

Tailored CVD graphene coatings as a transparent and flexible gas barrier

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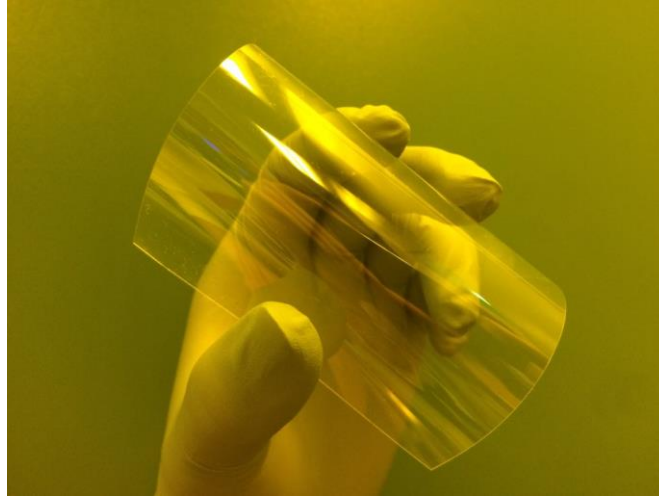


Figure S1. Photograph of graphene transferred on to PET film. The image showing excellent flexibility.

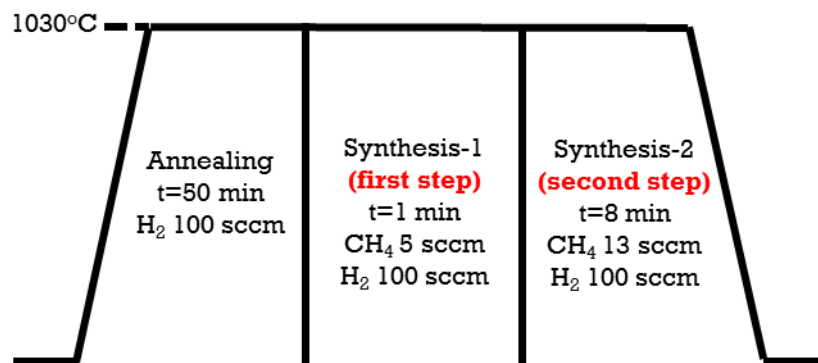


Figure S2. Schematic illustration of two-step growth processes.

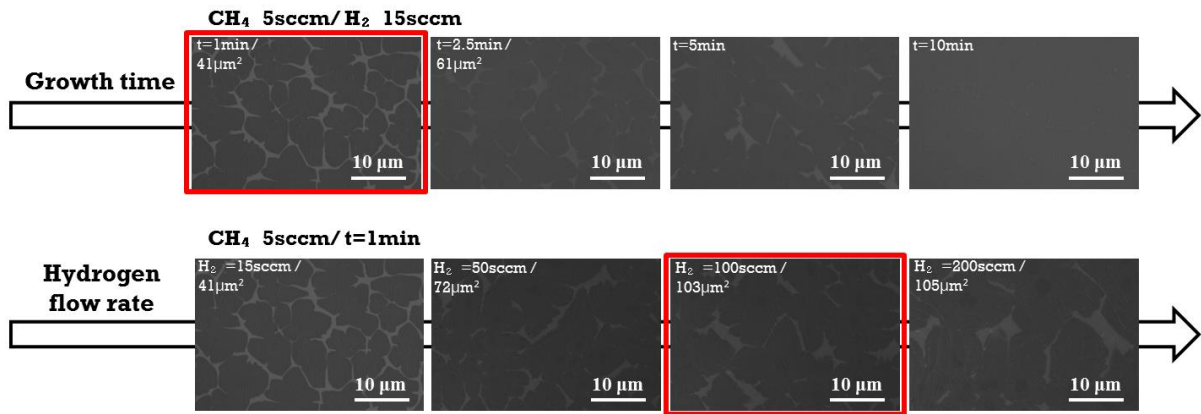


Figure S3. SEM images showing the effect of growth time and hydrogen flow rate at first step. The optimum condition for large domain graphene was 1 min of growth with hydrogen flow rate of 100 sccm.

