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Supplementary information

Laser scribed graphene presents an opportunity to print a new generation of disposable electrochemical sensors

Katie Griffiths,[a] Carl Dale[a], John Hedley[b], Matthew D. Kowal [c], Richard B. Kaner[c] and Neil Keegan*[a]

[a] *Institute of Cellular Medicine, Newcastle University, Newcastle upon Tyne, NE2 4HH, UK Fax: +44 (0)191 2227991; Tel: +44 (0)191 2223678; E-mail: Neil.Keegan@newcastle.ac.uk*
[b]*School of Mechanical and Systems Engineering, Newcastle University, Newcastle upon Tyne, NE1 7RU, UK*
[c] *Department of Chemistry and Biochemistry, University of California, Los Angeles (UCLA), Los Angeles, California 90095, USA*

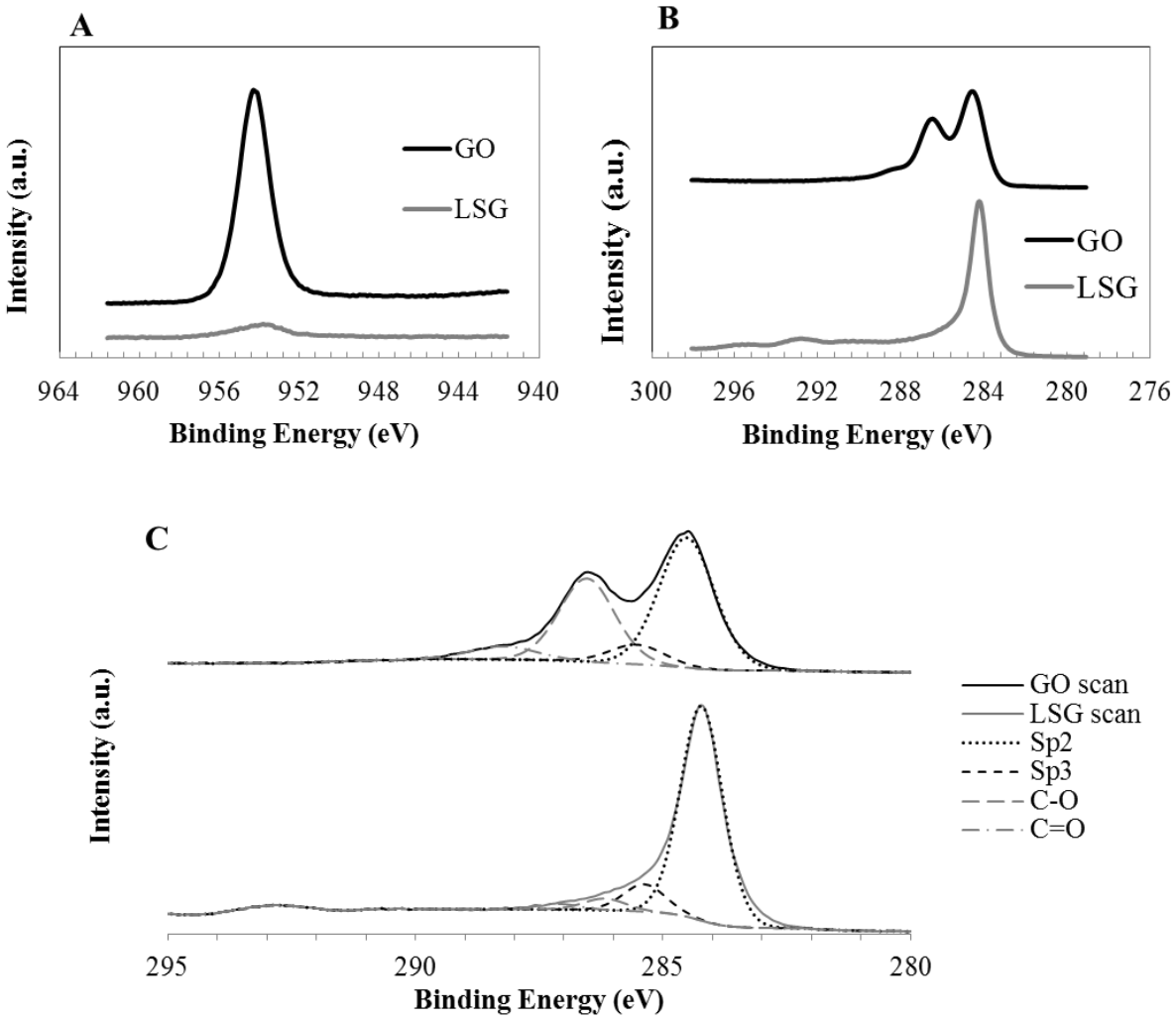

Figure S1. X-ray photoelectron spectroscopy data for graphite oxide (GO) and laser scribed graphene (LSG).

