Direct Patterning of Nitrogen-Doped CVD Graphene Based Microstructures for Charge Carrier Measurements Employing Femtosecond Laser Ablation

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Abstract. Chemical vapor deposited nitrogen-doped graphene, transferred on SiO2/Si substrate, was selectively patterned by femtosecond laser ablation for the formation of the topology dedicated to charge carrier measurements. Ultrashort 1030 nm wavelength Yb:KGW fs-laser pulses of 22 μJ energy,14 mJ cm−2 fluence, 96% pulse overlap, and a scanning speed of 100 mm s−1, were found to be the optimum regime for the high throughput microstructure ablation in graphene, without surface damage of the substrate in the employed fs-laser micromachining workstation. Optical scanning electron, atomic force microscopy, as well as Raman spectroscopy, were applied to clarify the intensive fs-laser light irradiation effects on graphene and the substrate, and to also verify the quality of the graphene removal. Measurements of magnetotransport properties of the fs-laser ablated nitrogen-doped graphene microstructure in the Hall configuration enabled the determination of the type, as well as concentration of charge carriers in a wide range of temperatures.

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