

## SUPPORTING INFORMATION

### **A new device concept for bacterial sensing by Raman spectroscopy and voltage-gated monolayer graphene**

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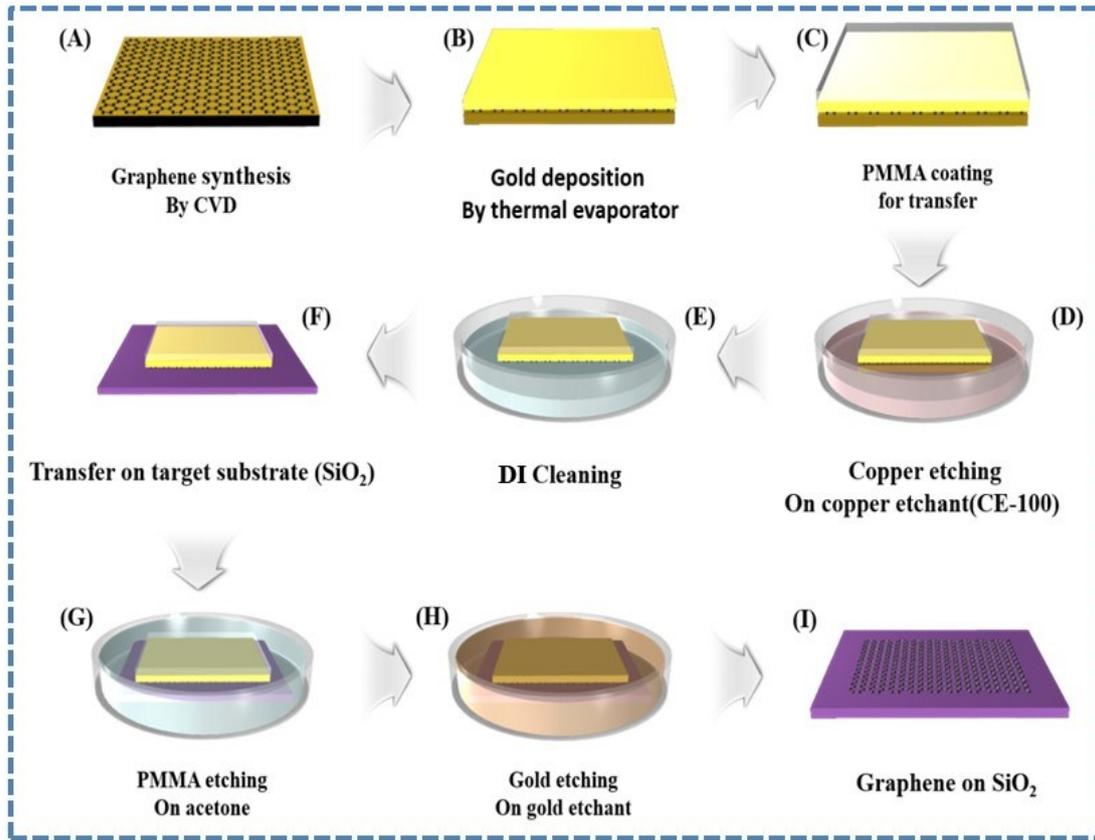
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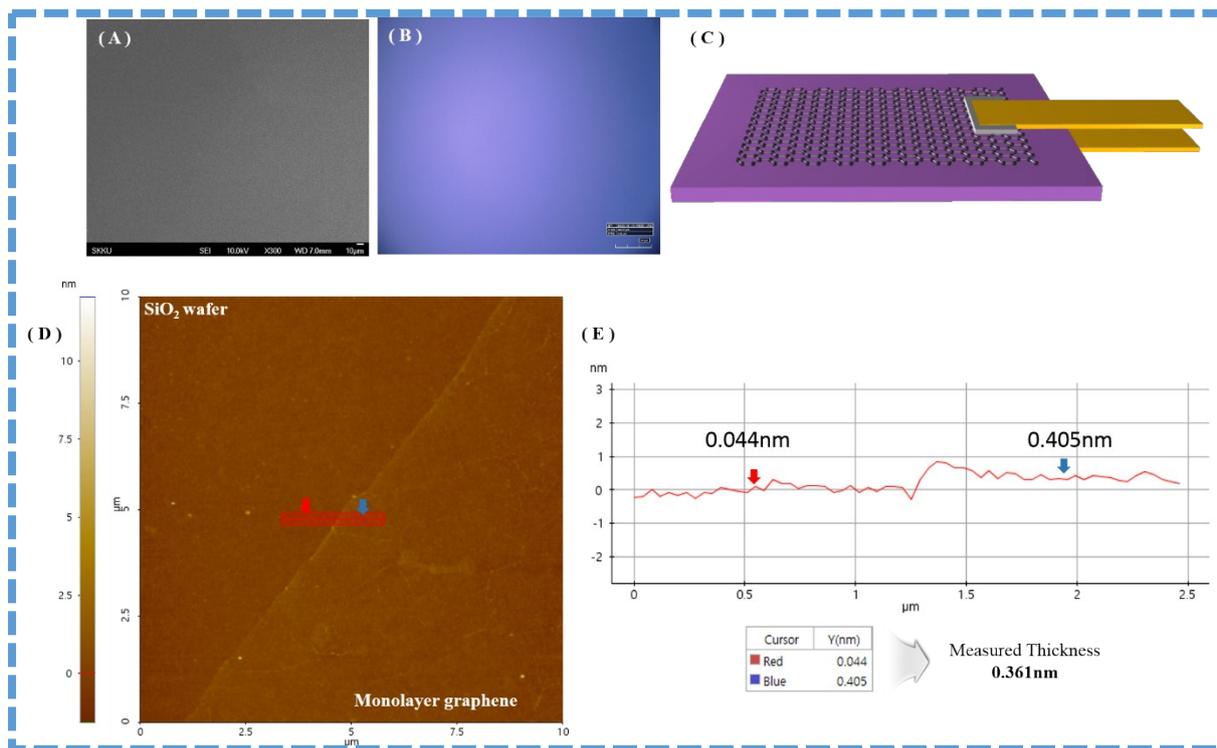
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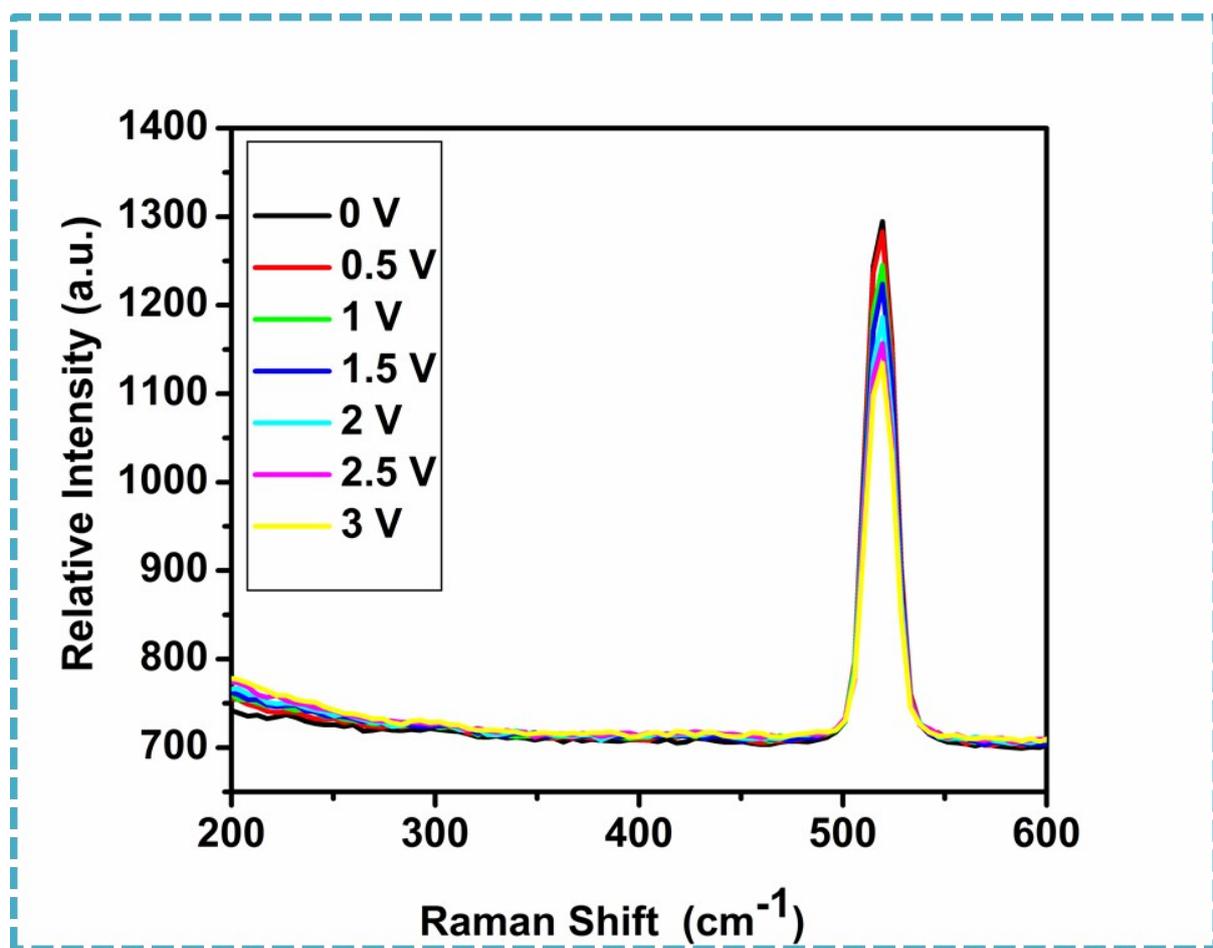
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**Figure SI-1: Synthesis, etching and transfer processes for monolayer graphene on SiO<sub>2</sub>.** (A) Synthesis of monolayer graphene on Cu foil. (B) Typically a gold thin film (30nm) was deposited by thermal evaporator and PMMA. (C) PMMA layer was cured at room temperature for 30min (D) Cu foil etching in liquid solution of copper etchant (Transene, CE-100) (E) Deionized water used to remove residual etchant (F) PMMA/Au/graphene stack was fully contacted with the SiO<sub>2</sub> (G) PMMA layer was dissolved by acetone followed by nitrogen gas blowing (H) Gold layer was dissolved by gold etchant (KI: I<sub>2</sub>: Deionized water solution) (I) Monolayer graphene on SiO<sub>2</sub> formed. This synthesis followed the procedure described in reference 1.



