

## Supporting Information

### Graphene Growth using a Solid Carbon Feedstock and Hydrogen

Hengxing Ji, Yufeng Hao, Yujie Ren, Matthew Charlton, Wi Hyoungh Lee, Qingzhi Wu, Huifeng Li, Yanwu Zhu, Yaping Wu, Richard Piner, Rodney S. Ruoff\*

\*To whom correspondence should be addressed: r.ruoff@mail.utexas.edu

The Department of Mechanical Engineering and the Materials Science and Engineering Program, The University of Texas at Austin, 1 University Station C2200, Austin, Texas 78712-0292, United States

## Figures

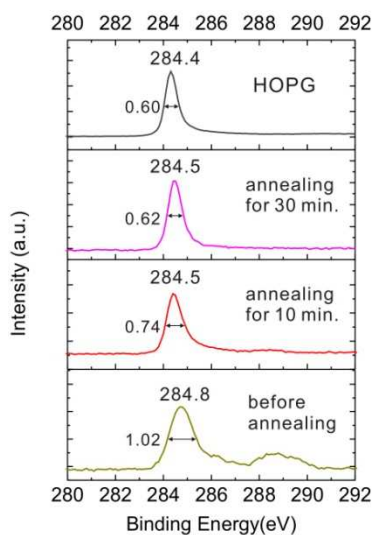


Figure S1. XPS spectra of HOPG and a thin carbon film on Cu heated for different times. Before heating of the sample, an intense peak centered at 284.8 eV with full width at half maximum (FWHM) of 1.02 eV (C-C bond), and two small peaks at 286.0 eV and 288.5 eV (C-O bond).<sup>[2]</sup> After heating the sample for 10 minutes at 1035 °C in 2 sccm H<sub>2</sub>, a narrower peak at 284.5 eV and an obvious decrease of the peaks at 286.0 eV and 288.5 eV is obtained, indicating an increase in sp<sup>2</sup>-hybridized carbon. When the sample was heated for 30 minutes at 1035 °C in 2 sccm H<sub>2</sub>, one peak at 284.5 eV with FWHM of 0.62 eV is obtained, almost the same as that of the single peak observed for HOPG.

