Conformal and transparent Graphene 3-axis Sensor for artificial skin

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Abstract

A considerable amount of research to realize the important issues related to the sensor such as flexibility, stretchablility, multiple functionalities and conformal devices, have been introduced. For showing the multiple functionalities, it is promising to focus on the capability of normal force, shear force detection and the vibration. Especially, there are a variety of papers related to the fingerprint structure which mimic the human skin because of the merit that the fingerprint structure in our human skin have important role such as higher sensitivity and vibration sensing capability. However, adopted sensors which include fingerprint structure by using thick and hard PDMS are not flexible and stretchable. Therefore, it is not suitable for sensor which has higher sensitivity unlike the conformal sensor.[1-3] Additionally, we can't obtain the exact signal without conformal contact which uses the strong adhesion force between substrate and sensor, especially in case of vibration detection. Paper, previously introduced in our group, has better performances of conformal concept such as the strong adhesion force between human skin and sensor than other research. [4] Now, we employed the approach using the conformal graphene 3D sensor which have capability of normal and shear force as well as the vibration detection. Our device effectively determined the direction and roughness even at the frequency which have correlation with the temporal vibration resolution of our human skin. In addition to, we introduced the fancy sensor through bumpless structure. The higher sensitivity, SEM image and vibration data support our concept and introduction. Finally, we showed properties of the various textures sensing including the period and non-period shapes and demonstrated the mini car control applications that explain our concept in this paper.

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Figures

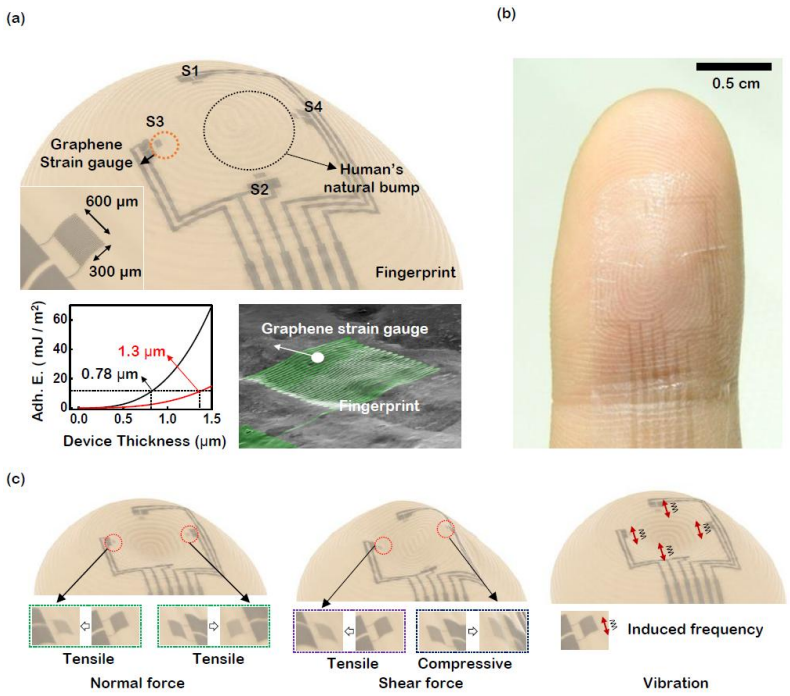

Figure 1 a. Illustration of conformal graphene 3-axis sensor, calculated adhesion energy of the sensor as a function of the substrate's thickness and SEM image b. Photographes of a conformal 3-axis sensor. c. Illustration of operation principle related to the normal force, shear force and vibration.