

Controlling the size of liquid exfoliated nanosheets and the impact of size on applications potential

Jonathan N Coleman

1 School of Physics and CRANN, Trinity College Dublin, D2, Ireland

Abstract

In this talk, I will review liquid phase exfoliation as a method for producing 2D nanosheets, both of graphene and a range of other 2D materials including BN, transition metal dichalcogenides, metal oxides and hydroxides, III-VIs and black phosphorous. A new and efficient method to control nanosheets size, liquid cascade centrifugation (LCC), will be described. I will also discuss the use of spectroscopic metrics to measure mean nanosheet size, thickness and monolayer population in dispersion and show how this facilitates the production of dispersions with predetermined parameters such as high monolayer content. Such systems are extremely useful in electrochemical applications such as supercapacitor and battery electrodes as well as hydrogen and oxygen evolution electrocatalysts. In such applications, nanosheet size tends to strongly impact performance. I will present both theoretical and experimental results showing the impact of nanosheet size on performance. Finally, I will demonstrate that size-selected, liquid exfoliated nanosheets can be inkjet-printed to form functional heterostructures which can operate as photodetectors and supercapacitors.