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Ionic polymer metal composite actuators based on silver nanowires/platinum electrodes with large deformation and fast response rate

Minjeong Park[1], Sookhyun Hwang[1], Yunkyeong Bae[1], Seonpil Kim[2], and **Minhyon Jeon[1]**
[1]Inje University, Korea
[2]Gyeongju University, Korea

Ionic polymer metal composite (IPMC) actuators bended by low electrical stimulus have been intensively investigated for use in practical applications such as soft robotics, sensors, and biomedical devices1. The requirements of electrodes for high-performances IPMC actuators should be highly electrically conductive, mechanically compliant, and durable against cyclic deformations. Typical IPMC actuators consist of nafion and two platinum (Pt) electrodes by electroless plating process2. The electroless plating method can be effectively utilized in the electromechanical coupling between nafion and Pt electrodes. The Pt electrode has excellent electrical conductivity, high electrochemical stability, and fast actuation response. However, the concerns associated with Pt electrodes are microcracks and solvent evaporation developed under continuous operation. These issues directly affect the performance degradation and durability of the IPMC actuators. In this study, the IPMC actuators with silver nanowires (Ag NWs)/ Pt electrodes are suggested and developed. Due to the inherent low resistivity of silver and the narrow width of Ag NWs, the Ag NWs has low resistance. In addition, the Ag NWs layer can mitigate the surface crack, irregular surface, and solvent evaporation of Pt electrodes under continuous operation3. We found that the large deformation (~39.8 %) and fast response rate (~13.3 %) of the Ag NWs/Pt actuator is considerably enhanced compared to that of a conventional Pt actuator under ±2 V_{AC}, 0.2 Hz. The newly designed Ag NWs/Pt actuator can be used in active biomedical devices, biomimetic robots, and flexible soft electronics.

Biography

Minjeong Park is currently pursuing her Ph.D. degree at the Department of Nanoscience & Engineering, Inje University, Republic of Korea. Her current research interests include graphene synthesis, and nano-composite using various electrodes and ionic polymer for flexible actuator. She is a group leader of nano-optoelectronic device laboratory. She is in charge of maintenance of experiment and analysis equipment such as chemical vapor deposition, atomic force microscope, field emission-scanning electron microscopy, etc.

mjpark9121@gmail.com

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