

## Electronic Supporting Information (ESI)

### A Graphene-Coated AFM Probe for Durable and Reproducible Nanoscale Electronic Measurements

Xintai Wang,<sup>a,b</sup> Angelo Lamanita,<sup>a</sup> Becky Penhale-Jones,<sup>a</sup> Nema Abdelazim,<sup>c</sup> Oleg. V. Kolosov,<sup>a</sup> and Benjamin. J Robinson<sup>a\*</sup>

<sup>a</sup> Physics Department, Lancaster University, Lancaster, LA1 4YB, United Kingdom. E-mail: b.j.robinson@lancaster.ac.uk

<sup>b</sup> Zhejiang MaShang GM2D Research Institute, 366 Shanhai Street, Cangnan, Wenzhou, Zhejiang China and School of Information Science and Technology, Dalian Maritime University, Dalian, China.

<sup>c</sup> School of Electronics and Computer Science, University of Southampton, Southampton SO17 1BJ, United Kingdom.

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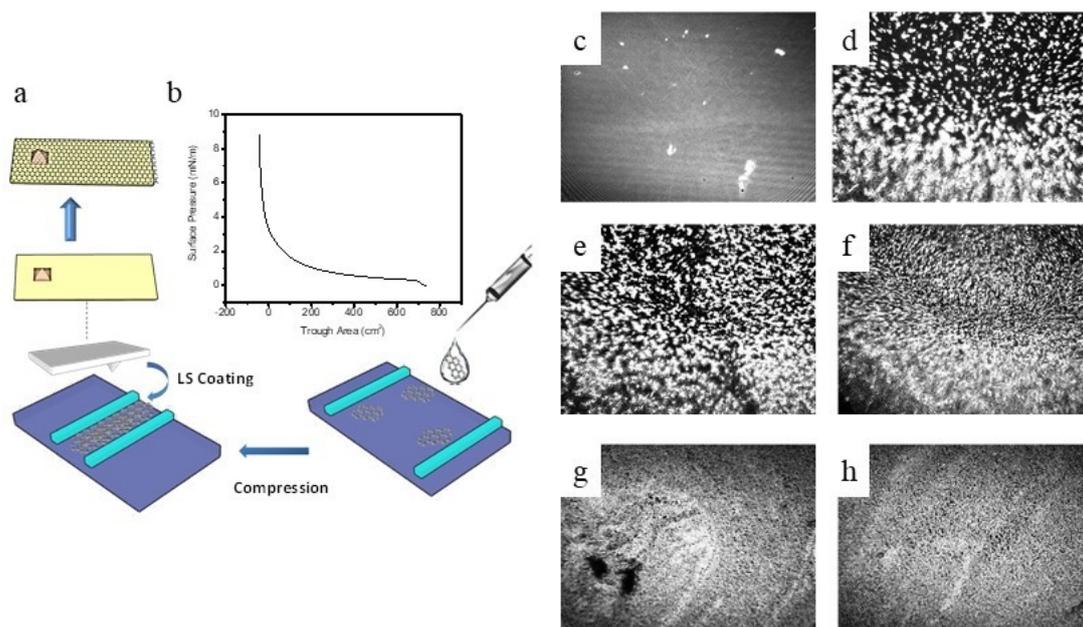
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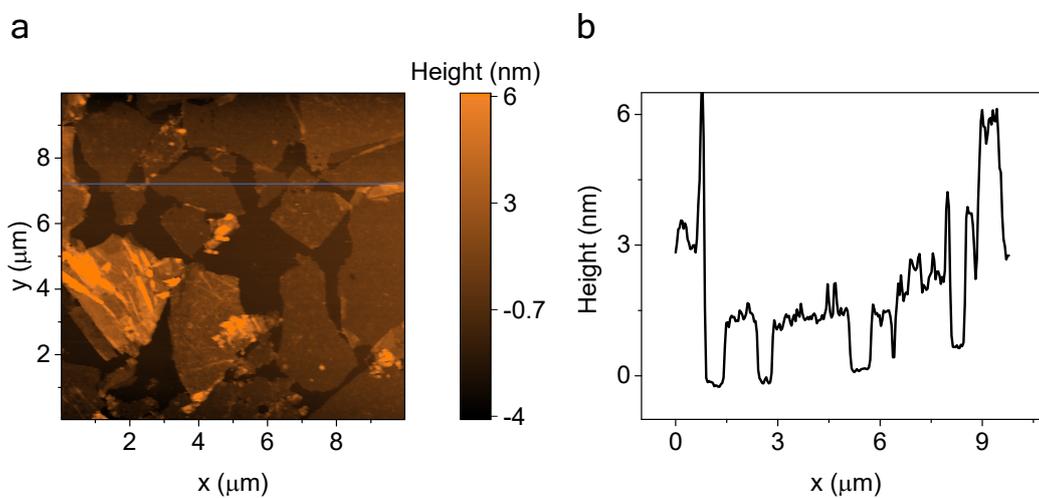
**Fig. S10** – Lifetime measurement of coated and non-coated probes

