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Electron Beam Irradiation Modulated Graphene Electronic Devices YANGBO ZHOU, ROBERT O'CONNELL, DANIEL FOX, HONGZHOU ZHANG, School of Physics and CRANN, Trinity College Dublin — We report controllable graphene doping using focused electron beams. Graphene field-effect-transistor (FET) devices with tunable electronic properties have been fabricated in a Scanning Electron Microscope (SEM). The doping state of graphene can be varied from electron to hole type at different electron beam energies (0.5keV to 30keV). The graphene FET devices exhibit high carrier concentrations ($\sim$ 5x10^{12}cm^{-2}), high mobility ($\sim$ 5x10^{3}cm^{2}/V·s) and remain quite stable in vacuum. It is found that substrate charging and the induced internal electrical field is responsible for the doping effect. This enables a high spatial resolved, non-destructive and tunable manipulation for graphene electronic device prototyping. Graphene devices based on multi-doped p-n junctions and fine super-lattice structures have also been demonstrated.

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