# IPMC Microgripper Research and Development

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This paper addresses the change in mechanical properties of an ionic polymeric metal composite (IPMC) microgripper finger when movement of the actuator is impeded by the introduction of a sensor. IPMC is an excellent material for compliant actuation for microgripper applications, e.g., bio-manipulation, and has been considered for fingers in a microgripper [1-3]. Since IPMC can act as both an actuator and a sensor [4-5], it is possible to create a sensor/actuator sandwich, as shown in Fig. 1. The finger consists of an actuator, adhesive, an insulator, adhesive, and IPMC sensor. The advantage of IPMC as a bio-manipulation material is that is compliant and will not harm biological samples. However, at the same time it is relative weak. Consequently, adding the sensor to the actuator increases the effective stiffness of the system, reducing the deflection of the sandwich finger.

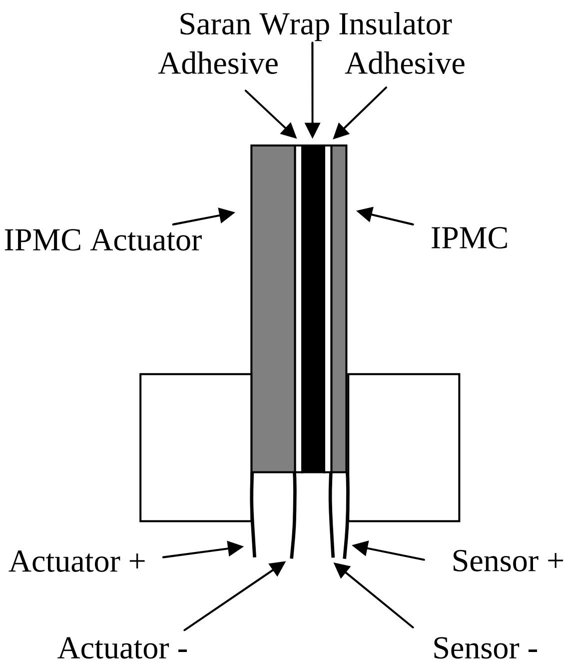


**Fig. 1. Schematic of the IPMC sandwich and its components**

This paper uses composite beam theory to describe the IPMC sandwich finger, where all layers of the sandwich are modelled as an equivalent beam with new properties. This model predicts the amount of motion that the composite beam will move. We experimentally measure the deflection of the IPMC actuator alone and the deflection associated with the sandwich. For the specific dimensions of the actuator and sensor, we predict that the sandwich will move 25% of the motion of the actuator alone. Experimentally, we measured 41%, suggesting that the adhesive actually moves slightly, making the beam slightly less stiff than the model predicts. This motion is adequate for microgripper applications where we trade the amount of motion for the ability to sense the position of the finger.

References:

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