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Polybenzimidazole-phosphoric acid complexes and proton conducting membranes

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Polybenzimidazole (PBI) polymers are excellent candidates for PEM fuel cell membranes capable of operating at temperatures up to 200°C. The ability to operate at high temperatures provides benefits such as faster electrode kinetics and greater tolerance to impurities in the fuel stream. In addition, PBI membranes doped with phosphoric acid can operate efficiently without the need for external humidification and the related engineering hardware to monitor and control the hydration levels in the membrane. A new sol-gel process was developed to produce PBI membranes loaded with high levels of phosphoric acid. This process uses polyphosphoric acid as the condensing agent for the polymerization and the membrane casting solvent. Upon hydrolysis of the solvent to phosphoric acid, a sol-gel transition occurs to provide membranes with an attractive set of properties. PBI membranes are currently being investigated as candidates for portable, stationary, and transportation PEM fuel cell applications.