Direct synthesis and characterization of graphene layers on SiO2 Wafers

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Direct synthesis of graphene on semiconductors and dielectric substrates is of high interest as this process bypasses typical transfer procedures, which usually uses polymers as sacrifice layers along with toxic chemicals and it leaves out residues and often damages the graphene flakes as well. The interest of direct graphene synthesis comes as high yield, electronic grade graphene is only possible by eliminating the transfer process and tuning the growth process to maximize graphene quality. The graphene layers were synthesized on 285nm oxide thickness silicon wafers by chemical vapor deposition at semi-atmospheric pressure environment inside the tube reactor, using controlled mixtures of hydrogen, argon and methane gases. The effects of the methane flux and the total pressure on the homogeneity of the graphene layers were investigated. The samples were characterized using Raman scattering spectroscopy and Raman mapping, X-ray photoelectron spectroscopy, atomic force microscopy and transferred to fused silica for transmittance. The last technique was used to determine the number of graphene layers in the samples. Large area, homogeneous bilayer graphene was obtained for an appropriate gas mixture and Raman spectroscopy results indicate that misoriented graphene bilayers were obtained. Also, we could control the density of defects by changing the growth pressure as well as Ar/H2/Ch4 ratios.