**Table. S1** – Lifetime measurement of coated and non-coated probes

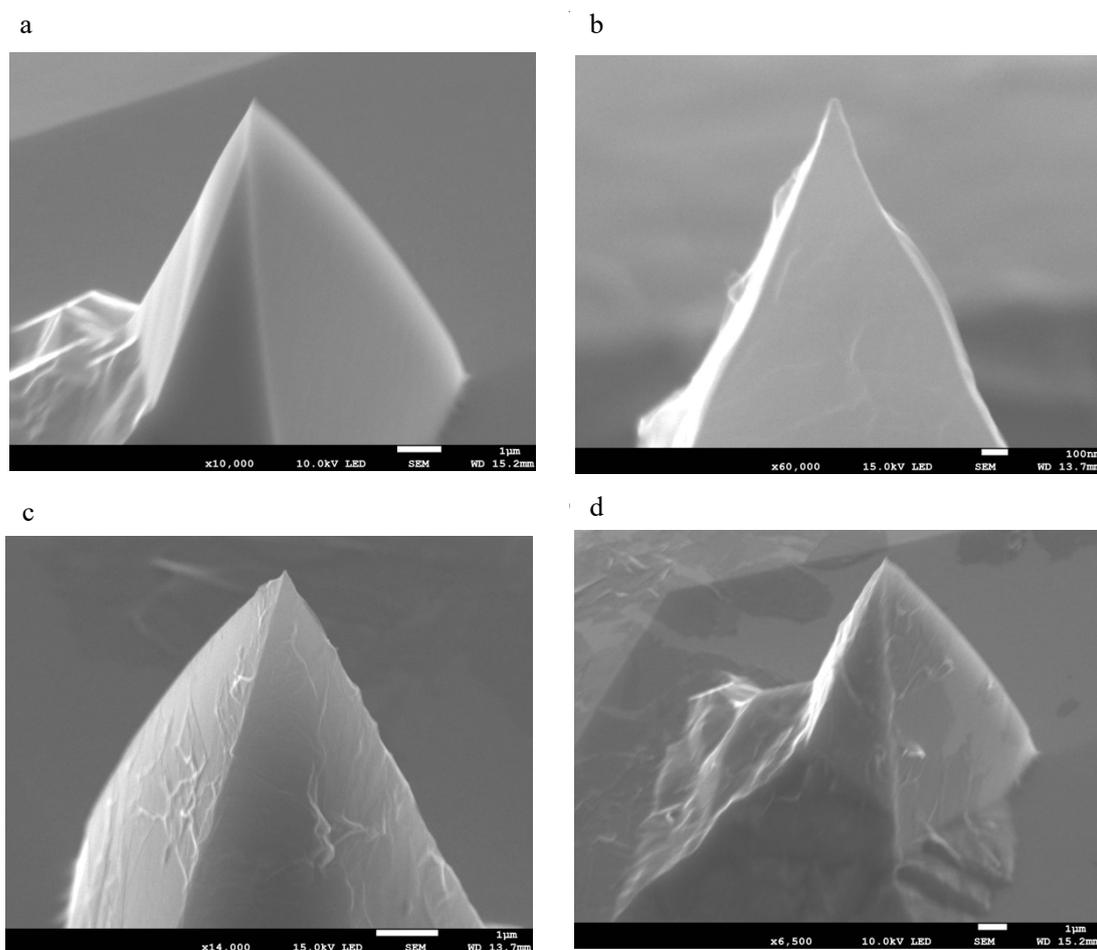


**Fig. S1** (a) An illustration of a conductive-AFM probe coated by graphene layer, (b) and the

isotherm spectra for LB film formation from graphene nano-flakes. (c-h) KSV photo of LB trough surface during compression while surface pressure is 0, 1, 2, 4, 6 and 8 N/m.

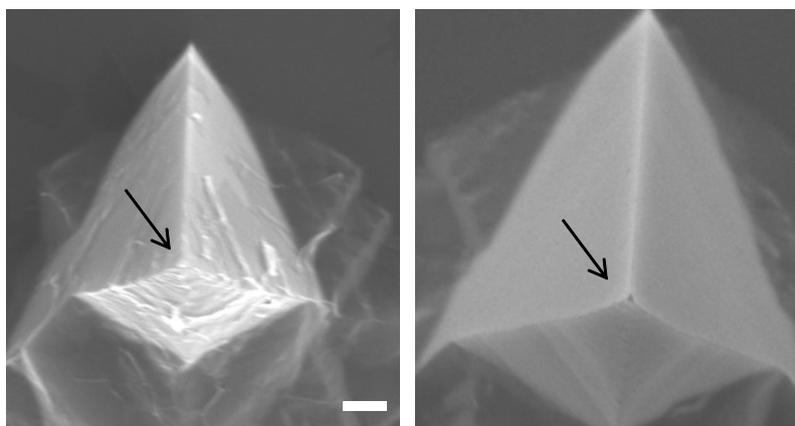


**Fig. S2** (left) AFM image of graphene film prepared by LB method on Si (right) corresponding height profile of graphene flakes.

