Solvent-free Fabrication of Ultrasensitive Strain and Pressure Sensor for detection of human motion

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Abstract

Flexible and wearable electronics have a huge potential application in human body signal monitoring1, human-computer interaction2 and electronic skin3, which has promoted the rapid development of flexible sensors. In this work, we proposed a solvent-free and low-cost strategy to prepare pressure and strain sensors based on graphene nanosheet cascade multilayer structure. The graphene nanosheets are directly attached to the PDMS surface by strong van der Waals forces, then assembled into a flexible sensor. Thanks to the graphene nanosheet cascade multilayer structure, the sensor has a detection limit of strain as low as 0.1% and the gauge factor (GF) can reach up to 55.2. In addition, the sensor also has an excellent pressure range as large as 700kPa. Compared to most of the reported graphene-based sensors, this work uses a novel manufacturing method without any chemical solvent involvement. Furthermore, the sensor not only has outstanding pressure sensitivity and wide response range, but also has excellent high strain sensitivity. Based on the convenience of preparation and the superiority of performance, the sensor can realize the signal of human body activity, speech recognition and handwriting recognition, demonstrating the huge application potential of the sensor in the wearable field.

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Figure 1: Schematic diagram of solvent-free graphene sensor and its application.

References

1. Wang, J.; Tenjimbayashi, M.; Tokura, Y.; Park, J.-Y.; Kawase, K.; Li, J.; Shiratori, S. Bionic Fish-Scale Surface Structures Fabricated via the Air/Water Interface for Flexible and Ultrasensitive Pressure Sensors. ACS Appl. Mater. Interfaces, Vol. 10, No. 36, pp. 30689–30697, 2018.
2. Zhu, L.; Zhou, X.; Liu, Y.; Fu, Q. Highly Sensitive Flexible Pressure Sensor Based on Silver Nanowires-Embedded Polydimethylsiloxane Electrode with Microarray Structure. ACS Appl. Mater. Interfaces, Vol. 11, No. 13, pp. 12968–12977, 2019.
3. Kim, J.; Campbell, A. S.; Ávila, B. E.-F. de; Wang, J. Wearable Biosensors for Healthcare Monitoring. Nature Biotechnology, No. 37, pp. 389–406, 2019.