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IONIC POLYMER-METAL COMPOSITE FOR USE IN SOFT ROBOTICS

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ABSTRACT:

Ionic polymer-metal composite (IPMC) artificial muscles (AM) is a low voltage driven actuator exhibiting large "bending" displacement and operates in an aqueous environment. Thus, they are suited for creating artificial fish-like propulsors that can mimic the undulatory, flapping, and complex motions of fish fins. Conversely, they can be envisioned as sensor when they are subject to mechanical deformation. In this presentation, a newly-developed IPMC AM with patterned electrodes will be discussed for realizing multiple degrees-of-freedom motion, such as bending and twisting. Furthermore, physics-based models that can simulate ion transport and corresponding strain for IPMC actuation will be discussed. The model can be used as an effective design tool for fabricating IPMCs specific to certain engineering applications including "twisting." In addition, experimental results on electromechanical coupling of various types of IPMCs will be included in the talk.

BIOGRAPHY:

Kwang J. (Jin) Kim is Southwest Gas Professor of Energy and Matter of the Mechanical Engineering Department and Director of "Active Materials and Smart Living (AMSL) Laboratory". Dr. Kim graduated from Yonsei University, Korea, in 1987 and received his MS and Ph.D. from Arizona State University (ASU) in 1989 and 1992, respectively. All three degrees are in Chemical Engineering. Later, he completed a postdoctoral study at the University of Maryland-College Park (1993-1995). His industrial experience includes Senior Research Engineer at Thermal Electric Devices, Inc. (1995-1997) and Chief Scientist at Environmental Robots, Inc. (1997-2001), Albuquerque NM. Prior to joining UNLV in Fall 2012, he was Foundation Professor and Department Chair of the Mechanical Engineering Department at University of Nevada, Reno. His research interests are in a broad spectrum of "Active Materials/Sensors" and "(Renewable) Energy Systems." He has authored/co-authored over 330 technical papers, including 143 referred journal papers, three books, and holds three patents. He is a fellow of ASME.