Industrial production of 2D Materials for Bio-Applications

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Two dimensional (2D) materials, such as graphene or transition metal dichalcogenides (TMDs), have emerged as promising candidates in bio-applications, for example drug delivering, tissue engineering, biosensing etc., due to their physico-chemical characteristics[1]. Here, we will discuss the fabrication of WS_2 nanoflake, by liquid phase exfoliation (LPE),[2,3] of either WS_2 powder or WS_2 single crystal, and their characterization, as well as the challenges of scale up towards industrial production. This activity is carried out in the framework of the EU-funded PERSEUS project, in which WS_2 flake-based nanosystems are produced for X-ray triggered oncotherapies.

In addition, interfacing cells with 2D materials, as the underlying material, can manipulate cell functions. In this realm, 2D materials can provide an appropriate electrical milieu that affects the bioelectrical properties of cells, such as the membrane potential. To this end, we will show how the electrostatic fields generated by electrically conductive graphene flakes embedded in an insulating polymer matrix can hyperpolarize the membrane potential of glioblastoma stem-like cells, driving their differentiation[4].