Putting pedal to semi-metal in a commercialization race – graphene films production at an industrial scale

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A key challenge in the development of advanced graphene products is the growth of large size and uniform graphene layers. Developing a commonly used technology of growing graphene on metals followed by the deterministic transfer of the CVD synthesized graphene onto arbitrary rigid or flexible substrates, we have managed to produce high-quality, large-scale graphene layers, which substantially contribute to widening the range of potential graphene applications.

We have also developed the method of growing epitaxial graphene on semi-insulating SiC and the Si-technology compatible Ge wafers to address the issues of rising demand for graphene in the electronics and sensor industry, as well as in the expanding wireless communication systems.

We present here direct graphene epitaxy by *Chemical Vapor Deposition* from hydrocarbon precursor on 4H-SiC(0001), 6H-SiC(0001) [1], Ge epi-layers on Si substrates [2,3] and metal substrates. The challenge is to increase the grain size and minimize the number of grain boundaries that spoil electrical conduction, while enlarging the surface area of the sample and improving the homogeneity of the film.

We demonstrate the applicability of epitaxial graphene on SiC in magnetic field detection in the temperature range from cryogenic to 350°C. Graphene has also great potential to develop extremely linear and wide-band components at mm-wave frequencies such as frequency mixers which are key components for high data rate communication in MMICs. Graphene grown on Cu can be used in anti-corrosion composites - coatings, transparent eco-heaters, thermoelectric modules and others.

The scalable synthesis of graphene films with high structural quality and its parameters control represents a significant step toward the development of innovative graphene-based electronic devices.

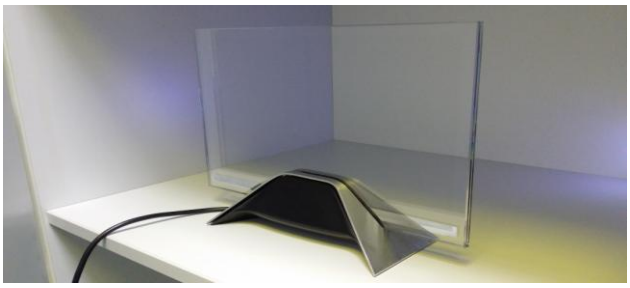

Figure 1: Transparent graphene eco-heater. Format A4.

References

[1] Strupinski, W., et al., Nano Letters, 11 (4) (2011), 1786-91.
[2] I. Pasternak, et al., Scientific Reports 6, 21773 (2016).
[3] I. Pasternak, et al., Nanoscale 8, 11241-11247 (2016).