ABSTRACT:

From Laser Synthesis to Lift-Off: 2D Materials in Aerospace Applications

As graphene and related materials increasingly integrate into various industries [1, 2], the necessity to produce high-quality of these material on a large scale becomes crucial [3]. Here, we present a unique approach for large scale production of graphene and related materials through laser-assisted synthesis method. For example the present method utilizes laser technology to significantly expand graphite, achieving an expansion rate of 800 mL/g with a remarkably low energy consumption of just two watts per second. The graphene samples exhibited high quality (ID/IG) ~ 0.13 and few layers with a (I2D/IG) ~ 0.52. Through filtration technique, free-standing films with different thicknesses (11-69 μm) were successfully prepared, reaching significant electrical conductivity up to (~ 1707 S/cm). Graphene film with a 11 μm thickness achieve the highest absolute effectiveness (SSE/t) of ~ 58666 dB cm2 g -1 , surpassing most current graphene and MXene films, which typically present values in the range of 10000 to 40000 dB cm2 g -1 . Similarly, other related materials such as transition metal oxide crystals are also produced using laser synthesis.

References:

[1] AC Ferrari et al., Nanoscale, 7(2015), 4598.
[2] H Döscher et al., 2D Materials 8 (2021), 022005.
[3] XD Luong et al., Nature 577 (2020): 647.