Liquid Phase Exfoliation of Layered Materials

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Abstract

In this lecture, we will review a principal route to produce layered materials on a low-cast, large scale and with modest quality - Liquid Phase Exfoliation (LPE), now widely adopted by both the academic and industrial sectors.

LPE encompasses a range of processes including ultrasonic and high-shear methods (including rotor-stator and high-pressure homogenisation) either performed in solvents or aqueous mixtures assisted by surfactants/polymers, electrochemical exfoliation and methods that involve the spontaneous dissolution of charged nanomaterials. We will review the key mechanisms for exfoliation in each case.

Modifying the chemistry of layered materials through the production of graphene oxide or incorporating other functionalities enables easier processing with improved compatibility with solvents and polymer matrices. We will also briefly discuss post-processing of the layered material dispersions through means of centrifugation to sort and purify layered materials, and formulating inks for specific printing processes and applications.