# Highly Efficient *n*-type Doping of Graphene by Vacuum Annealed Amine-rich Macromolecules

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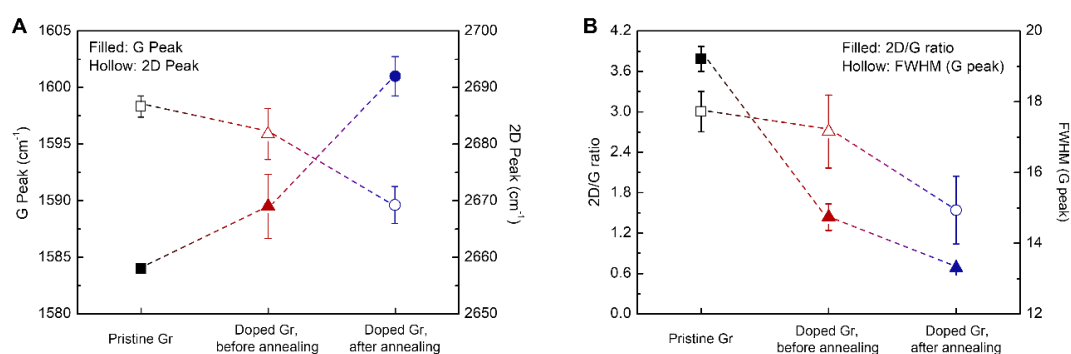
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**Figure S1.** Raman spectra of graphene before/after doping&vacuum annealing. (**A**) Position of G and 2D peak of each graphene. (**B**) 2D/G ratio and full width half maximum (FWHM) of G peak of each graphene.
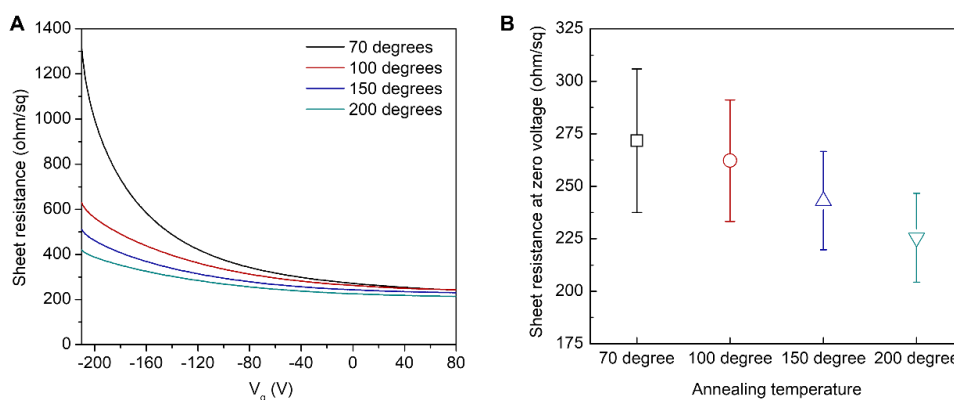


