Defect formation in supported graphene irradiated by accelerated xenon ions

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Abstract: Raman spectroscopy and Monte-Carlo simulation studies for supported graphene irradiated by 160 MeV Xe ions are presented. Changes in the density and dominating types of defects with increasing fluence were observed. In order to analyze contribution of defect formation mechanisms, in which the substrate is involved, a comparative

study was performed for graphene on SiO2/Si, copper and glass substrates. The major defining mechanisms were found to be atomic recoils and formation of defects induced by hot electrons. For graphene on copper, the impact of substrate recoil atoms was found to be greater comparing to graphene on silicon oxide and glass, where the recoils participated approximately equally. Moreover, a possibility of defect formation in graphene due to hot electrons generated in the substrate near the interface was noted. Finally, a linear dependence of air-induced doping on D and G peak intensity ratio that represents defect density in graphene was found. The study is useful for solving the long-standing controversy on major mechanisms of defect formation in irradiated graphene, as well as for graphene-based nanoelectronic device engineering.

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