**The influence of nanosheet size on formation of graphene films by Langmuir-Blodgett deposition from the liquid phase**

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Graphene as a 2D material has numerous applications. The material is an efficient electrical and heat conductor with high mechanical stability and optical transparency. Because of these characteristics, it can be used in sensors, solar cells, microphones, light-emitting diodes, batteries, transparent conductors and for many other applications. The favored commercial method of producing graphene is chemical vapor deposition (CVD). This technique is costly, due to the significant metal waste involved. Liquid phase exfoliation (LPE) is a promising alternative method for mass production of graphene, although it is challenging to obtain high quality thin films from LPE graphene. Langmuir-Blodgett assembly (LBA) is a way of obtaining low-cost, high-quality thin films from LPE graphene [1], however the graphene dispersion needs to be carefully prepared in order to successfully apply LBA. Here we study the influence of exfoliation parameters on nanosheet size, and in turn of the sheet size on quality of LBA films, with a focus on applications in transparent conductors. A certain amount of graphite is added to N-Methyl-2-pyrrolidone (NMP), which is used as the solvent, and the entire solution is sonicated. In order to control the nanosheet dimensions, we employ cascade centrifugation (CC) [2]. The first step in CC is 1 krpm. At this speed, the sediment contains any unexfoliated graphite layers and the supernatant has the remaining graphene sheets. The following steps are in the range from 2 to 5 krpm. For each step, bigger sheets remain in the sediment while smaller ones stay in the supernatant. In order to characterize the nanosheets we use AFM, UV-VIS spectroscopy and optical microscopy. The resulting dispersion is used to assemble graphene films using the Langmuir-Blodgett method. We examine the influence of nanosheet thickness and lateral size on film quality for applications in transparent conductors.

REFERENCES

[1] A. Matković et al., 2D Mater., vol. 3, no. 1, 2016.

[2] C. Backes et al., ACS Nano, vol. 10, no. 1, pp. 1589–1601, 2016.