**Figure S2.** Changes in GFETs characteristics according to annealing temperature. (**A**) Gate-dependent electrical property of PEI doped GFETs characteristics according to annealing temperature. (**B**) Changes in sheet resistance of PEI doped GFETs according to annealing temperature.
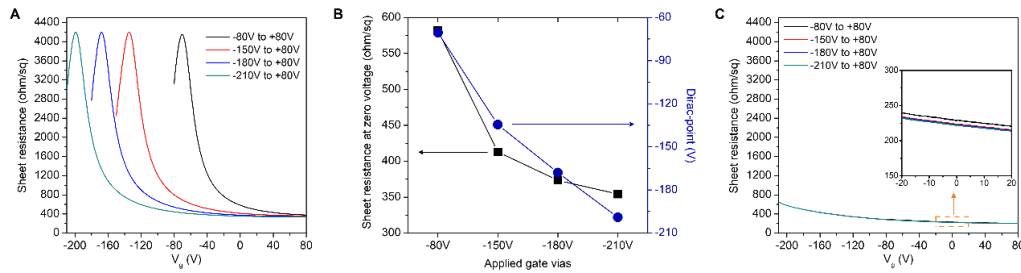
**Figure S3.** Changes in GFETs characteristics according to gate voltage before and after vacuum annealing. (**A**) Gate-dependent electrical property of PEI doped GFETs characteristics depending on the gate sweep range before annealing. (**B**) Changes in sheet resistance and Dirac-point of GFETs by applied gate voltage. (**C**) Gate-dependent electrical property of PEI doped GFETs characteristics depending on the gate sweep range after annealing. Inset is enlarged graph of the orange dash line.
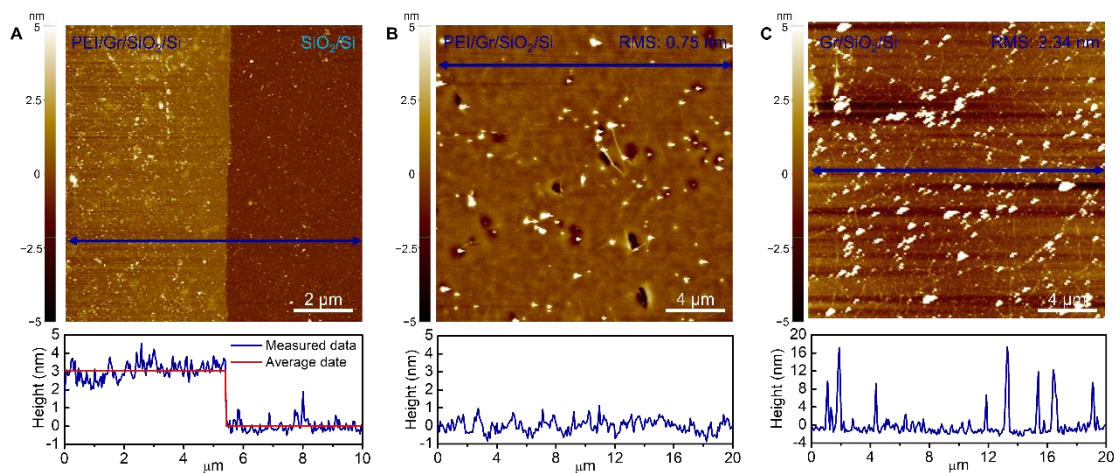


**Figure S4.** Atomic force microscope (AFM) analysis of surface height and uniformity. Each graph under the images are surface roughness of blue arrow lines on the image. (**A**) Thickness of PEI/Gr structure on $SiO_2$/Si b. Since the thickness of graphene is 0.3 nm, the thickness of PEI is less than 3 nm. (**B**) Roughness of PEI /Gr/$SiO_2$/Si. (**C**) Roughness of Gr on $SiO_2$/Si.
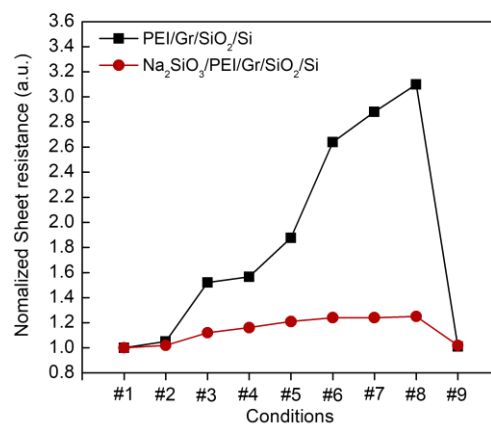


**Figure S5.** Sheet resistance change in air atmosphere before and after passivation of PEI doped GFET. Sodium metasilicate used as a passivation layer was diluted (5 wt %) in Di, spin-coated (3000 rpm) on PEI/Gr/$SiO_2$/Si and baked on a hot plate for 120 °C and 20 min to form a film. #1 condition was measured on vacuum and #2, 3, 4~8 was 1 h, 24 h, 48 h, 72 h, 7 days, 10 days, 14 days later respectively. #9 was after re-annealed each devices at 150 °C, for 2 h.