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ELECTROACTIVE POLYMER ACTUATORS AS ARTIFICIAL MUSCLES FOR SPACE APPLICATIONS

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ABSTRACT

Electroactive polymers (EAP) can induce large bending and longitudinal actuation strains and operate similar to biological muscles. This capability can be used to develop miniature, lightweight actuators that consume low-power and to produce miniature robotic devices. This reported study is concentrating on the development of effective EAPs and the resultant enabling mechanisms employing their unique characteristics. Several EAP driven mechanisms for space applications were developed including a gripper, manipulator arm and surface wiper. The manipulator arm was made of a composite rod that was lifted by an electrostatically activated longitudinal scrolled rope, and an end-effector gripper with bending EAP fingers allowing grabbing and holding such objects as rocks. An EAP surface wiper was developed to operate like a human finger removing dust from windows and solar cells. These EAP driven devices are taking advantage of the large actuation displacement of these materials where there is a limited requirement for an actuation force capability. The effect of low temperatures and vacuum that are typical to such planets as Mars was determined for EAPs and the results are very encouraging since some of these materials have shown effective response to at least -100°C.

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