Abstract Submitted
for the NWS18 Meeting of
The American Physical Society

Performance of biocompatible silk-polypyrrole actuators under biologically relevant conditions JO'ELEN HAGLER, BEN PETESON, JANELLE LEGER, AMANDA MURPHY, Western Washington University — Biocompatible actuators that are capable of controlled movement and can function under biologically relevant conditions are of significant interest for biomedical applications. Previously, we demonstrated that a composite of silk biopolymer and the conducting polymer poly(pyrrole) (PPy) can be formed into a functional bilayer bending actuator. These silk-PPy composites can generate forces comparable to human muscle (>0.1 MPa) making them ideal candidates for interfacing with biological tissues. We explore the performance of these silk-PPy bilayer actuators under biologically relevant conditions including exposure to protein, serum, enzymes, and biologically relevant temperatures. Free-end bending actuation performance, current response, force generation, and mass degradation under these conditions were investigated. We find that the performance of our silk-PPy devices is sensitive to protein serum and enzyme type, as well as the temperature at which the devices are actuated. However, the silk-PPy actuators under all conditions tested here retained the ability to bend, generate forces, and conduct currents at comparable levels to devices tested under standard operating conditions. The results suggest that our silk-PPy actuators are promising candidates for implantation *in vivo* and for interfacing with biological systems.

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Date submitted: 20 Apr 2018 Electronic form version 1.4