Supplementary Information

Fabrication of a graphite-paraffin carbon paste electrode and demonstration of its use in electrochemical detection strategies

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Chip dimensions

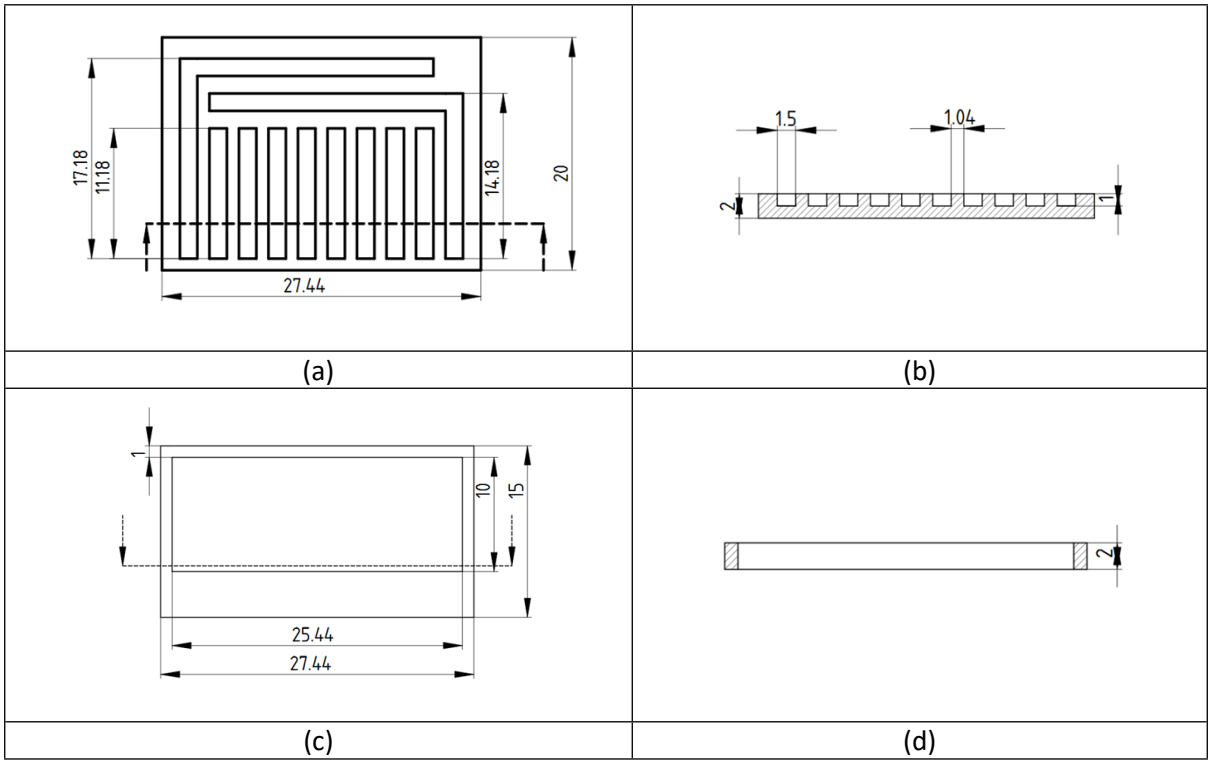
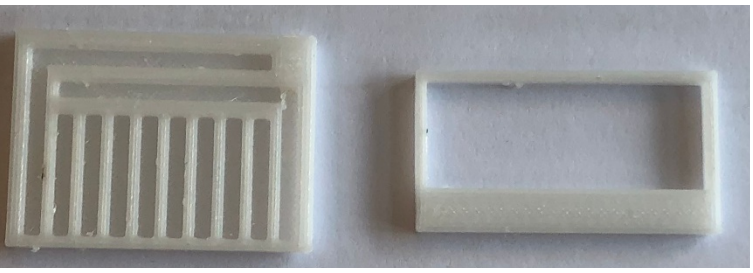


