NOVEL METHOD TO MEASURE ELECTRICAL PROPERTIES OF TWO DIMENSIONAL MATERIALS BASED ON CARBON FIBRES

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In the last years, the research field of two-dimensional (2D) materials has grown tremendously due to the exceptional opto-electronic properties of these materials and the possibility to use them in novel devices and applications [1-3]. In order to investigate the transport properties and electrical behaviour of 2D materials based nanodevices, metallic electrodes are typically used. To fabricate this kind of samples with 2D flakes, two techniques are mainly followed. In the first approach, the electrodes are evaporated on top the flake using clean room techniques. In the second method, called deterministic transfer, the flake is aligned with the pre-patterned metallic electrodes and then transferred [4]. Both of these methods are time-consuming, non-reversible and can lead to surface contamination of the 2D material.
In this work, we present an alternative method to make electrical measurements of 2D materials in a fast, reproducible and non-invasive way. We use carbon fibre (C-fibres) tips, instead of electrodes, to contact the flakes directly without damaging them. At this end, we prepared samples transferring MoS_2 flakes on Au substrate and SiO_2 substrate to measure transport both out-of-plane (using one C-fibre to measure from MoS_2 to Au) and in-plane (using two C-fibres to measure on the MoS_2) as a function of the number of layers of MoS_2. Additionally, we characterised the optoelectronic properties of MoS_2 flakes and measured the gate-dependence of the current-voltage characteristics.

In conclusion, C-fibres can be used as a procedure to perform fast and local measurements of the electrical properties of a 2D material without damaging the samples. This method could be interesting to easily measure vertical transport and to test new and unknown samples without the necessity of the usual fabrication methods.

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