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3D-Graphene based Pressure and Strain Sensor

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Abstract

We demonstrate a broad range and fast response pressure and strain sensor using a flexible and conductive 3D graphene structure. The sensor can detect small pressures/strains and various biological signals from the movement of human skin. The active element of sensor consists of a 3D graphene nanoporous framework made of graphene sheets separated with air-filled pores. A simple hydrothermal technique followed by freeze-drying and high-temperature thermal annealing is used for the synthesis of 3D graphene aerogel. The resulting graphene aerogel is highly elastic and the contact resistance between aerogel and rigid metal electrode is highly sensitive to applied stimuli. The extraordinary sensitivity of the contact resistance permits the detection down to a few micrometers by a small change of the sample size. In addition, the elastic nature of graphene aerogel provides high responsivity to the sensor, allowing detecting fast actions down to a few milliseconds and temperature independent. We show that the 3D graphene-based sensors can be used as wearable electronic sensors for diverse kinds of biological motion detection, human-machine interface and soft robotics applications.

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