**Figure SI-2: Physical characterization of monolayer graphene film grown by CVD.** (A) SEM image of full growth monolayer graphene film on copper foil. (B) Optical microscopy image of fully grown monolayer graphene, data (after transfer) on SiO<sub>2</sub>. (C) Depiction of copper tape attachment to monolayer graphene film on SiO<sub>2</sub> to fabricate the biosensor device. (D) AFM image of fully grown monolayer graphene on SiO<sub>2</sub>. (E) Thickness of graphene layer measured by AFM as  $0.36 \pm 0.05$  nm, using cross sectional analysis.



**Figure SI-3:** Fingerprint region of Gram-negative bacteria (*Escherichia coli* O157:H7) with voltage variation from 0 V to 3 V.

	Protein Band at 425 cm <sup>-1</sup>	Disulphide bond at 490 cm <sup>-1</sup>	D band	G band	2D band
Graphene	Absent	Absent	1350 cm <sup>-1</sup> with similar intensity	1585 cm <sup>-1</sup> with similar intensity	2700 cm <sup>-1</sup> with similar intensity
Gram-negative bacteria	Present	Absent	1350 cm <sup>-1</sup> with dissimilar intensity	1585 cm <sup>-1</sup> with dissimilar intensity	2700 cm <sup>-1</sup> with dissimilar intensity
Gram-positive bacteria	Present	Present	1350 cm <sup>-1</sup> with dissimilar intensity	1585 cm <sup>-1</sup> with dissimilar intensity	2700 cm <sup>-1</sup> with dissimilar intensity

**Figure SI-4:** A generalized summary of our experiment is provided in this table, which is appropriate for inclusion in a Data Base.

### References:

1. J.Y. Choi, *Nature nanotechnology*, 2013, **8**, 311.