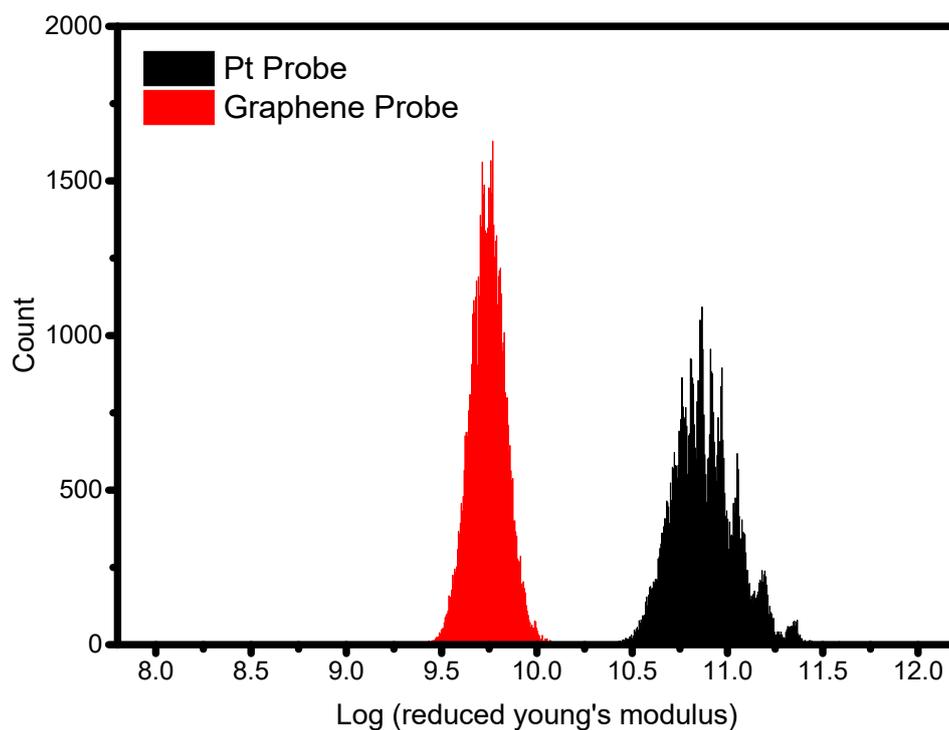


**Fig. S3** (a) SEM image of a new Pt coated probe. (b, c, d) SEM image of graphene coated probes

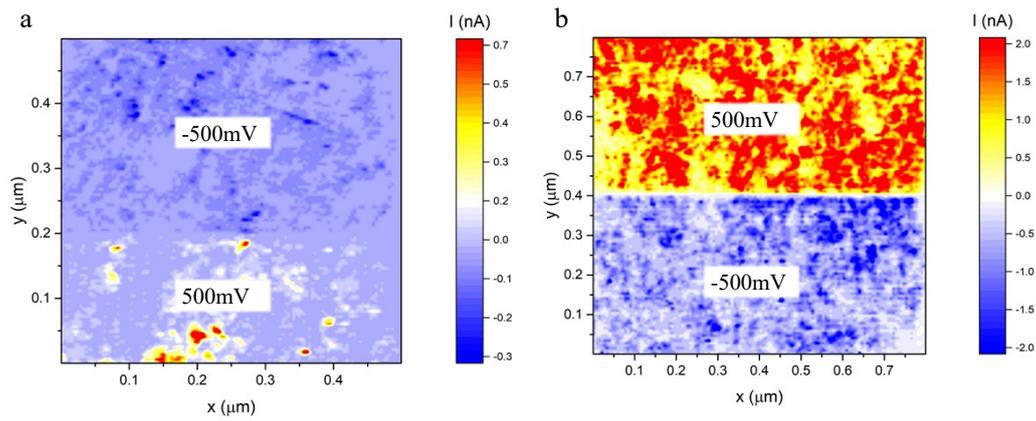
prepared from different batches.



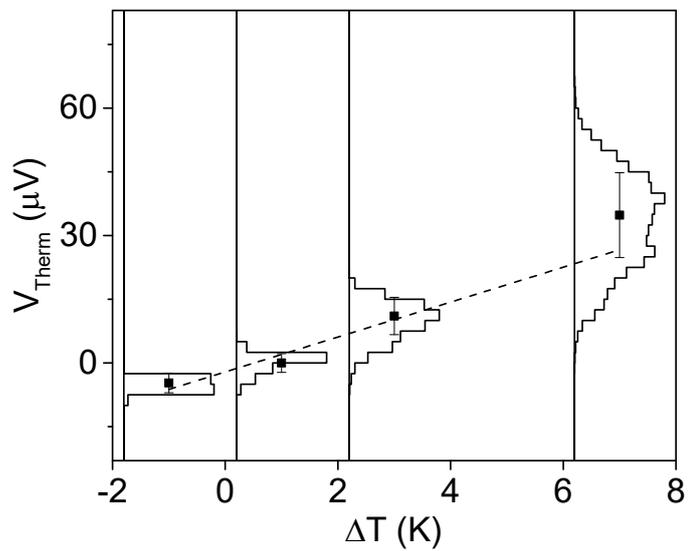
**Fig. S4** (left) SEM image of a graphene coated probe after 5 cycles of image scan. (right) SEM image of a Pt probe without graphene coating after 5 cycles of image scan, black arrow indicate the de-wearing part at apex.



