Fabrication and Characterization of an Ionic Polymer Metal Composite

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Extended Abstract

An Ionic Polymer Metallic Composite (IPMC) is a conductive polymer plated with metal layers as exterior electrodes that work as an actuator when voltage is applied. Potential applications for IPMC include uses as soft actuators, and bio-signal sensor systems for detecting small electrical currents in tissues. In this paper, we optimized the fabrication process and characterized the properties of an IPMC synthesized from chemical deposition of palladium onto Nafion polymer from Dupont. Three main fabrication steps consist of polymer preparation, impregnation–reduction plating (IRP) and autocatalytic plating (ACP). Optimization focused on the IRP and ACP steps, i.e. the study of impacts of reducing agents on the thermal stress of the IPMC. NaBH4 and N2H4•HCl were tested as reducing agents during the fabrication processes. To quantify the effect of variable thermal stress on IPMC the resistance and physical response to voltage differentials were tested. Results gave evidence that NaBH4 produced more desirable qualities, material resistance and magnitude of physical response compared to N2H4•HCl. Other findings suggested that using a standardized salt solution for IPMC storage instead of DI water could prevent dissociation of counter ions from the polymer and improve displacement with the use of accurate voltage supply. Finally, the IPMC was characterized using a scanning electron microscopy (SEM). Collected images gave evidence that NaBH4 resulted in better surface uniformity of the palladium coating and chemistry contents. The future research will be focused on synthesizing novel polymers to serve as dielectric materials for further optimization of the desired physical and chemical qualities of the IMPC.