In-plane junctions in graphene field-effect transistors generated by photochemical mask-less patterning

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The new method for mask-less doping of graphene based on two-photon oxidation is suggested [1]. We have demonstrated that below single pulse ablation thresholds the femtosecond laser pulses can initiate both photophysical and photochemical processes in graphene lattice [2]. The process of laser-induced local oxidation was investigated on single layer graphene field-effect transistors (GFETs). We demonstrated the laser pulses in range of 280 fs to 20 ps with 515 nm wavelength applied to graphene with varied pulse energy can locally modify electrical and optical properties of graphene. Thus, the developed process provide mask-less graphene/laser induced graphene oxide junction patterning. The scale of local heterojunction produced is less than 1 µm. We investigated in details the photoresponse [3] the in-plain graphene junctions under continues wave and fs-pulsed laser irradiation below threshold energy. The difference in Seebeck coefficient for pristine and oxidized graphene results in electrostatic Dirac point shift, thus local junction organization and local photocurrent generation. The photocurrent generated by different laser irradiation has presumably thermoelectric nature. The method can be applied to carbon nanotubes and over 2D materials.

References

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Figures

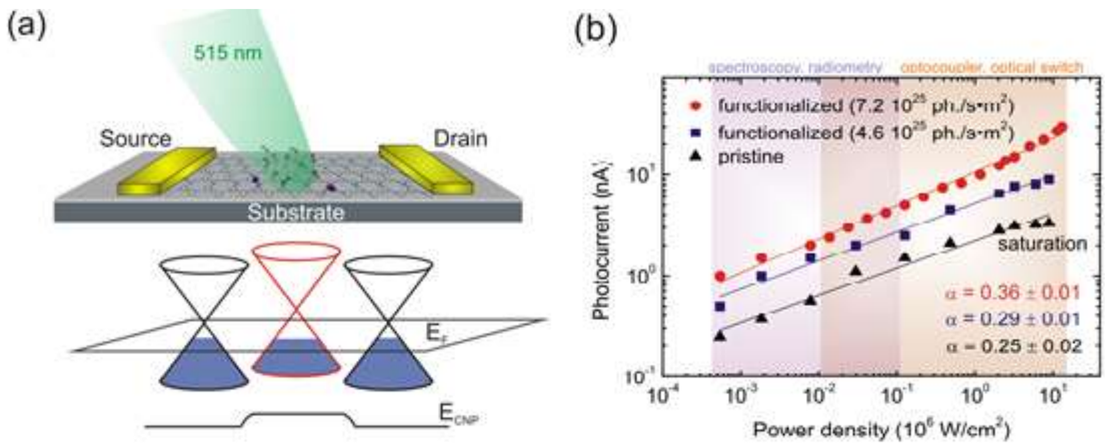

Figure 1: In-plain junction in graphene filed effect transistor. (a) Device geometry (top) and schematic band structure (bottom) of each region of graphene. (b) Photocurrent as a function of incident power density measured at pristine graphene FET channel (▲), and functionalized channels with low (■) and high (●) femtosecond pulsed laser fluence.