

The Study of Shape Memory Ionic Polymer-Metal Composite Actuator

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Abstract

In the study of smart materials, the growth of biomimetic actuators has been important. The Ionic Polymer-Metal Composite (IPMC) is a smart material utilized in the actuation and sensing applications. A Multiple Shape Memory Ionic Polymer (MSM-IPMC) actuator has Multiple-Shape Memory Effect (MSME) and can perform by the addition of electrical and thermal inputs. The MSM-IPMC actuator displays complex 3D deformation such as bending and oscillating. These characteristics of the MSM-IPMC are controlled by thermal-mechanical and electro-mechanical effects. The four strategic goals or plans stated in the 2018 NASA Strategic Plan are to Discover, Explore, Develop, and Enable. This research project is most relevant to strategic objective 3.1, which states to “Develop and transfer revolutionary technologies to enable exploration capabilities for NASA and the nation.” In recent years, shape memory polymers have drawn greater interest for applications such as intelligent medical devices, smart armors, and adaptive wing structures. The MSME of a star shaped polymer using Aquivion (to mimic the nastic movements of a flower and starfish locomotion) was conducted in this study to show that Aquivion displays great MSME. Because of the broad glass transition range, Aquivion can be potentially programmed at different shapes, which can be recovered at various temperatures respectively.