Electronic Supplementary Material (ESI) for Physical Chemistry Chemical Physics.

Supplementary Information

Asymmetric carrier transport and weak localization in few layer graphene grown directly on dielectric substrate

Muhammad Sabbtain Abbas[1,4], Pawan Kumar Srivastava[2], Yasir Hassan[3] and Changgu Lee[2,3*]

[1] Department of Physics, Sungkyunkwan University, Suwon 16419, South Korea.
[2] School of Mechanical Engineering, Sungkyunkwan University, Suwon 16419, South Korea.
[3] SKKU Advanced Institute of Nanotechnology (SAINT), Sungkyunkwan University, Suwon 16419, South Korea.
[4] Centre for Advanced Studies in Physics (CASP), Government College University Lahore, 54000, Pakistan.

[*]Corresponding author (peterlee@skku.edu)

Growth Mechanism and Growth Conditions:

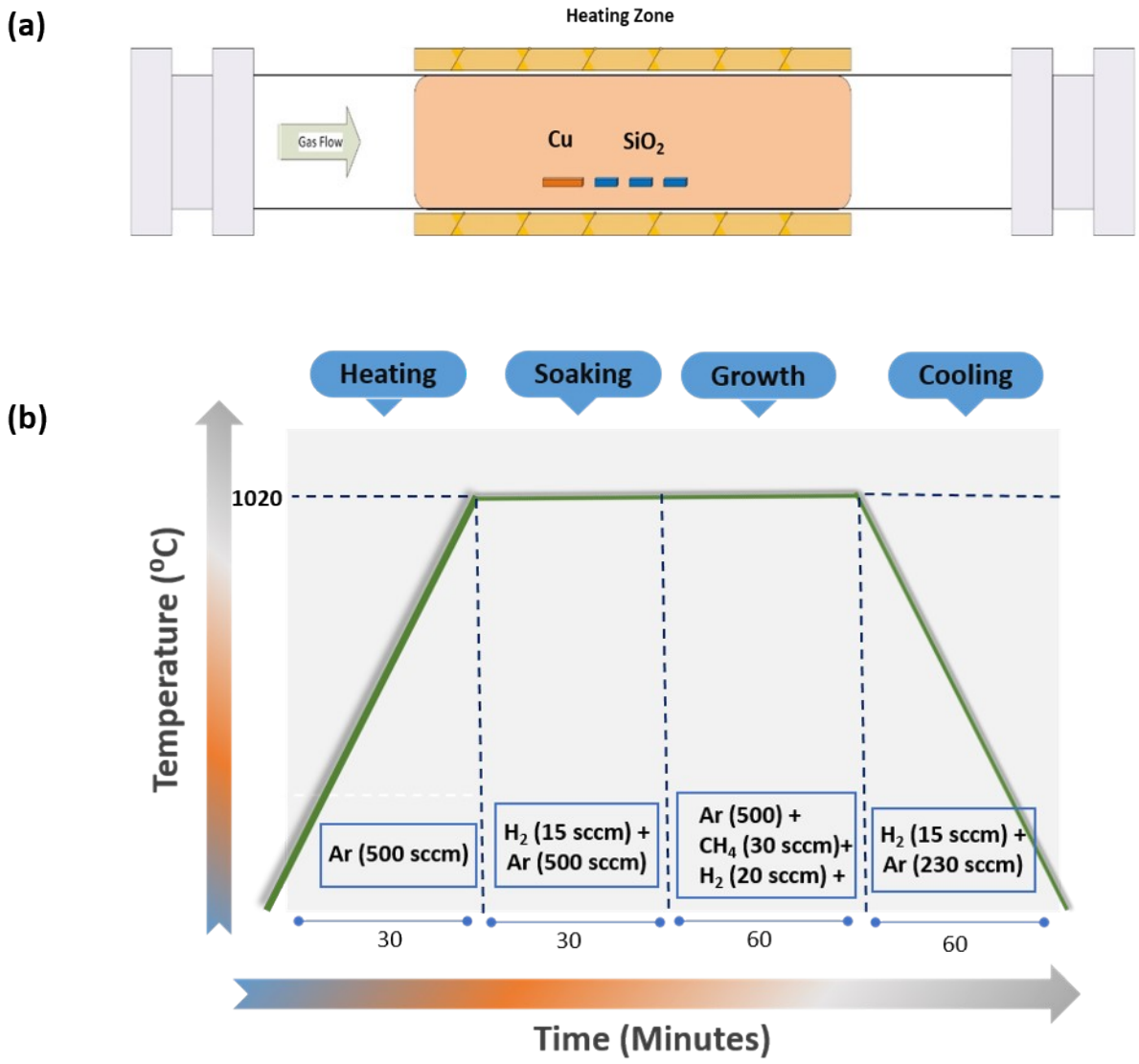

Figure S1. **Synthesis Process of direct growth of graphene on SiO_2**. (a) Schematic of the CVD system and placement of Copper foil relative to the SiO_2 substrate. (b) Schematic of the growth process with growth conditions.

