Electroactive Polymer Artificial Muscle (EPAM) Technology & Development

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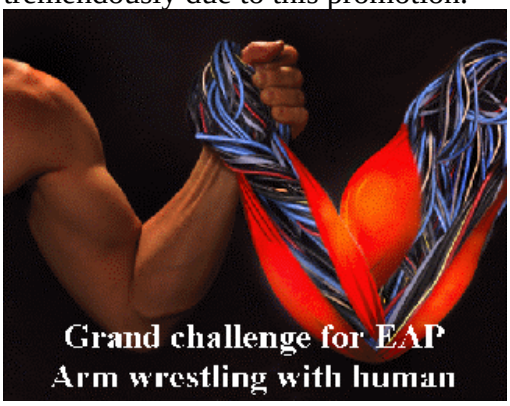
This topic is one of the major projects in progress in the biomedical, biochemical, chemical and mechanical engineering fields. Only since the 1990's has significant enough attention been paid to the development and research of: Electroactive Polymer (EAP) Actuators, Electroactive Polymer Artificial Muscles (EPAM), and Ionic Polymer-Metal Components (IPMCs) for those devices.

Research in polymer gels resulted in the concept that an artificial muscle and potential robot actuator design is possible. The use of acids and bases to create Ionic Polymer-Metal Composites (IPMC) is what allows for the bending of the electroactive polymer (EAP) devices.

IPMCs can be used as actuators, sensors, and artificial muscle. They have a perfluorinated ion exchange membrane (PIEM) surrounded by a platinum particle electrode which is coated by a silver (or copper) layer to reduce surface-electrode resistance and increase actuation capability in the IPMC artificial muscles. The dynamic deformation of IPMCs results in the creation of dynamic electric fields. IPMCs use low voltages (unlike the Electric EPAMs) and low frequencies. However, IPMC are slow in response to signals, must remain wet and have a low reaction force.

Alternatives include pneumatics and hydraulics, which had some success but depend upon compressors that are driven by electric motors, and electromagnetic actuators. The purpose of the recent research is to develop an artificial muscle that is self-sufficient and can be used in many applications including prosthetics.

Yoseph Bar-Cohen, a leader in the development of research, devices, and organizations for the development of artificial muscle, proposed a human vs. robotic armwrestling contest in March 2005 and will have another match (robot vs. robot) in 2006. The funding and increase in research for artificial muscle has increased tremendously due to this promotion.



Many fundamental physical and engineering improvements remain before the extent or limit of the EPAM are known.

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