Humidity sensing with Langmuir-Blodgett assembled graphene films from liquid phase

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Chemical sensors are an enabling tool across many industries, including the largest ones such as energy, transport, and construction. Low-cost, high performance sensors, especially ones compatible with flexible substrates, are becoming increasingly important with the development of mobile gadgets and wearable devices. Here we show humidity sensors produced from thin films of graphene exfoliated in the liquid phase and deposited with Langmuir-Blodgett assembly. The films are formed from connected nanoflakes that are ~120nm in diameter and ~10 layers thick. We show that such films have an abundancy of reactive edges that act as binding sites for gas detection, enabling high sensitivity to gas presence [1]. The method that we demonstrate uses low-cost processes, is highly scalable and consistently yields films of high quality that can be deposited on any substrate, including flexible and transparent ones. We produce our thin films on top of a Si/SiO2 wafer with four contacts for measuring sheet resistance in real time as gas is introduced. The sensors that we make are more sensitive to humidity than ones demonstrated with CVD graphene [2], with up to 30% change in sheet resistance upon exposure to water vapor. Although we demonstrate detection of humidity, the same sensors can be used to detect other, both toxic and non-toxic gases.

References

[1] T. Tomašević-Ilić et al, Appl. Surf. Sci., 1 (2018) 446
[2] A. D. Smith et al, Nanoscale, 45 (2015) 19099

Figures

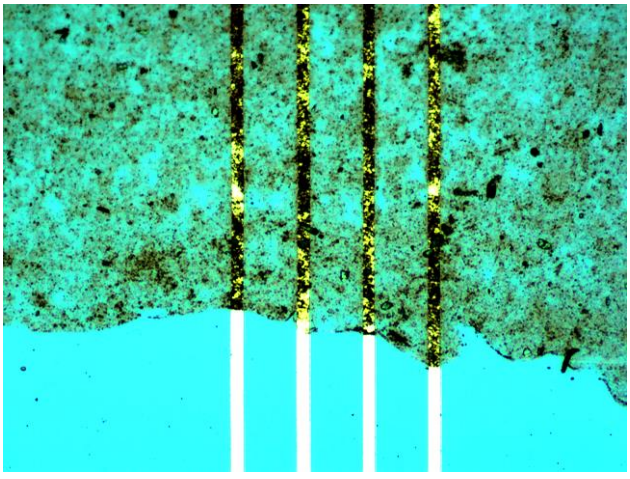

Figure 1: The active area of the graphene sensor on four metallic contacts