Controlled induced defects on CVD graphene using ultrashort pulsed excitation

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It has been recently shown experimentally that two-photon absorption in graphene is an extremely intense phenomenon[1]. Besides, graphene is an ideal memory material because of its transparency, conduction properties and solution processability[2]. The goal of this work is to investigate the creation of defects onto graphene lattice, after illumination by a focused femtosecond laser beam and then to optimize the procedure in order to develop a novel three dimensional optical data storage memory, with high spatial resolution consisting of graphene/polymer layers.

In a first step, we examine the generation of defects on chemically deposited graphene on the top of Si/SiO_2 substrate. The graphene lattice is illuminated using 80fs pulses centered at 820nm and a repetition rate of 80MHz with different laser power and exposure time in order to create defects which will be both as large as needed for being clearly detected and as small as needed for giving high storage density. The fabricated samples are characterized by SEM imaging as well as Raman spectroscopy. Detailed Raman mapping of graphene took place before and after the laser illumination using a laser excitation of 514nm and a 100x objective lens. The Raman spectrum of pristine graphene consists of two distinctive features, known as G and 2D peaks. The presence of defects gives rise to another two features, D and D` peaks, which initially are forbidden in non-defected graphene as a result of Raman selection rule. The defected areas exhibit much higher I(D)/I(G) ratio compared to the non-defected ones indicating successful generation of defects[3,4] (**Figure 1a**). Defects of different sizes can be obtained by varying the exposure time at relatively low laser power levels. SEM images verify the size and shape of the defected areas (**Figure 1b**).

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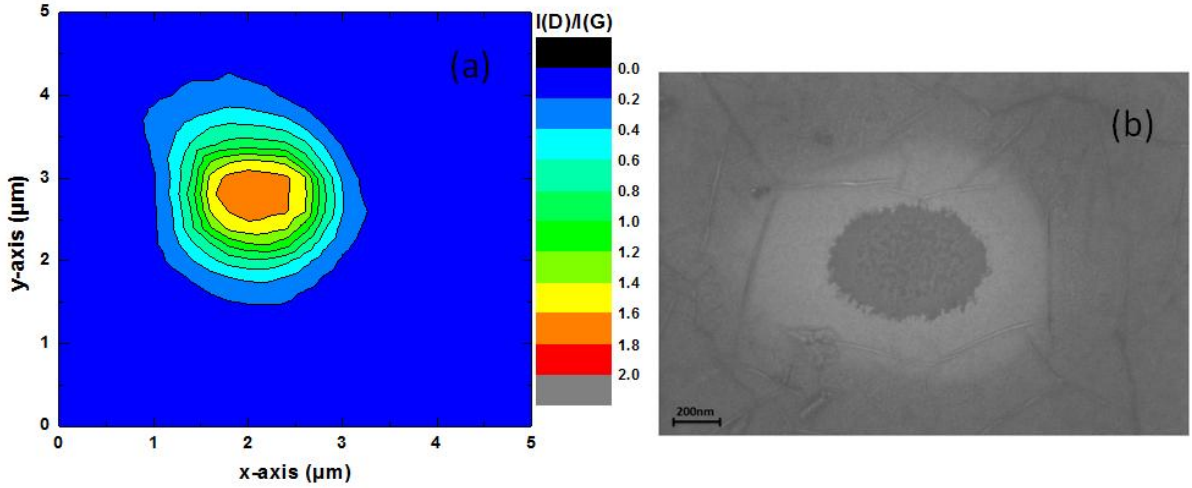

Figure 1. (**a**) Raman map of the D to G peak ratio I(D)/I(G) measured with 0.2μm mesh of CVD graphene after illumination with 3mW laser power for 20sec and (**b**) SEM image of the same defected area.