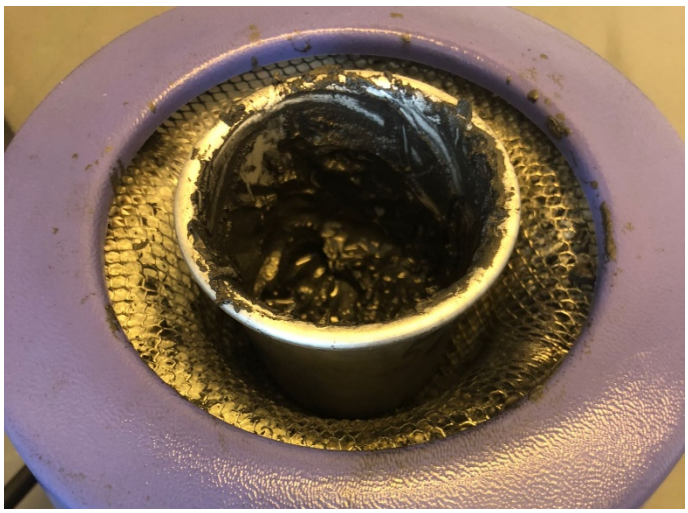
Figure S1. Dimensions required for duplication of 3D printed parts. a) Base top-down view. b) Base section taken through a. c) Well top-down view. D) Well section taken through c.

Electrode recipe

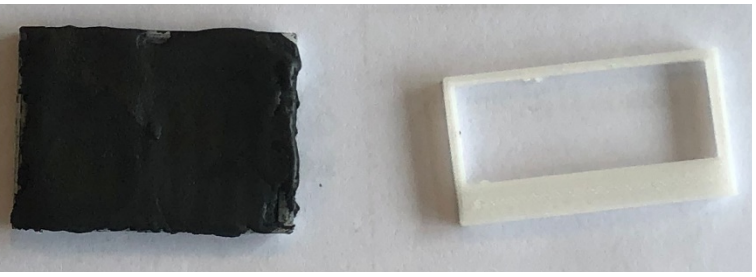
1. Well and base printed from PETG



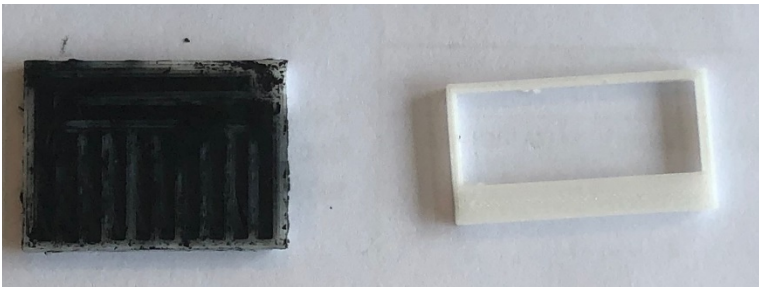
2. Graphite and paraffin wax weighed into metal container for heating
3. Mixture heated until workable



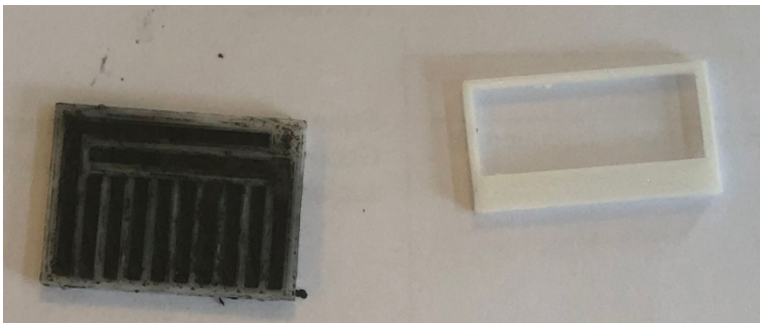
4. Spatula used to push mixture into tracks in base



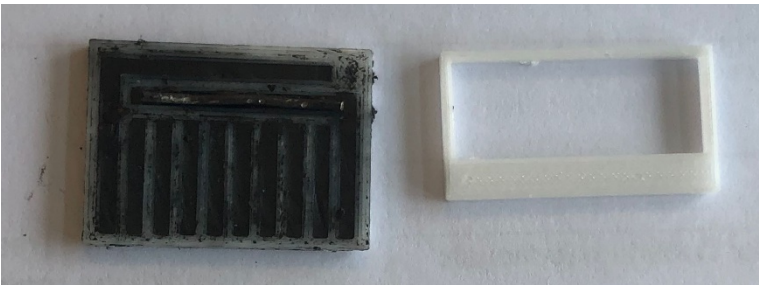
5. Flat end of spatula used to scrape off any excess



