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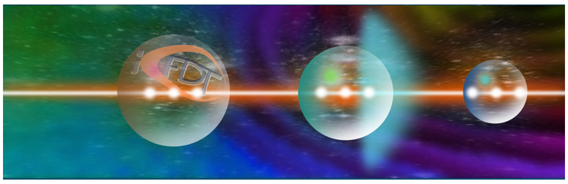

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Graphene growth from commercial Kapton by direct laser scribing studied by confocal micro-Raman spectroscopy, laser confocal and atomic force microscopies.

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Laser-induced graphene (LIG) is prepared by single step laser writing processes on many carbonaceous material [1]. By Raman spectroscopy it is observed that the laser scribing on a polymeric material with hexagonal structure, such as polyimmide (Kapton), induces a breaking of C-O, C=O and C-N bonds, with consequent rearrengement of carbon atoms to form a graphene structure. Depending on the laser wavelength (IR or UV) the pristine bonds are broken by pyrolisis or by photolysis process. Anyway, due to the short conversion time, it is necessary to carefully choose the laser writing parameters to obtain the appearence of 2D band which indicates that the black material on the Kapton surface is really graphene.
In this work, we performed different scribing tests irradiating a commercial Kapton tape with nanosecond UV and CO2 lasers by changing writing speed and laser power to systematically investigate the light-material interactions in LIG fabrication processes and to optimize the experimental parameters. Graphene straight lines (Fig.1) and squares were produced and characterised by confocal micro-Raman spectroscopy, laser confocal and atomic force microscopies gaining a deep insight on transient formation process of LIG and helping the identification of critical parameters that govern this process. The present study investigates the effects of the laser processing parameters on the LIG quality, with consequent process optimization confirming that LIG is a low-cost straightforward method to directly fabricate graphene sheets on a carbon-rich substrate that will have a growing importance in a near future.

Figure 1. (a) Bright field optical images of lines scribed with UV nanosecond laser at a scanning speed of 5 mm/s and increasing power from line 1 to 3. (b) Raman spectra acquired from lines 1 (light blue), 2 (blue) and 3 (green).

[1] K. Avinash, F. Patolsky, Laser-induced graphene structures: From synthesis and applications to future prospects, Materials Today 70, 104-136, 2023 .

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