Carbon Nanotube and Graphene based Bio-inspired Electrochemical Actuator

Wei Chen

i-Lab, Suzhou Institute of Nano-Tech and Nano-Bionics, Chinese Academy of Sciences, Suzhou 215123, P. R. China
wchen2006@sinano.ac.cn

Bio-inspired actuation materials, also called artificial muscles, have attracted great attention in recent decades for their potential application in intelligent robots, biomedical devices, and micro-electro-mechanical systems. Among them, ionic polymer metal composite (IPMC) actuator has been intensively studied for their impressive high-strain under low voltage stimulation and air-working capability.

A typical IPMC actuator is composed of one ion-conductive electrolyte membrane laminated by two electron-conductive metal electrode membranes, which can bend back and forth due to the electrode expansion and contraction induced by ion motion under alternating applied voltage. As its actuation performance is mainly dominated by electrochemical and electromechanical process of the electrode layer, the electrode material and structure become to be more crucial to higher performance. The recent discovery of one dimensional carbon nanotube and two dimensional graphene has created a revolution in functional nanomaterials. Their unique structures render them intriguing electrical and mechanical properties, which makes them ideal flexible electrode materials for IPMC actuators in stead of conventional metal electrodes.

Currently although the detailed effect caused by those carbon nanomaterial electrodes is not very clear, the presented outstanding actuation performance gives us tremendous motivation to meet the challenge in understanding the mechanism and thus developing more advanced actuator materials. Therefore, in this presentation IPMC actuators prepared with different kinds of carbon nanomaterials based electrodes are introduced. Key parameters which may generate important influence on actuation process are discussed in order to shed light on possible future research and application of the novel carbon nanomaterials based bio-inspired electrochemical actuators.

References


Figure Different nano-carbon based electrode materials for IPMC actuators