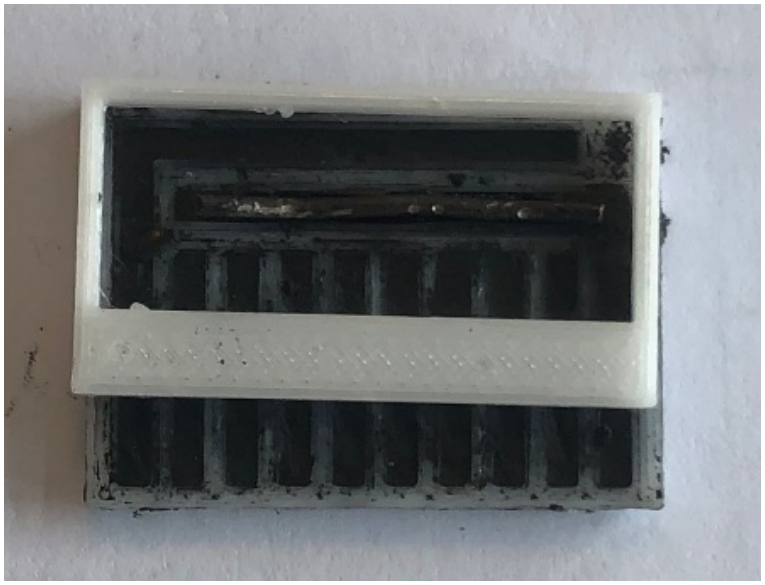
6. Chip rubbed on file paper to smooth surface



7. Silver wire pushed into reference track



8. Well attached using nail polish



Full EIS characterisation

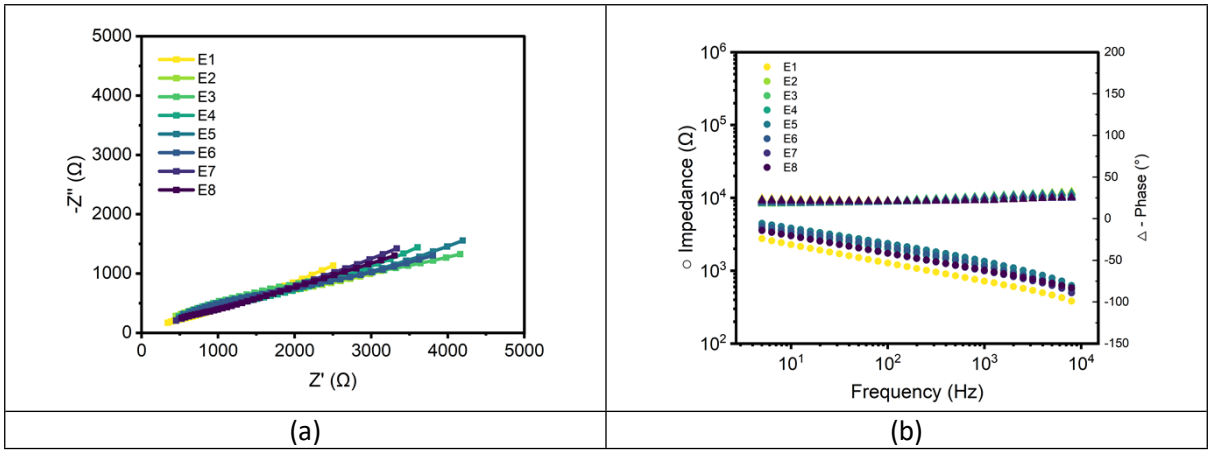


Figure S2. a) Nyquist plot of EIS characterisation of full electrode chip in 1 mM RuHex in PBS, performed at $E_{1/2}$ between frequencies of between 10000.0 and 5.0 Hz with 10 mV sine wave stimulation. b) Bode plot of the same EIS characterisation.

