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Effect of Energetic Charged Particle Irradiation on Graphene

ISAAC CHILDRES, LUIS A. JAUREGUI, ROMANEH JALILIAN, JIFA TIAN, HELIN CAO, MIKE FOXE, LEONID ROKHINSON, IGOR JOVANOVIĆ, YONG P. CHEN, Purdue University, West Lafayette, IN — Energetic charged particles are commonly used in the fabrication and characterization of graphene devices. For example, oxygen ions are used in plasma etching processes and energetic electrons are used for electron beam lithography as well as electron microscopy. Using electronic transport measurements and Raman spectroscopy, we have studied the effect of exposure to electrons and oxygen ions on exfoliated graphene on a SiO₂/Si substrate and the performance of electronic devices made from such graphene. Electronic transport measurements show an overall decrease in graphene's conductivity and shift of the charge-neutral point to the negative when irradiated with electrons and to the positive when irradiated with oxygen ions. Raman spectra indicate emergence of characteristic defects. We have studied these effects on suspended and non-suspended graphene devices to determine the influence of the SiO₂ substrate. Our results are valuable for understanding the possible defects generated in graphene by charged particle irradiation.

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