The Varied Use of Membranes and Mediators to Enhance the Ionic and Electronic Conductivity of a Capacitor

Narasimhan, Swati

This project is the result of experimentation with assorted mediator concentrations and various dielectrics with the purpose of creating a high capacity, low resistance capacitor. To conduct this experiment, a PVDF+LiTFS membrane was cast; its ionic and electronic conductivities were found with AC Impedance and DC Polarization tests. The same tests were repeated for a Nafion membrane. Various mixtures with varying concentrations of mediator (NaI+I2) were created and tested on a Gamry Potentiostat with Potentiostatic EIS and Cyclic Voltammetry tests. The ionic conductivity of a Nafion membrane, agreed to be between 0.02-0.3 S/cm, served as a control. Obtaining this value verified all data. Capacitors made with a 0% mediator concentration mixture served as a control to show the importance of the mediator. The results established that the higher the mediator concentration, the greater the capacity. Sample Seven, Test Three (22%) had a charge three times greater than that of Sample Nine (0%). A loading mass of 0.04g creates a lower resistance and higher capacity. Sample Seven Test Three (0.04g) had a capacity double that of Test Two (0.08g). Both had a change resistance of 0.1ohm. Nafion membranes have a much higher conductivity than PVDF+LiTFS membranes, despite their restricted voltage. One comparison showed Nafion membranes to have a conductivity seven times greater. Also, sonication, hot-pressing, and adding sulfuric acid all lower the resistance and increase the capacity exponentially. Capacitors can revolutionize public transportation, laptops, cell phones, medical equipment, and all other electronic devices that currently use inefficient batteries to provide energy.

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