SEM characterisation

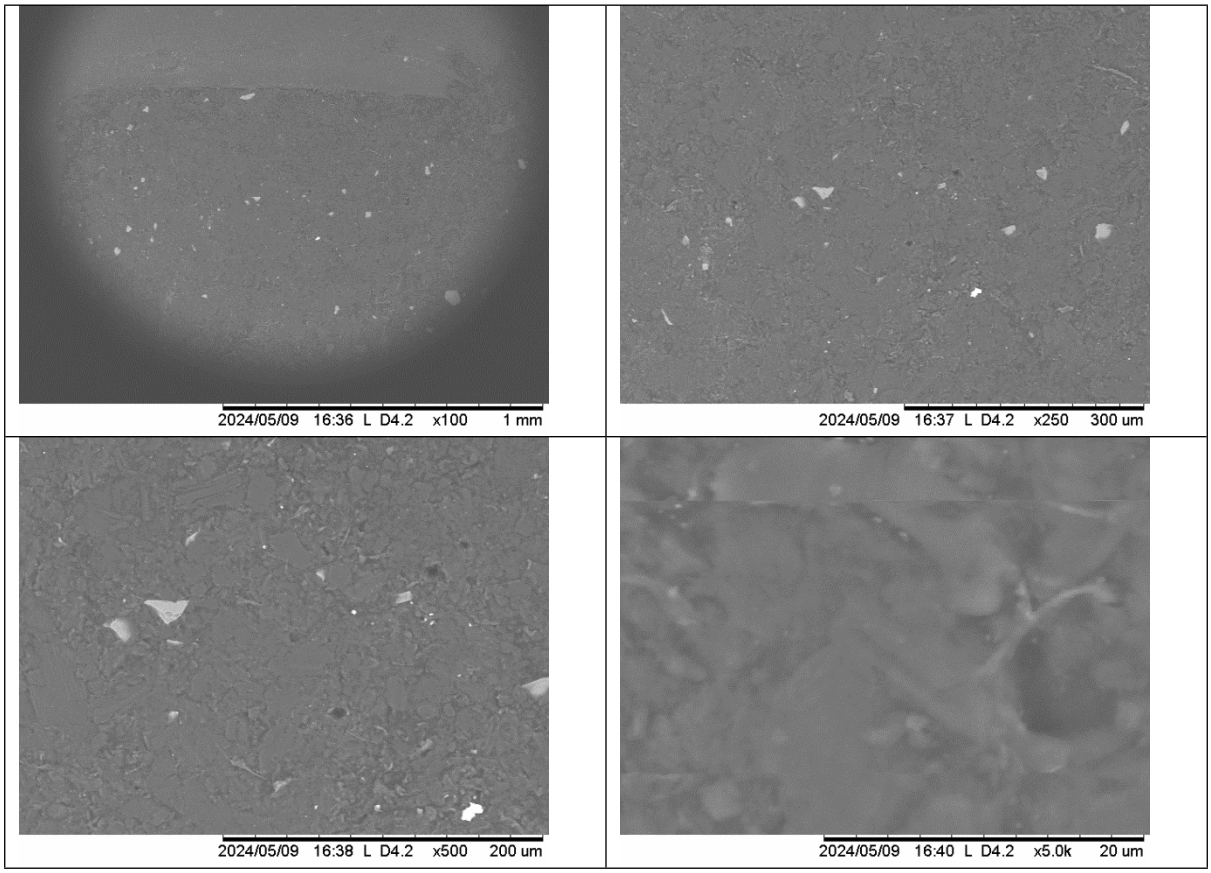


Figure S3. SEM measurement of the carbon surface of a produced chip, performed using a Hitachi TM – 1000 microscope. Taken at 100, 250, 500 and 5000x magnification. The figure highlights the compound nature of the produced chips, showing an overall rough texture composed of areas of high and conductivity.

