Electroactive Polymer for Flexible Energy Storage

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Abstract

In the past few decades, NASA relied on the conventional battery power for their space travels. Nevertheless, if they hope to widen their outer space exploration reach, they must come up with new energy capabilities. Additionally, the energy storage or stored power demands of most technologies are currently accommodated by rechargeable batteries like nickel cadmium cells. The batteries have been enough for most applications; however, they are characterized by high weight, lack of flexibility, and have limited peak power performance. Capacitors have been studied for years because of their high-power density and long cycling life. In addition, they are able to charge and discharge with higher power than rechargeable batteries.

Until recently, most studies with ionic polymer metal composite (IPMC) materials focused on their capabilities as actuators. IPMCs are characterized by significant displacements, but low-density forces. Solid polymer electrolytes (SPEs) are suitable materials for the growth of flexible and compact capacitors. Flexible IPMCs fabricated utilizing platinum (Pt) or Gold (Au), are studied for their applicability as Solid Polymer Electrolyte membranes for high--power capacitors, as they have shown improved performance as electronic devices. In this study, the fabrication of an all-solid-state capacitor which uses a Nafion membrane is investigated for its capacity and cycle life. In order to verify the reliability and properties of the all-solid-state capacitor, cyclic voltammetry and charge-discharge tests are performed. In addition, the study also explores the role of mechanical engineering in IPMC based capacitor design and manufacturing.