Image A shows both a decrease in and shift of the O1s peak when GO is reduced to LSG, signifying a loss of oxygen during the reduction process. The C1s peak also confirms a decrease in oxygen content as shown in image B which demonstrates the change from a double peak at the C1s location for GO to a prominent single peak following reduction to LSG. This variation in peak arrangement supports evidence of an alteration in bond configuration, which can be seen further detailed in image C. In the case of GO the ratio of carbon-oxygen to carbon-carbon bonds is greater than in the case of LSG where the largest peak is clearly sp^2 bonded carbons, with considerably lowered carbon-oxygen bonds. In the case of LSG there is also a small peak at 293 eV attributable to the sp^2 bonded carbon ring structure.

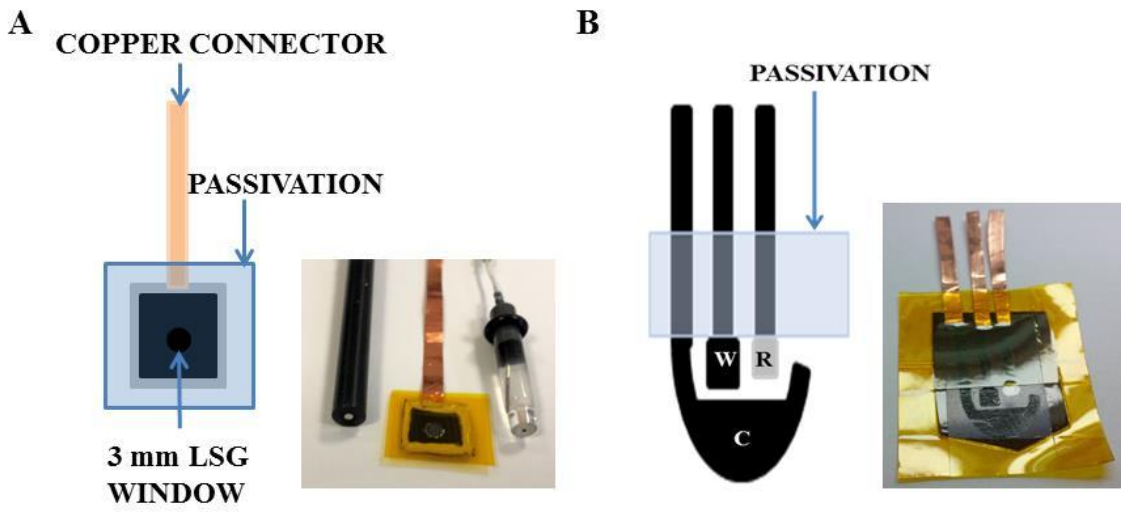

Figure S2. The electrochemical set up as used in the CV experiments for the standalone LSG electrodes is shown in panel A. The left image is schematic of LSG working electrode, while the right image is a photograph of all the electrodes required in the setup. The working LSG electrode is centre, the macroscale platinum counter electrode on the left and the standard silver/silver chloride reference electrode on the right are easily connected to a standard laboratory potentiostat via crocodile clips and immersed in the solution under test. Panel B shows a schematic of the planar three electrode LSG system on the left (W = working electrode, C = counter electrode, R = pseudo-reference electrode, while on the right a photograph shows that the setup can easily be connected to a standard laboratory potentiostat via copper connectors and immersed in the solution under test.

