PM-P007

Highly Sensitive Tactile Sensor Using Single Layer Graphene

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Tactile sensors have widely been researched in the areas of electronics, robotic system and medical tools for extending to the form of bio inspired devices that generate feeling of touch mimicking those of humans. Recent efforts in adapting the tactile sensor have included the use of novel materials with both scalability and high sensitivity [1]. Graphene, a 2-D allotrope of carbon, is a prospective candidate for sensor technology, having strong mechanical properties [2] and flexibility, including recovery from mechanical stress. In addition, its truly 2-D nature allows the formation of continuous films that are intrinsically useful for realizing sensing functions. However, very few investigations have been carrier out to investigate sensing characteristics as a device form with the graphene subjected to strain/stress and pressure effects. In this study, we present a sensor of vertical forces based on single-layer graphene, with a working range that corresponds to the pressure of a gentle touch that can be perceived by humans. In spite of the low gauge factor that arises from the intrinsic electromechanical character of single-layer graphene, we achieve a resistance variation of about 30% in response to an applied vertical pressure of 5 kPa by introducing a pressure-amplifying structure in the sensor. In addition, we demonstrate a method to enhance the sensitivity of the sensor by applying resistive single-layer graphene.

Keywords: Tactile sensor, Graphene pressure sensor, Pressure amplifying structure, Locally applied vertical force, Graphene sensor

PM-P008

Highly Sensitive and Transparent Pressure Sensor Using Double Layer Graphene Transferred onto Flexible Substrate

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Graphene, an allotrope of carbon, is a two-dimensional material having a unique electro-mechanical property that shows significant change of the electrical conductance under the applied strain. In addition of the extraordinary mechanical strength [1], graphene becomes a prospective candidate for pressure sensor technology [2]. However, very few investigations have been carried out to demonstrate characteristics of graphene sensor as a device form. In this study, we demonstrate a pressure sensor using graphene double layer as an active channel to generate electrical signal as the response of the applied vertical pressure. For formation of the active channel in the pressure sensor, two single graphene layers which are grown on Cu foil (25 um thickness) by the plasma enhanced chemical vapor deposition (PECVD) are sequentially transformed to the poly-di-methyl-siloxane (PDMS) substrate. Dry and wet transfer methods are individually employed for formation of the double layer graphene. This sensor geometry results a switching characteristic which shows ~900% conductivity change in response to the application of pulsed pressure of 5 kPa whose on and off duration is 3 sec. Additionally, the functional reliability of the sensor confirms consistent behavior with a 200-cycle test.

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Keywords: graphene, double layer graphene, pressure sensor, flexible sensor