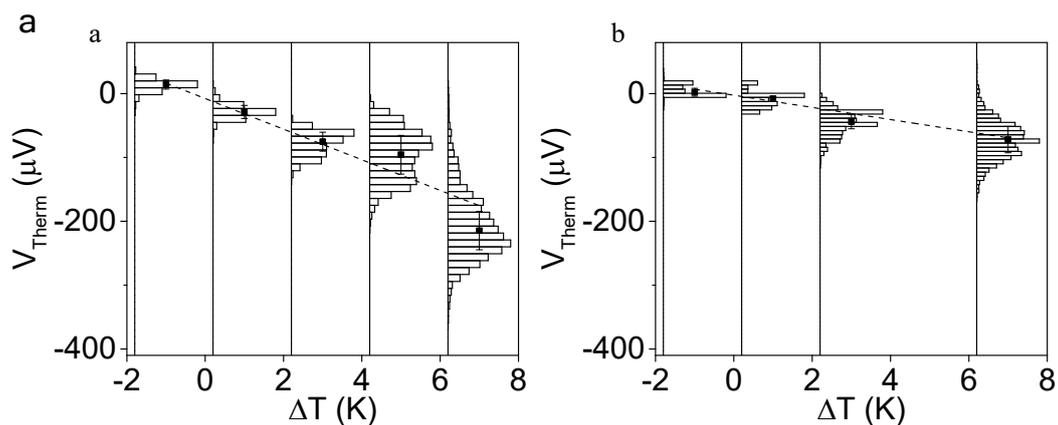
**Fig. S5** Young's modulus of a Pt probe and a graphene coated probe contacting an Au<sup>TS</sup> substrate, the significantly lower young's modulus for graphene coated probe means graphene was acting as a soft top contact to SAMs underneath.



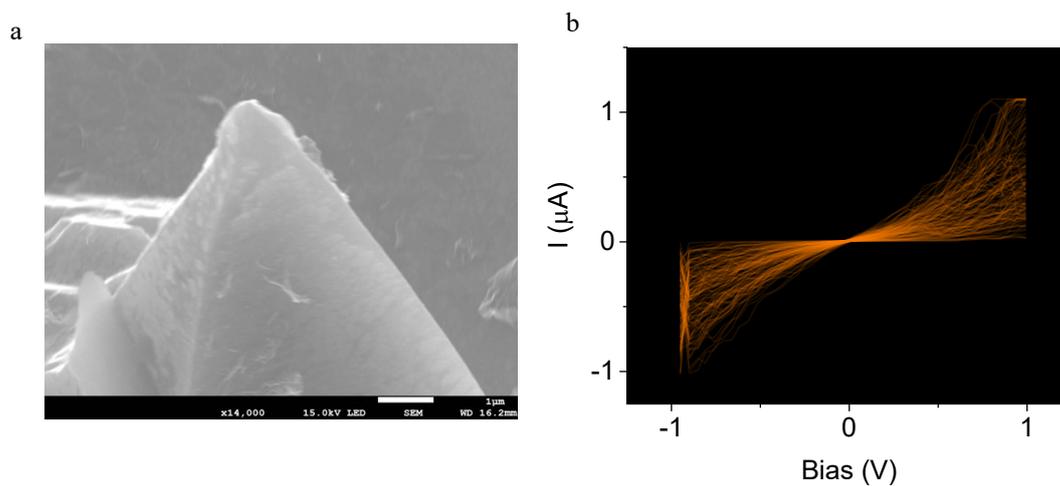
