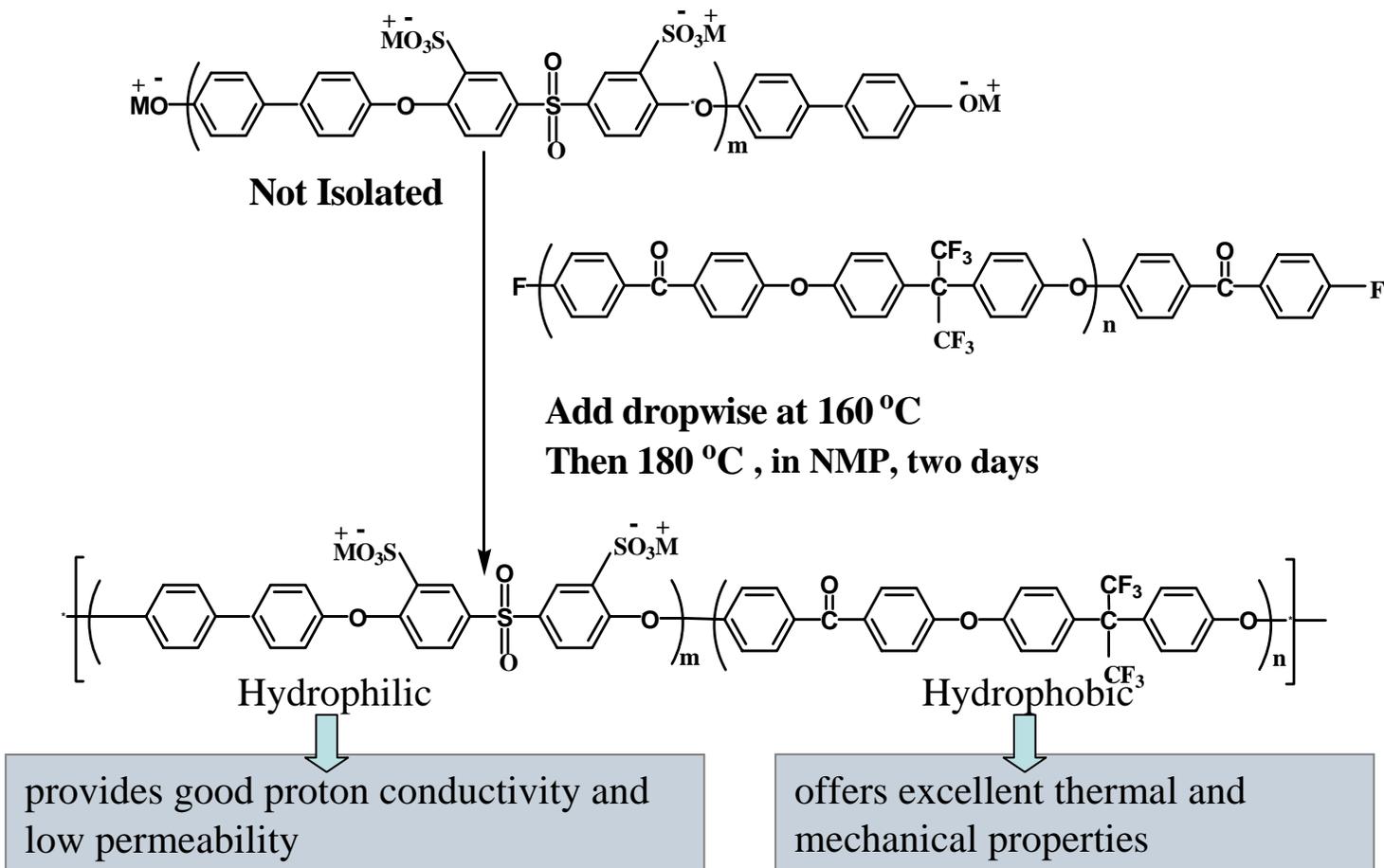


BPSH 20 – PI 20

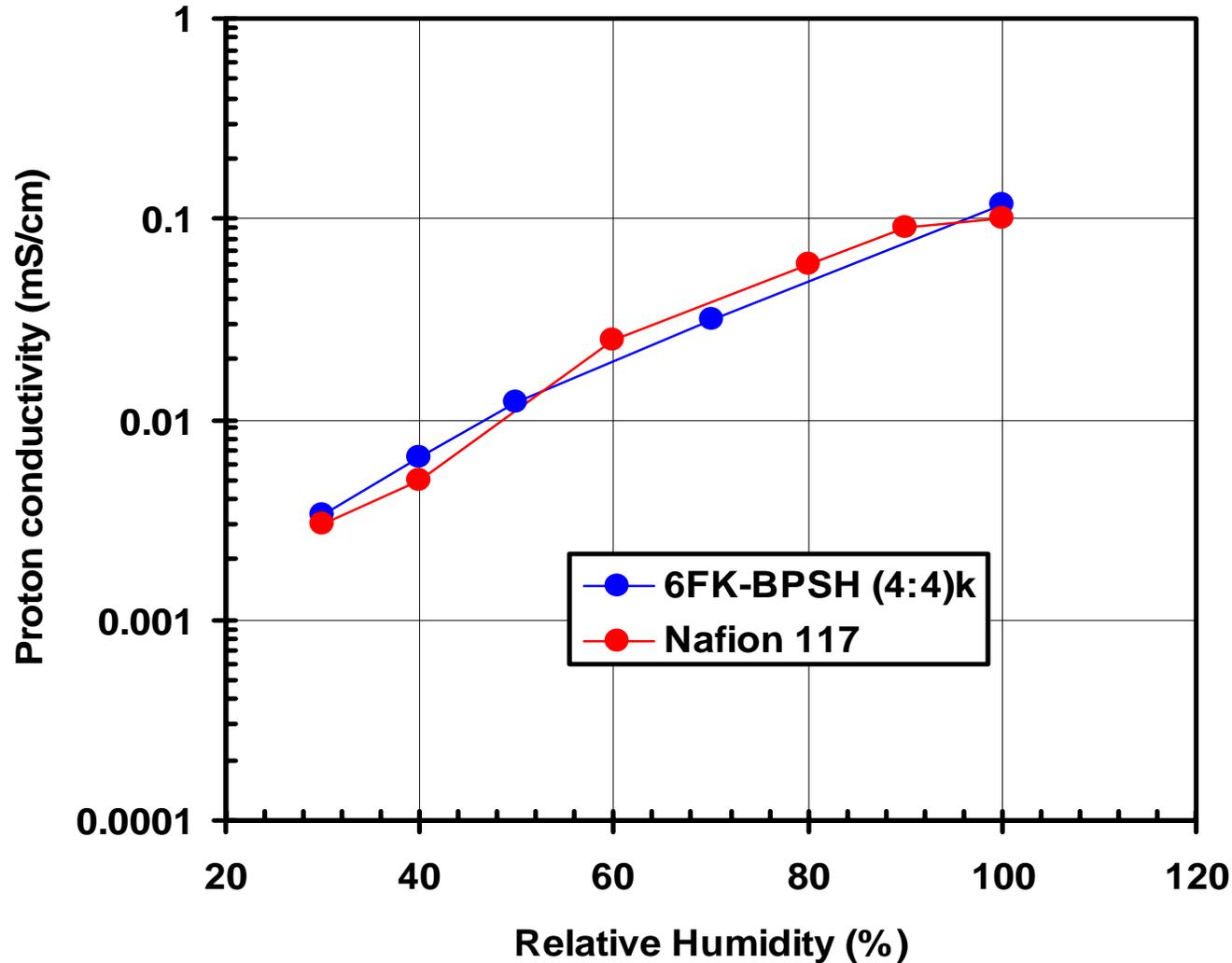


BPSH 15 – PI 15

Synthesis of 6FK-BPSH Multiblock Copolymers

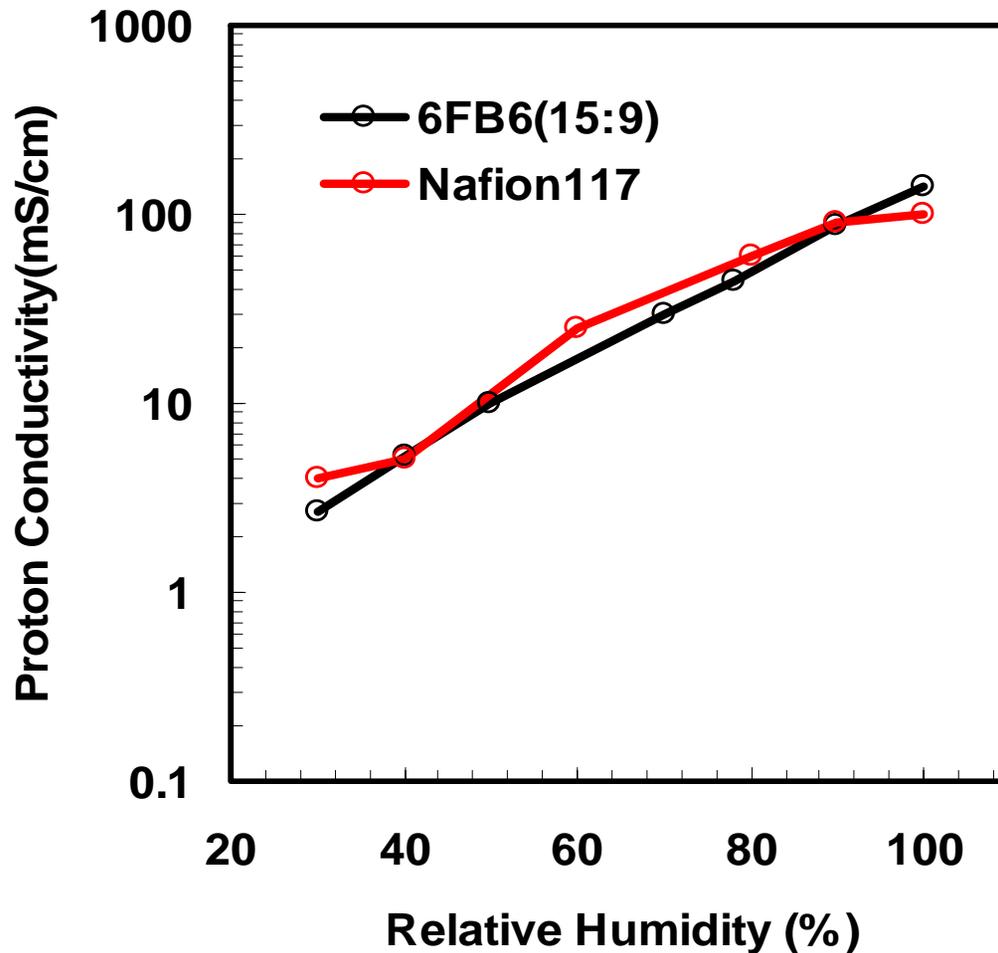


Comparison of Conductivity vs. RH for 6FK-BPSH Multiblock(4:4)K and Nafion 117



80 °C

Proton Conductivity vs. RH for 6FB6, a 15,000-9,000 gm/mole Multiblock Copolymer



Target IEC: 1.25

Water uptake: 42%

Proton conductivity in liquid water: 0.09 S/cm