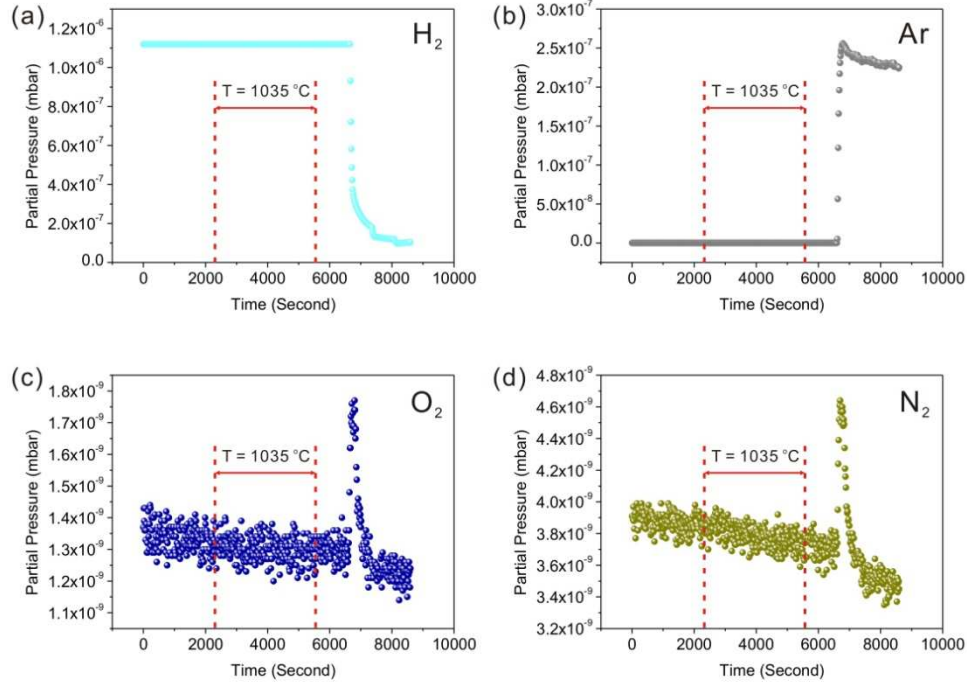


Figure S2. Partial pressure of (a)  $\text{H}_2$  ( $m/e = 2$ ), (b)  $\text{Ar}$  ( $m/e = 40$ ), (c)  $\text{O}_2$  ( $m/e = 32$ ), and (d)  $\text{N}_2$  ( $m/e = 28$ ), respectively, when annealing an aC-coated Cu foil in 2 sccm  $\text{H}_2(\text{g})$ . The red dashed lines mark the time range when the  $T = 1035^\circ\text{C}$ . The flow gas was changed from  $\text{H}_2$  to  $\text{Ar}$  at 6600 s when the temperature was below  $400^\circ\text{C}$ . The partial pressure of  $\text{O}_2$  and  $\text{N}_2$  decrease continuously suggesting that the temperature and changes in the type of gas flowing in the tube furnace does not influence the gas pressure. The peak appearing at about 6600 s in panel c and d is due to opening the  $\text{Ar}$  valve, which indicates the mass spectrometer is sensitive to the change of gas in the tube furnace.

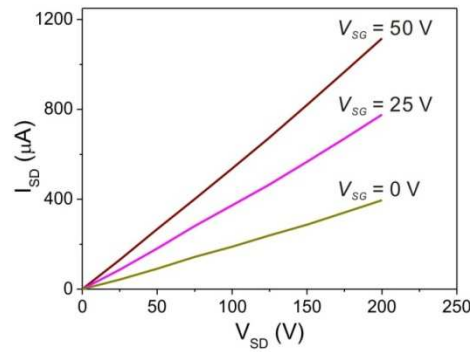


Figure S3. Source-drain current ( $I_{SD}$ ) with respect to the source-drain bias ( $V_{SD}$ ) measured at different gate voltages ( $V_{SG}$ ).

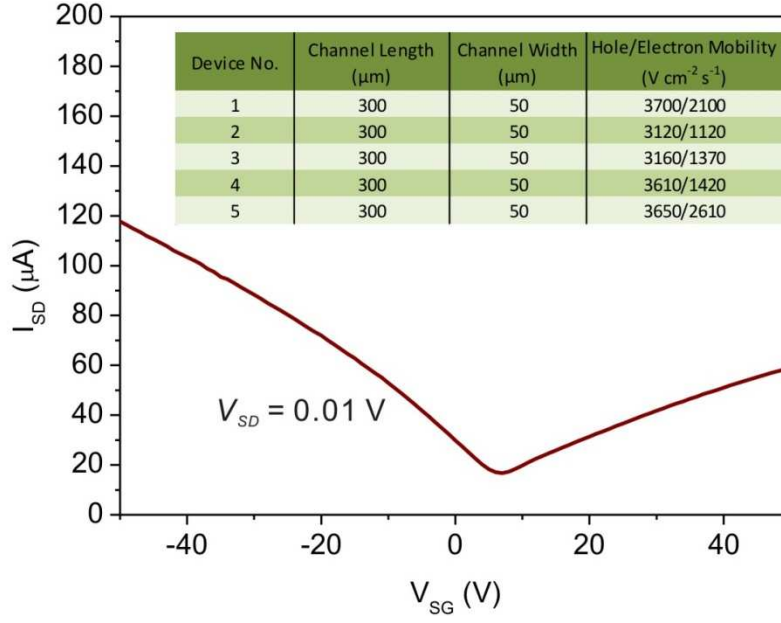


Figure S4. Source-drain current ( $I_{SD}$ ) versus source-gate voltage ( $V_{SG}$ ) of a back-gated graphene based field-effect transistor with a channel length of 50 μm and width of 300 μm. The inset table presents the mobility that derived from different devices.

The carrier mobility can be obtained from the  $I_{SD}$ - $V_{SG}$  curves in the linear region as <sup>[3]</sup>:

$$\mu = \frac{\Delta I_{SD} t_{ox}}{\epsilon_0 \epsilon_{ox} \frac{W}{L} V_{SD} \Delta V_{SG}}$$

Where  $\mu$  is the carrier mobility,  $\Delta I_{SD}$  is the current change induced by  $\Delta V_{SG}$  in linear region of the  $I_{SD}$ - $V_{SG}$  curve,  $t_{ox}$  = 285 nm is the SiO<sub>2</sub> thickness,  $\epsilon_{ox}$  = 3.9 is the SiO<sub>2</sub> permittivity,  $\epsilon_0$  is the vacuum permittivity,  $W$  and  $L$  are the FET width and length, respectively, and  $V_{SD}$  is the source-drain voltage.

## References

- [1] X. S. Li et. al, *Science* **2009**, 324, 1312
- [2] P. Merel et. al, *Applied Surface Science* **1998**, 136, 105.
- [3] X. Liang et. al, *Nano Letters* **2007**, 7, 3840.