Laser Induced Graphene: A New Paradigm

Yarjan Abdul Samad, Rami Elkaffas, Shanavas Shajahan, Dhinesh Babu Velusamy
Khalifa University of Science & Technology, Abu Dhabi, UAE
Yarjan.abdulsamad@ku.ac.ae

As graphene and related materials increasingly integrate into various industries [1, 2], the necessity to produce high-quality graphene sheets on a large scale becomes crucial [3]. Here, we present a unique approach for large scale production of graphene through laser-assisted graphite expansion followed by ultrasonic exfoliation. 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 cm^2 g^{-1}, surpassing most current graphene and MXene films, which typically present values in the range of 10000 to 40000 dB cm^2 g^{-1}.

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.

Figures

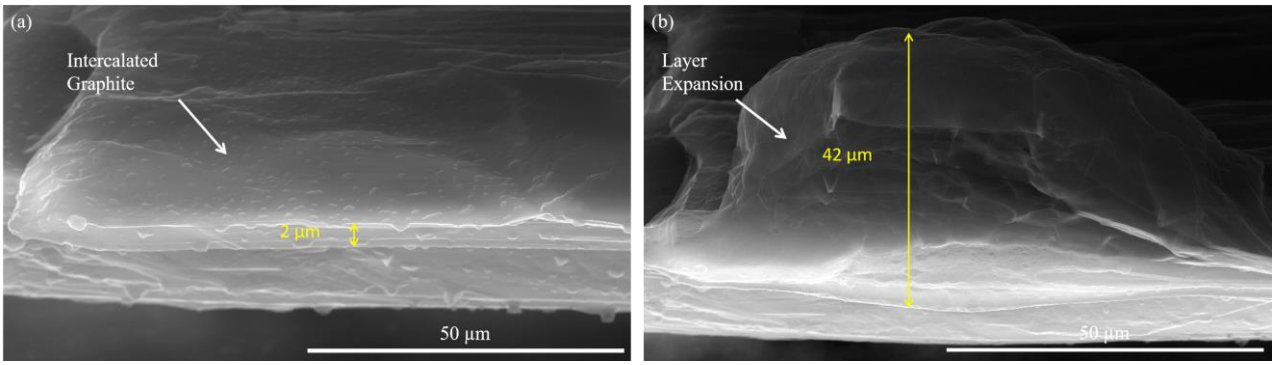

Figure 1: a) SEM of Intercalated Graphite, (b) *In Situ* Expansion of Intercalated Graphite in SEM