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Biocompatible Silk-Poly(Pyrrole) Composite Trilayer Actuators CARLY FENGEL, NATHAN BRADSHAW, SEAN SEVERT, AMANDA MUR-PHY, JANELLE LEGER, Western Washington Univ — Biocompatible materials capable of controlled actuation are in high demand for use in biomedical applications such as dynamic tissue scaffolding, valves, and steerable surgical tools. Conducting polymers (CPs) have some desirable traits for use as an actuator, such as the ability to operate in biologically relevant fluids and responsiveness to low voltages. However CPs alone are limited due to their brittle nature and poor solubility. Recently we have shown that a composite material of silk and the CP poly(pyrrole) (PPy) shows promising characteristics as an actuator; it is mechanically robust as well as fully biocompatible. Initial proof-of-concept experiments demonstrated that these composites bend under an applied voltage (or current) using a simple bilayer device. Here we present trilayer devices composed of two silk-PPy composite layers separated by an insulating silk layer. This configuration results in more charge is passed in comparison to the analogous bilayer system, as well as a more sustainable current response through cycling, resulting in a larger angle of deflection per volt applied. In addition, the motion of the trilayer devices is more symmetric than that of the bilayer analogs, resulting in a more repeatable movement. We will discuss the fabrication and characterization of these devices, as well as their performance and future applications of this technology.

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