

## Supplementary Data

### On the nucleation of graphene in chemical vapor deposition

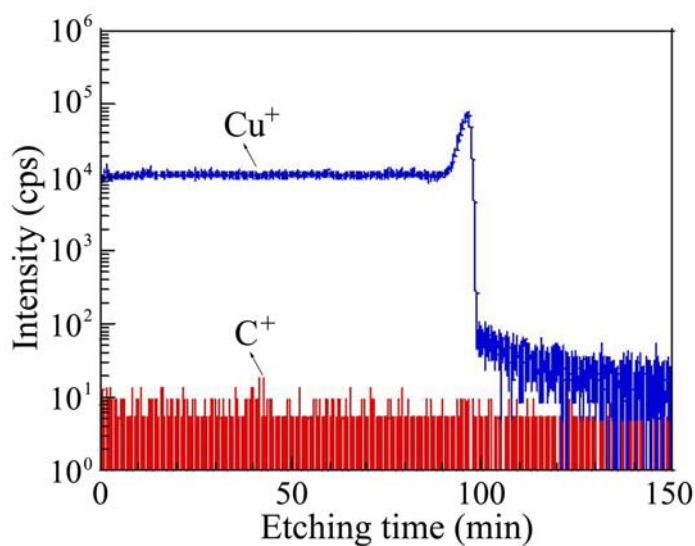
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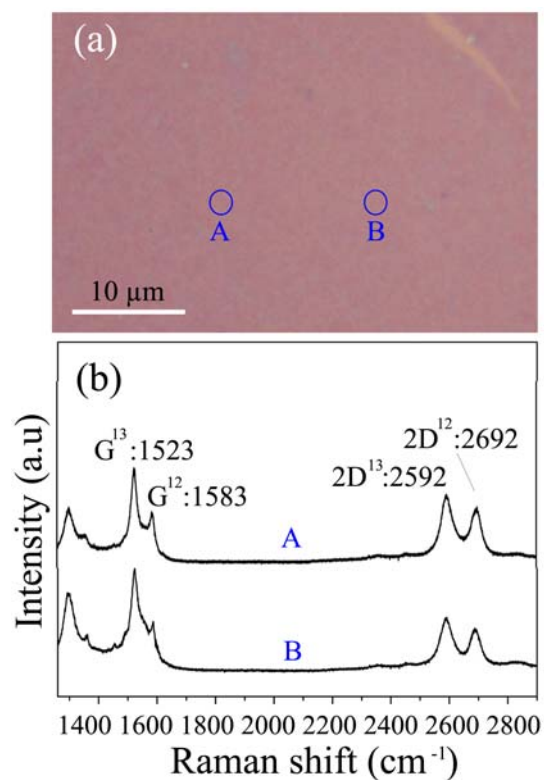
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**Fig. S-1** SIMS analysis of C<sup>+</sup> and Cu<sup>+</sup> species as a function of etching time for the as-sputtered Cu film deposited on c-plane Al<sub>2</sub>O<sub>3</sub>. The data shows that the 500 μm thick Cu film is almost etched away after 100 min, and signal of C<sup>+</sup> species is at a minimum level. We also studied C<sup>-</sup> species, which is more sensitive than C<sup>+</sup>, but only minimum level C<sup>-</sup> was detected (not shown here).



**Fig. S-2** (a) Optical micrograph of transferred graphene film from the Cu/c-plane Al<sub>2</sub>O<sub>3</sub> with the <sup>13</sup>CH<sub>4</sub>-CVD at 900°C (<sup>13</sup>CH<sub>4</sub>/H<sub>2</sub>/Ar = 20/20/400 sccm). (b) Representative Raman spectra measured at 2 random points of graphene film (a), which indicate the separated <sup>12</sup>C- and <sup>13</sup>C-graphene domains. This suggests the different <sup>12</sup>C source from the gas-supplied <sup>13</sup>CH<sub>4</sub>.