Flexoelectric Polymer Electrolyte Membranes

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In this work, a multilayer assembly of flexible solid polymer electrolyte membranes (PEM) and flexible electrodes has been developed, inspired by the basic principles of bioelectricity and signal transmission in neurons. The PEM assembly can generate electrical voltage/current via ion shuttling or pumping during PEM bending/flexing, therefore can be used to harvest energy from wind and rolling tires. The system operates based on the principle of ‘bending’ piezoelectricity (i.e., flexoelectricity), wherein electricity is produced by ion polarization. To study the flexoelectric property of the system, a unique experimental setup was designed, combining Dynamic Mechanical Analyzer (DMA) and Solartron Potentiostat/Galvanostat. DMA serves as a source to apply bending deformation to the sample while Solartron Potentiostat/Galvanostat captures electrical energy output. The flexoelectric coefficient, ion polarization density, and electrical energy output was studied under static and dynamic bending deformation.