

Nano-patterned graphene on polymer substrate by direct peel-off technique

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Abstract

A graphene on polyimide polymer film (Gr-PI film), obtained by direct peel-off technique, is proposed and investigated. Thanks to its high transparency, electrical conductivity, mechanical strength and chemical durability, the Gr-PI film is an ideal substrate for flexible electronic and optoelectronic devices, including transistors, light emitting diodes and plasmonic antennas. It is obtained using a straightforward method. After spin-coating and curing a PI film on graphene previously grown on copper, one can separate the Gr-PI film from the copper foil thanks to the difference in adhesive energy between the graphene-copper and graphene-PI interfaces. The resulting Gr-PI film shows an average electrical sheet-resistance ranging from 520 Ω/sq to 860 Ω/sq and very high optical transmission (>90%), which have allowed the demonstration of a transparent heater. The surface morphology of the Gr-PI film follows that of the copper foil, with the latter maintaining its surface properties and allowing in this way its re-use in subsequent chemical-vapor-deposition growths. The method can also be applied to patterned graphene, as it is demonstrated for nano size ribbons with a width of a few tens of nm.

Figures