Process \ Type	a) 1step-w/o ECP	b) 1step-ECP	c) 2step-ECP
	 RMS=78nm	 RMS=78nm	 RMS=78nm
(1) Electro-chemical polishing	 RMS=28nm	 RMS=37nm	 RMS=37nm
(2) 1step graphene growth	 RMS=28nm	 RMS=17nm	 RMS=11nm
(3) 2step graphene growth			 RMS=11nm

Figure S4. AFM images and root mean square (RMS) roughness values of Cu foils that went through various graphene growth processes. (a) 1step-w/o ECP (b) 1step-ECP and (c) 2step-ECP, respectively. The scan size is 10 \times 10 μ m².

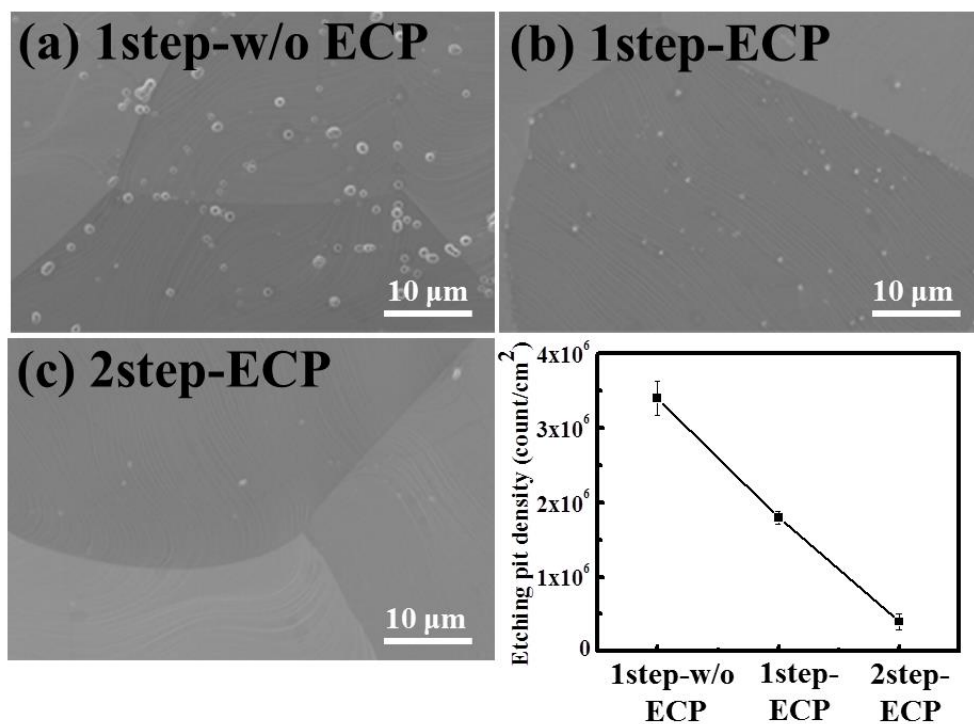


Figure S5. (a)-(c) SEM images of graphene surface on Cu foils after the copper etchant dropping, and (d) their etching pit density. The defect density shows a linear decrease from 1step-w/o ECP to 2step-ECP.

