Ink-jet printed graphene electronics

F. Torrisi, F. Bonaccorso, T. Hasan, W. Wu, Z. Sun, A. Lombardo, T. Kulmala, C. W. Hsieh, P. J. Paul, D. P. Chu, A. C. Ferrari

University of Cambridge, 9 J.J. Thomson Avenue CB3 0FA, Cambridge, UK
ft242@cam.ac.uk

Ink-jet printing is one of the most promising techniques for inexpensive large area fabrication of flexible plastic electronics[1], due to its versatility, the limited number of process steps[2], the ease of mass fabrication[2]. Here we produce a graphene-ink from liquid phase exfoliation of graphite in organic solvents. Ultrasonication followed by ultracentrifugation is used to remove large graphite fragments that are likely to clog the ink-jet nozzle. We investigate N,N-dimethylacetamide, Ethyl Acetate, 1-Methyl-2-pyrrolidone (NMP), Dimethylformamide as organic solvents. By Optical Absorption Spectroscopy (OAS), Transmission electron microscopy (TEM) and Raman spectroscopy we find that NMP gives the highest yield of monolayer graphene[3]. Graphene stripes are then printed on Si/SiO₂ modified by self-assembled monolayers. This reduces the substrate wettability and allows uniform printing of graphene electrodes. We then print thin-film transistors, with mobilities up to 95cm²V⁻¹s⁻¹, as well as transparent and conductive patterns, with 80% transmittance and 30kΩ/□ sheet resistance. This paves the way to all-printed, flexible and transparent graphene devices on arbitrary substrates[4].

References:

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