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Hybrid hydrogels based on 2D MoS_2 for applications in wearable devices

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The continuous research on electronics, biocompatible materials and nanomaterials has led to the design of a new generation of wearable devices that can be employed in direct contact with the body of the user, which is attractive for real-time, non-invasive health monitoring[1]. For the satisfaction of such requirements, hydrogel-based conductive devices are often proposed as promising candidates for these applications, thanks to their softness, flexibility, and biocompatibility. Here we report the synthesis of conductive hybrid hydrogels containing two-dimensional (2D) MoS_2. The nanoflakes are integrated in the polymeric matrix creating an anisotropic structure, which helps to generate mismatch stress for a strain sensing under a certain stimulus[2], thus allowing the gel to give an electrical response to pressure. 2D MoS_2 nanoflakes were produced *via* top-down chemical exfoliation[3] and were incorporated in the hydrogel through a covalent grafting to the polymeric building blocks by exploiting the prior surface functionalization of the flakes[4]. The conductivity of the hydrogels was increased with the further incorporation of *in-situ* polyaniline (PANI), which is a widely used material in biomedical applications as a biocompatible conductive polymer[5]. The as-obtained hydrogels are characterized through a combination of techniques, whereas their electromechanical properties are investigated via a home-made setup to prove that compression causes an increase in current due to the piezoresistive properties introduced with the incorporation of 2D MoS_2 and PANI.

References

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Figures

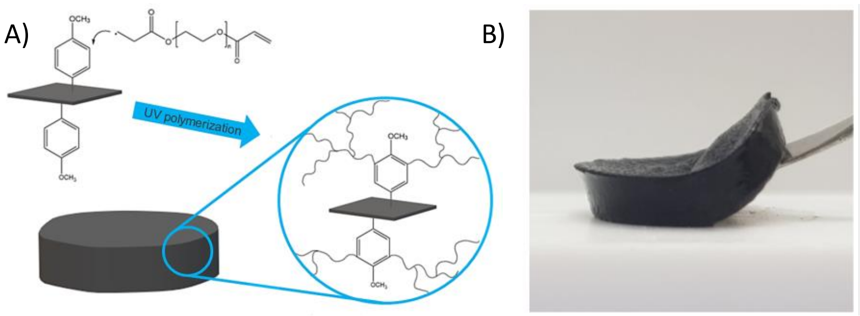

Figure 1: A) Grafting of PEGDA onto functionalized MoS_2 surface. B) MoS_2/PEGDA soft hybrid hydrogel.

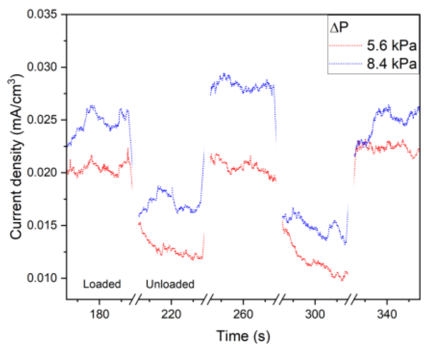

Figure 2: Compressive electromechanical tests of MoS_2/PEGDA/PANI hydrogel.