Mechanical Characterization of Graphene Based Bucky Gel Actuator

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Abstract
Bucky gel actuator (BGA) is an electroactive polymer (EAP) that responds to low voltage stimulation via large deformations. Microvalves, micropumps, and artificial muscles are candidate applications for BGA. BGA contains three layers, an electrolyte sandwiched between two electrodes, in which ions can move freely. When a low voltage (less than 10 V) is applied to it, ions move under the electric field; anions go to the anode, and cations go to the cathode. There is a significant difference between cations and anions in size, which results in mass transport and, therefore, the BGA bends [1]. The amount of bending, or tip displacement, directly depends on the number of ions absorbed by electrodes. That means if the electrode can absorb more ions, the BGA will bend more, and the displacement of the tip will be larger. Researchers have increased the absorption surface by using carbon nanotubes (CNT) in the electrodes. Since BGA mechanical properties are important for their applications, researchers have studied them via nano-indentation and dynamical mechanical analysis (DMA) [2]. In this paper, graphene flakes are proposed, for the first time, as electrode constitutive material instead of CNTs. Graphene-based BGA actuators are fabricated and their mechanical properties are characterized by tensile, nano-indentation, DMA tests.

References
[1] T. Fukushima, K. Asaka, A. Kosaka, and T. Aida, Angew. Chem. Int. Ed., **44** (2005) 2410-2413.
[2] A. Ghamsari, Y. Jin, and E. Woldesenbet, Smart Mater. Struct., **21** (2012) 045007.

Figures

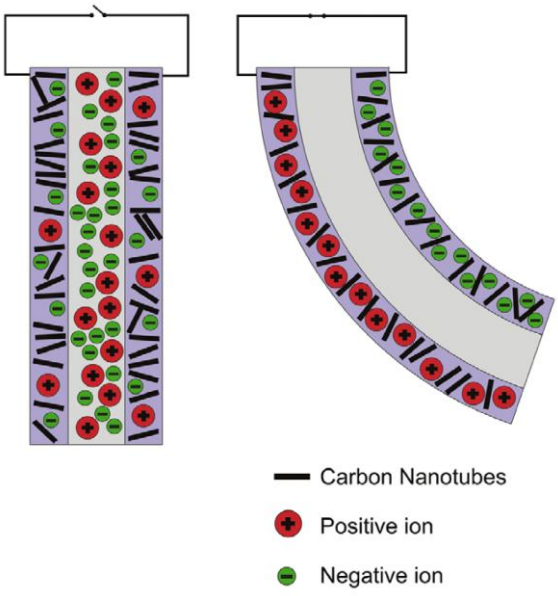

Figure 1. Schematics of BGA bending as a result of ion transfer [2].