FTIR characterisation

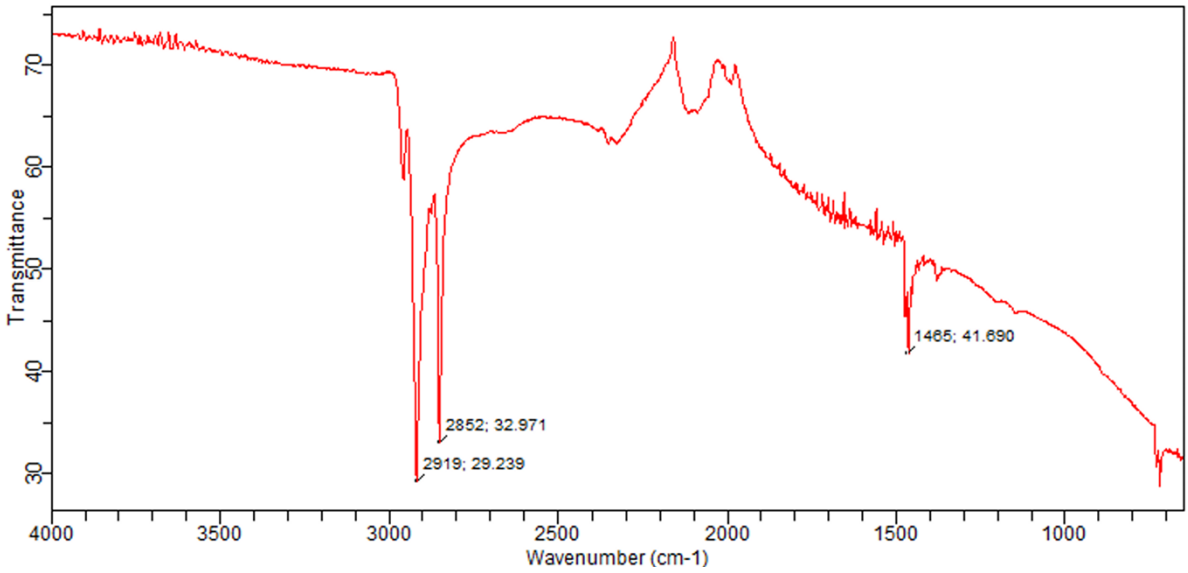


Figure S4. FT-IR measurements of carbon paste used in chip manufacturing, taken using an Agilent Technologies 5500 Series FTIR. When these peaks are compared to others seen in literature produced from similar carbon materials[1,2] they indicate a structure primarily generated from C-H and C – H_2 at 2919 cm^{-1} and 2852 cm^{-1} (expected in the hydrocarbon structure of paraffin wax) and C-C groups at 1465 cm^{-1} (expected in the pure carbon structure of graphite).

Dopamine Interferents

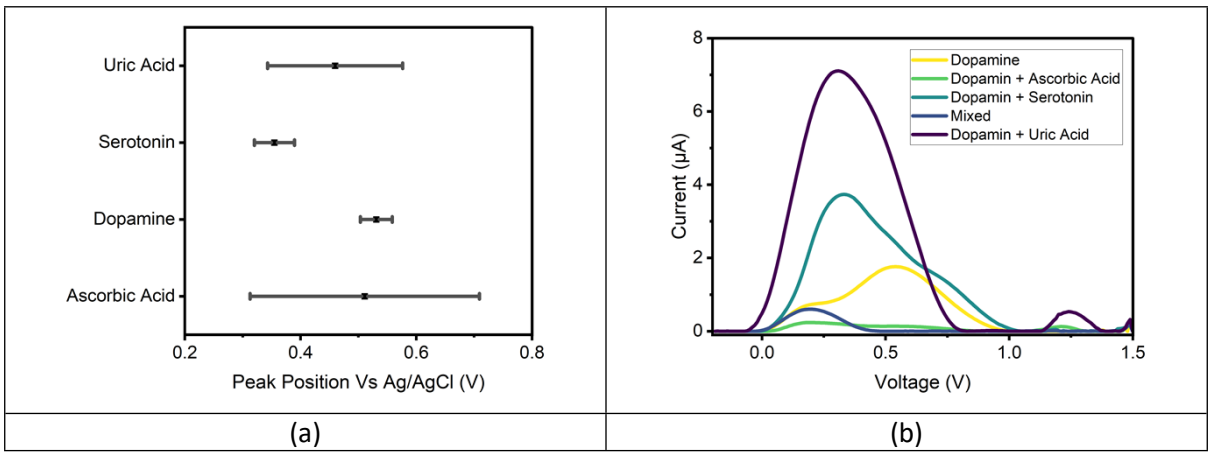


Figure S5.a) Peak positions of the SWV measurement of both dopamine and some common interferents at concentrations of 0.5 mM diluted in PBS. b) Example SWV scans of dopamine, alone and mixed with common interferents all at concentrations of 0.5 mM diluted in PBS. Single electrode data plotted for simplicity but full data available in supplementary excels.

References

1 L. Mardani, M. T. Vardini, M. Es' haghi, E. G. Kalhor, *Anal. Methods*, 2020, **12**, 3, 333-344.

2 Z. Su, S. Hu, Y. Zhang, Z. Liang, Y. Peng, Q. Cao, X. Yu, Z. Zhu, P. He, Z. Li, 2024. *Analyst*, **149**, 1, 188-195.