Improved graphene-based Hall effect sensors through control of defect levels in graphene

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Abstract

Graphene has been speculated to be a suitable material for producing robust and sensitive Hall sensors due to its ultra-high carrier mobility. [1] A key challenge however is producing electronic grade, high mobility graphene at scale. Paragraf has realised this by being the first company in the world to produce graphene using our proprietary and commercially scalable growth method, directly onto target substrates without the need of a transfer process, using standard semiconductor manufacturing tools. [2] We cover all aspects of production, from the growth of graphene to processing into final devices. One of our products is a magnetic sensor that works based on the Hall effect and has potential applications in current sensing and positioning systems.

In order to produce high sensitivity magnetic sensors to meet our customers' requirements, we need to ensure the maximum possible graphene carrier mobility. Through optimising our proprietary epitaxy process, we have minimised the level of defects in our graphene. The reduced defect level is confirmed by Raman spectroscopy to be extremely low: similar to that of transferred, Cu-foil grown graphene but without the need for a transfer step. This leads to a doubling of the graphene carrier mobility and magnetic sensors with a sensitivity significantly exceeding 0.06 V/VT of traditional Si-based Hall sensors [3].

References

[1] Song, G. *et al.* "Operation of graphene magnetic field sensors near the charge neutrality point." *Communications Physics* 2.1 (2019): 1-8
[2] Thomas, S. "A method of producing a two-dimensional material", WO2017029470
[3] Eisenbeis, R. "Understanding and Applying Hall Effect Sensor Data Sheets" (2021) Retrieved from Texas Instruments website: https://www.ti.com/lit/an/slia086a/slia086a.pdf?ts=1681657926566&ref_url=https%253A%252F%252Fwww.bing.com%252F

Figures

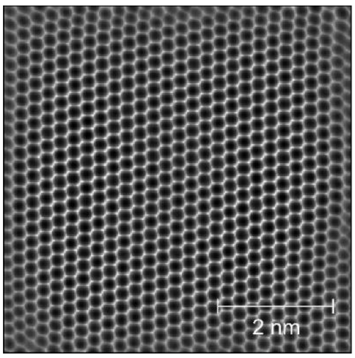

Figure 1: Filtered scanning tunnelling microscope image showing the hexagonal lattice of Paragraf's graphene.