**Fig. S6** Current map of BPT SAMs using a normal Pt probe (a) and a graphene coated probe (b), bias voltage = 500 mV and -500mV.



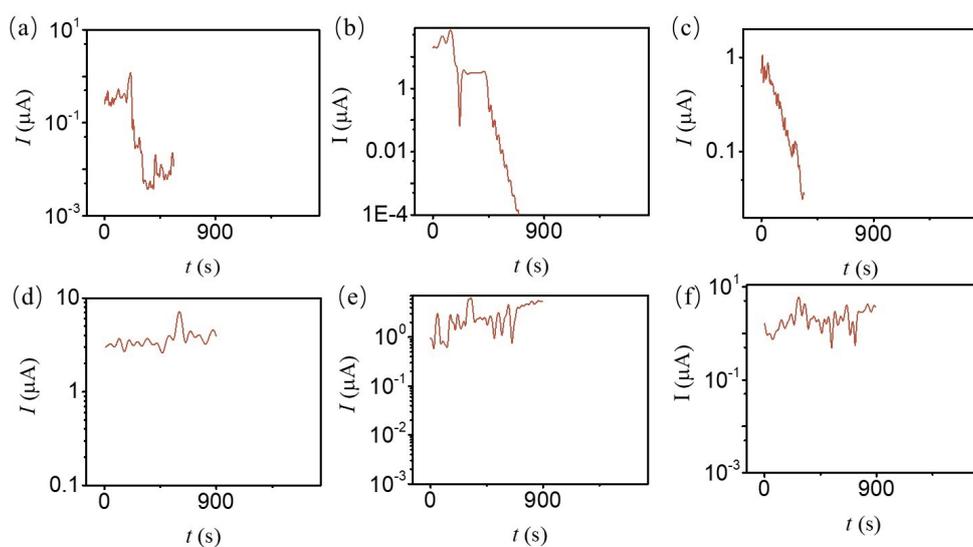
**Fig. S7** Thermovoltage distribution of graphene coated probe on Au<sup>TS</sup> and  $\Delta T$ , positive relationship between thermovoltage and  $\Delta T$  indicate negative Seebeck coefficient.



