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Graphene patterning by nanosecond laser ablation: the effect of the substrate interaction with graphene

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Abstract

This paper focuses on the development of patterned graphene/substrate by means of green nanosecond pulse laser irradiation. Monolayer graphene samples supported on a Si/SiO_2 substrate were patterned using 532 nm laser irradiation under fluence conditions ranging from 31 mJ cm^{-2} to 4240 mJ cm^{-2}. Raman spectroscopy was used to investigate the effect of laser irradiation on the graphene. It was found that at 356 mJ cm^{-2} selective ablation of the graphene occurs. However, at fluence values above 1030 mJ cm^{-2} (when damage to the substrate is observed) no ablation of the graphene takes place. In contrast, its graphenic structure was found to have been modified. Only at fluence values where the ablation of the substrate occurs, is graphene eliminated in an area almost equivalent to that of the ablated substrate. In this case, additional damage to the graphene sheet edges is produced. The increment in the number of oxygenated functional groups in these regions, as measured by x-ray photoelectron spectroscopy (XPS), suggests that this damage is probably caused by thermal phenomena during the ablation of the substrate.

Keywords: CVD graphene, laser scribing, pulsed laser, nanosecond laser

S Online supplementary data available from stacks.iop.org/JPhysD/49/305301/mmedia

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