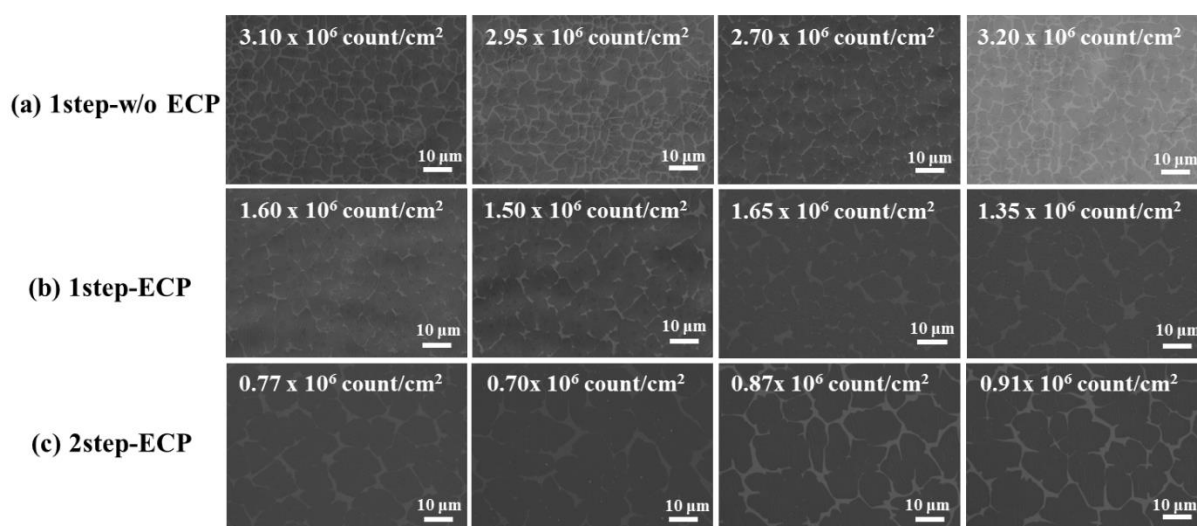


Figure S6. SEM images measured four times in different position of graphenes grown (a) 1step-w/o ECP, (b) 1step-ECP, and (c) 2step-ECP, respectively.

Analysis/ Sample type	Domain size	Raman 2D/G ratio	Transmittance	Sheet resistance	WVTR	Etching pit density
a)1step-w/o ECP	32 μm^2	2.07	97.2757 %	726 Ω/\square	1.058 g/m ² -day	4.25x10 ⁷ Count/cm ²
	28 μm^2	2.03	97.3715 %	702 Ω/\square	1.066 g/m ² -day	4.87x10 ⁷ Count/cm ²
	35 μm^2	2.11	97.3829 %	724 Ω/\square	1.023 g/m ² -day	4.40x10 ⁷ Count/cm ²
	35 μm^2	2.07	97.7334 %	752 Ω/\square	1.086 g/m ² -day	4.71x10 ⁷ Count/cm ²
	30 μm^2	2.00	97.8395 %	693 Ω/\square	1.082 g/m ² -day	4.37x10 ⁷ Count/cm ²
b)1step-ECP	60 μm^2	2.00	97.3829 %	681 Ω/\square	0.959 g/m ² -day	2.00x10 ⁷ Count/cm ²
	58 μm^2	2.16	97.4405 %	634 Ω/\square	0.894 g/m ² -day	2.56x10 ⁷ Count/cm ²
	66 μm^2	2.32	97.3787 %	644 Ω/\square	0.899 g/m ² -day	2.35x10 ⁷ Count/cm ²
	69 μm^2	2.07	97.3684 %	603 Ω/\square	0.825 g/m ² -day	2.31x10 ⁷ Count/cm ²
	52 μm^2	2.19	97.3620 %	633 Ω/\square	0.890 g/m ² -day	2.19x10 ⁷ Count/cm ²
c)2step-ECP	100 μm^2	2.01	97.2752 %	388 Ω/\square	0.654 g/m ² -day	0.25x10 ⁷ Count/cm ²
	120 μm^2	2.23	97.3299 %	351 Ω/\square	0.677 g/m ² -day	0.23x10 ⁷ Count/cm ²
	112 μm^2	2.02	97.8583 %	399 Ω/\square	0.664 g/m ² -day	0.31x10 ⁷ Count/cm ²
	94 μm^2	2.21	97.6690 %	414 Ω/\square	0.665 g/m ² -day	0.18x10 ⁷ Count/cm ²
	99 μm^2	2.15	97.1979 %	355 Ω/\square	0.657 g/m ² -day	0.20x10 ⁷ Count/cm ²

Table S1. The various properties summarized of the three different samples studied in this work.