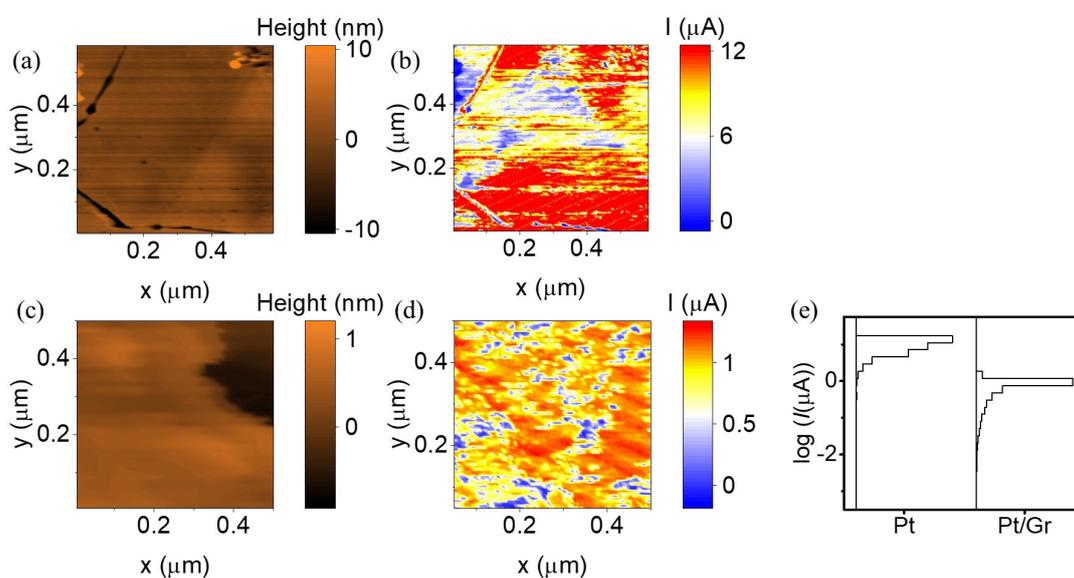
**Fig. S8** Plot of thermovoltage distribution of BPT (a) and C8S (b) SAMs measured by graphene coated probe vs.  $\Delta T$ , negative relationship between thermo-voltage and  $\Delta T$  indicate positive Seebeck coefficient.



**Fig. S9** IV curve statistics for BPT SAMs (right), measured by a graphene coated de-wearing probe (left).



**Fig. S10.** Lifetime measurements of conductive probes with and without graphene coating. (a–c) Current stability tests for three individual probes without graphene coating. (d–f) Current stability tests for three individual probes with graphene coating. All measurements were performed under conditions identical to those in Fig. 4.



**Fig. S11.** AFM topography and current map of template striped gold scanned using Pt probe without (a, b) and with (c, d) graphene coating, and the current distribution of current map (e).

**Table S1.** Life-time of Pt AFM probe with and without graphene coating

	Probe life-time (s)*
Pt - 1	210
Pt - 2	280
Pt - 3	240
Pt - 4	190
Gr/Pt - 1	>900
Gr/Pt - 2	>900
Gr/Pt - 3	>900
Gr/Pt - 4	>900

\* Probe life-time indicate the time while current decreased for 10 times ( $t$  at  $I_{\text{initial}}/I = 10$ )