

Ink-jet printed graphene electronics

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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 $95\text{cm}^2\text{V}^{-1}\text{s}^{-1}$, as well as transparent and conductive patterns, with 80% transmittance and $30\text{k}\Omega/\square$ sheet resistance. This paves the way to all-printed, flexible and transparent graphene devices on arbitrary substrates[4].

References:

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