Sensitive Piezoresistive sensors made of Graphene/PDMS 3D porous structures for wearable electronics

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The excellent properties of graphene have made it the best candidate for the next generation of flexible electronics applications [1]. Wearable sensors require several properties, such as high flexibility, stretchability, lightweight, and inexpensive fabrication, and they have to be suitable for integration with electrical components. One solution is the combination of nanostructures that act as sensors and polymers that guarantee the flexibility of the device. Different methods have been proposed in the literature to achieve these essential properties [2]. However, all techniques develop a flexible sensor entirely enclosed by the polymer, which reduces the effect of external stimuli, limiting the graphene sensitivity. In order to improve the sensitivity of the piezoresistive system, here we present a device in which the 3D polymer skeleton is covered by graphene layers grown by the CVD method, as shown in figure 1a.

Sensors based on piezoresistivity rely on transducing external mechanical loading into resistance change signal. Based on this principle, we investigated the electrical and mechanical properties of the graphene/polymer 3D structures by measuring their electrical resistance variation as a function of compressive and tensile strain. The optimized methodology to produce these materials will be presented and discussed as the results obtained.

The realization of a piezoelectric sensor with an exposed graphene surface would be exploitable for several applications, such as biosensing, where the device will also be sensitive to external analytes.

References

[1] Yonghee Kim et al., Macromolecular Research 27.7, (2019), pp. 625639

[2] Yu Pang et al, ACS Appl. Mater. Interfaces, (2016)

Figures

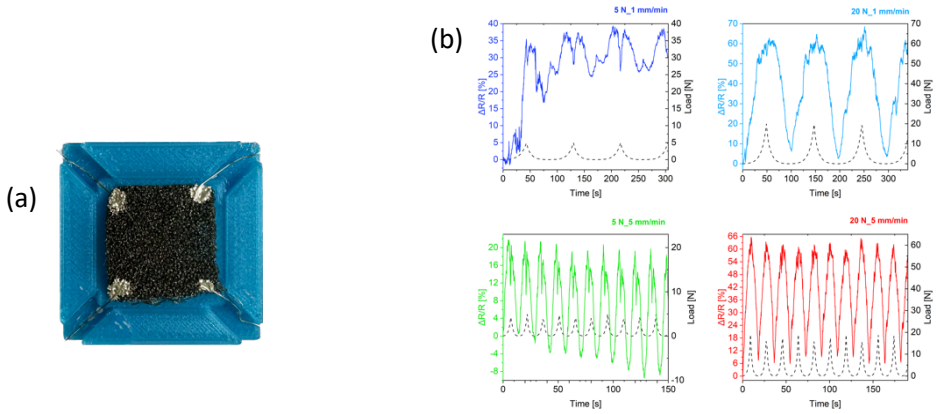

Figure 1: (a) 3D Graphene/PDMS foam contacted with silver paste. (b) Electrical-resistance variation of the composite as a function of compressive strain