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Enhanced durability of ionic electroactive polymer actuators coated with hexagonal-boron nitride

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Ionic electroactive polymer (EAP) actuators driven by electrical stimuli have been widely investigated for use in practical applications such as sensors, and biomedical devices. However, by conventional metallic electrodes such as gold or platinum, the actuation performance of ionic EAP actuators is degraded under long-term excitation, resulting from an increase in the surface electrode resistance due to micro-scale crack growth and evaporation of water molecules through cracked electrodes. Therefore, it is important to prevent the evaporation of water molecules from micro-cracks. Recently, hexagonal boron nitride (h-BN) has received much attention owing to its extraordinary physical properties such as chemical stability, electrical resistivity, and negative electron affinity. Specifically, h-BN, a structural analogue of graphene, possesses only 1.8 % lattice mismatch with graphene but a large band gap (~5.9 eV). Therefore, the combinations of graphene and h-BN, including both in-plane h-BN hybrids and stacked graphene/h-BN structures, have been demonstrated very intriguing physical properties. Moreover, as the graphene and h-BN have the same hexagonal lattice structure and a smaller covalent bond length than water molecules, it is expected to keep the water evaporation from the polymer membrane. Also, h-BN has a flat structure at the atomic level and has excellent insulation properties, so we expect the prevention of oxidation of the electrodes and accordingly increase the durability of the actuator. In this study, we demonstrate the first h-BN/AgNWs-graphene nanocomposite electrodes for ionic EAP actuators. The new structure of ionic EAP actuators improves durability by preventing water evaporation and electrode oxidation.

Biography

Yunkyeong Bae has completed her bachelor's degree at the age of 24 years from Inje University. She is currently pursuing her master degree at the department of Nanoscience and Engineering, Inje University, Korea. Her research fields include graphene growth of 2D materials and fabrication of ionic polymer metal composite actuators and characterization of electrodes or ionic polymers of actuators.

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