Surface morphology of direct grown graphene:

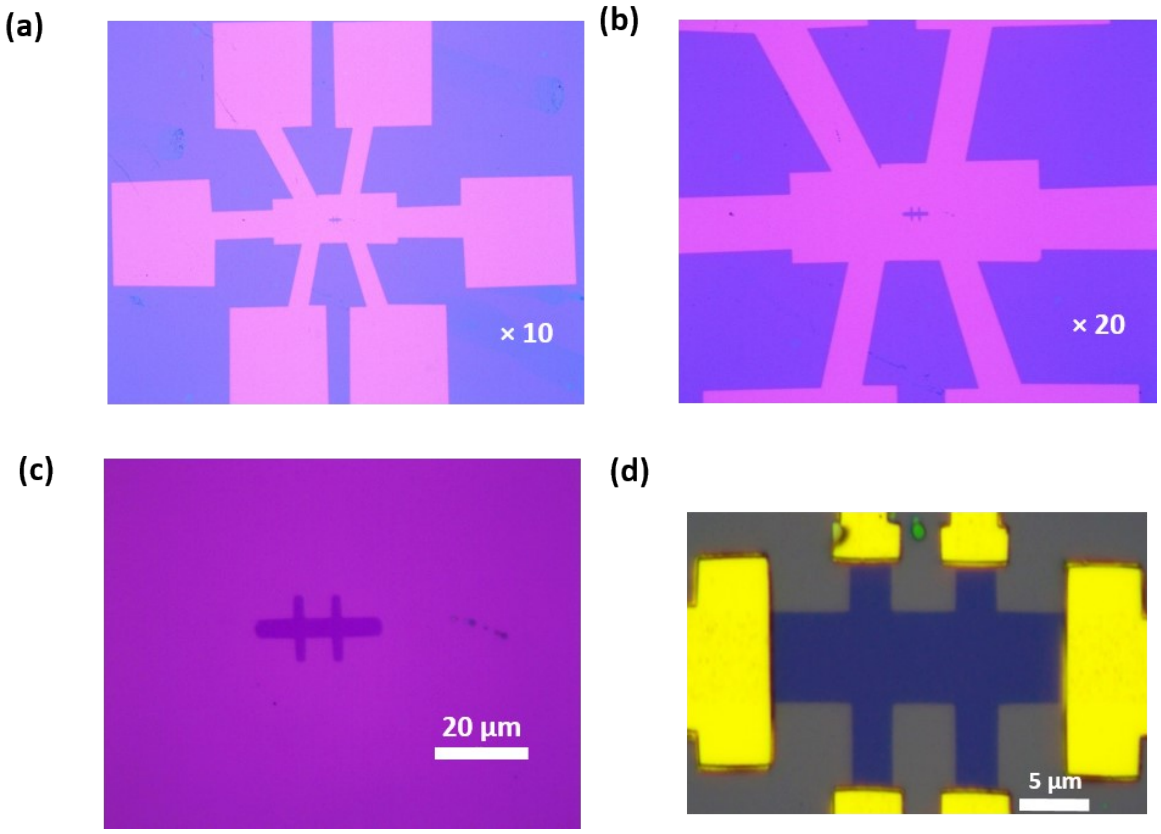

Figure S2. Surface Morphology of the direct grown graphene on SiO_2 . (a,b & c) are the optical images of the device preparation process with channel area and the O2 plasma etched area for contact electrodes. (d) is the optical image of the actual channel area with contact electrodes in Hall bar configuration.

Quantification of Defects:

For the quantification of defects in graphene devices, defect density n_D and average distance between defects L_D can be estimated from following relations.

$$L_D^2 = (1.8 \pm 0.5) \times 10^{-9} \lambda_L^4 (\frac{I_D}{I_G})^{-1}$$ …………………………………………………… 1

$$n_D^2\,(cm^{-2}) = \frac{(1.8 \pm 0.5) \times 10^{22}}{\lambda_L^4} (\frac{I_D}{I_G})$$ …..…………………………………………….. 2

or

$$n_D(cm^{-2}) = \frac{10^{14}}{\pi L_D^2}$$ …..………………………………………….. 3

Where λ_L is the excitation laser wavelength in nm (532 nm) and $(\frac{I_D}{I_G})$ is the Raman D and G intensity ratio (0.6).