Large scale production of 2D crystals-based composites for energy and (opto)electronic applications

Francesco Bonaccorso

Istituto Italiano di Tecnologia, Graphene Labs, Via Morego 30, 16163 Genova, Italy.

Email: francesco.bonaccorso@iit.it

Abstract

Graphene and other bi-dimensional (2D) crystals, thanks to their excellent and complementary properties, are emerging as promising materials to improve the performance of existing devices or enable new ones.[1-6] In addition, the possibility to assembly such 2D crystals in vertical heterostructures will provide a rich toolset for the creation of new, tailored materials.[1,2] Nevertheless, a key requirement for the widespread applications in the field of flexible (opto)electronics and energy storage and conversion devices relies in the development of industrially scalable, reliable, inexpensive production processes.[2] Here, a balance between ease of fabrication and material quality with on-demand properties is a must.

In this context, liquid-phase exfoliation of bulk layered materials[2,4] is offering a simple and cost-effective pathway to fabricate various 2D crystal-based (opto)electronic and energy devices, presenting huge integration flexibility compared to conventional methods. Here, I will show our scaling up approach for the solution processing of 2D crystal based on wet-jet milling of layered materials. Moreover, I will present an overview of 2D crystals for flexible and printed (opto)electronic[7-9] and energy applications,[10-16] from the fabrication of large area electrodes[3,14] to devices integration.

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