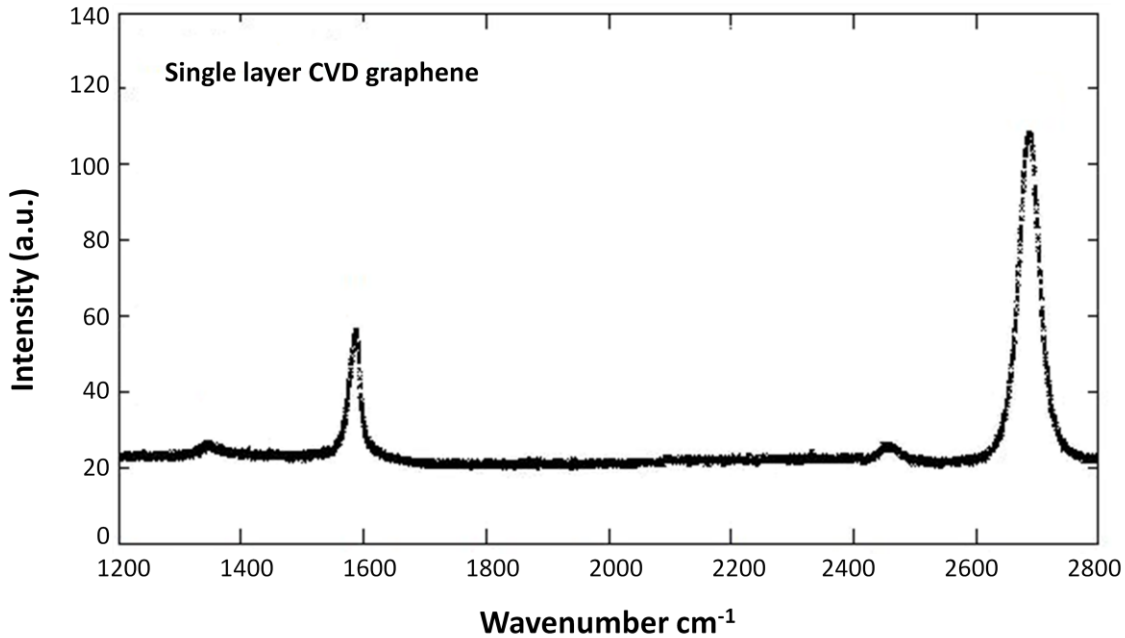

Figure S3: Raman spectra of SLG

Raman spectroscopy is a commonly employed technique to characterise graphene[1-3] as it provides vital information relating to the quality of the material (defects) and the number of layers present. The Raman spectrum in Figure S3 is characteristic of single layer CVD graphene situated on a 285 nm SiO_2/Si (p-doped) substrate. It can be clearly observed that the 3 main characteristic peaks of graphene are present; the D peak (1350 cm^{-1}), the G peak (1580 cm^{-1}) and the 2D peak (2680 cm^{-1}). The ratio of the 2D peak to the G peak (I_{2D}/I_G) alongside the symmetric nature of the 2D peak confirms that the graphene is single layer. Whereas the small intensity of the D peak in comparison to the G peak (I_D/I_G) indicates the graphene is of high

quality containing only a small number of defects. The D peak intensity has been reported to increase with the number of defects within the graphene material[4-5].

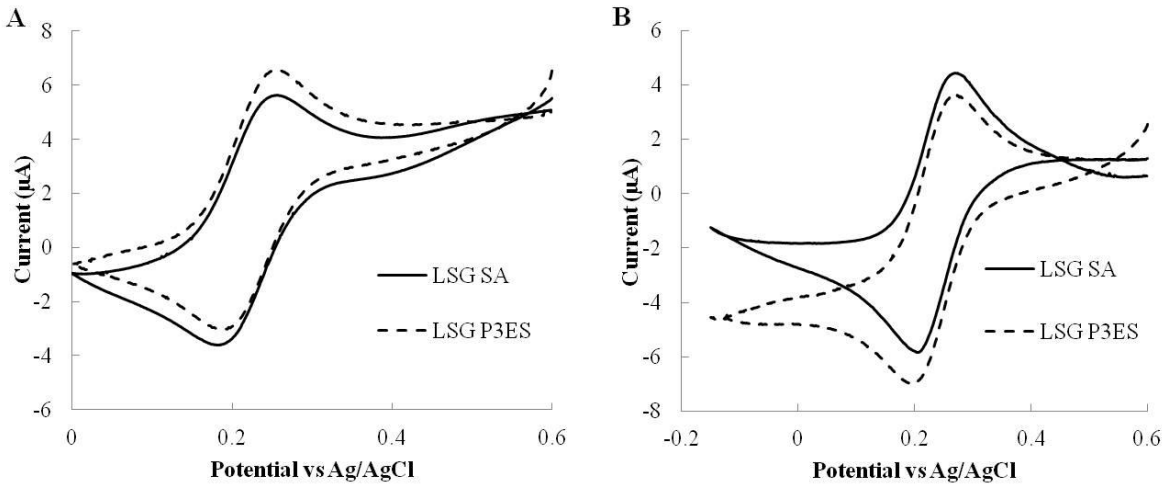

Figure S4. Cyclic voltammograms of (A) 1,1'-ferrocene dimethanol and (B) potassium ferricyanide at a scan rate of 10 mV s^{-1} . The standalone LSG electrodes (LSG SA) were made on a new, separate processing run from all other results in this work, using a new batch of GO. In a further additional processing run a new batch of planar three electrode LSG systems (P3ES) were made using the new batch of GO (the area of these electrodes has been normalised from 4 mm^2 to 7.1 mm^2 to match the area of standalone electrodes). This brings the total number of processing runs discussed in this manuscript to 4 separate wafer depositions and 2 separate batches of GO.

References

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