Supporting Information

Multi-material 3D-printed platform for electrochemical detection and analysis of dopamine and glucose

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DC voltages used in the CA experiments, according to CV readings

Table SI. DC voltages used for the chronoamperometry experiments.

Substance	Concentration (mM)	CV voltage oxidation peak at 50 mV/s (V)	DC voltage used in CA (V)
Dopamine	0.05	0.23	0.65
	0.143	0.28	0.65
	0.25	0.65	0.70
	0.5	0.69	0.75
	1	0.95	1.00
Glucose	1	0.20	0.50
	2.5	0.32	0.50
	5	0.44	0.55
	7	0.52	0.80

Electrode and connector dimensions

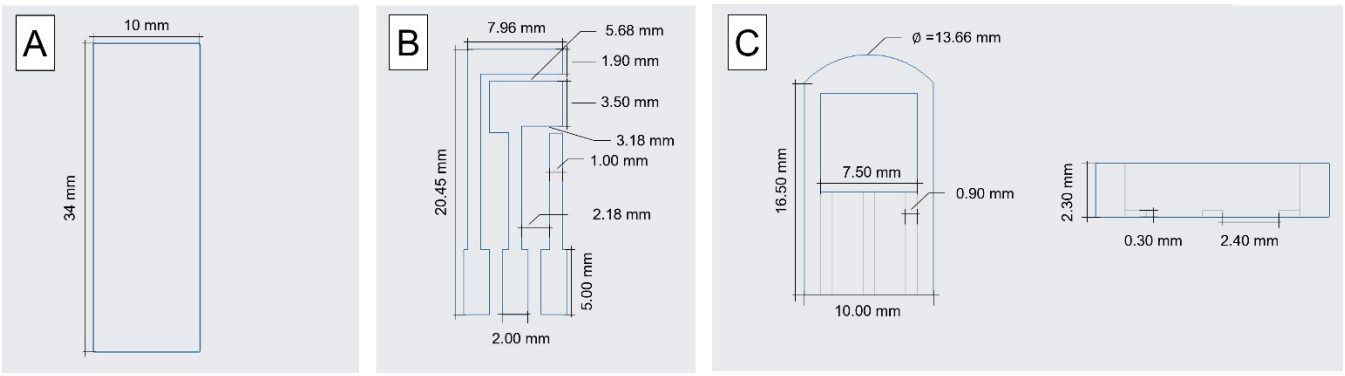

Figure S1. Detailed dimensions of (A) bottom support of the 3D-printed electrode, with a thickness of 500 microns, (B) the electrode itself, with a thickness of 300 microns, and (C) the cover used to isolate the working, reference, and counter electrodes (where the sample is placed) from the tracks and pin connectors.

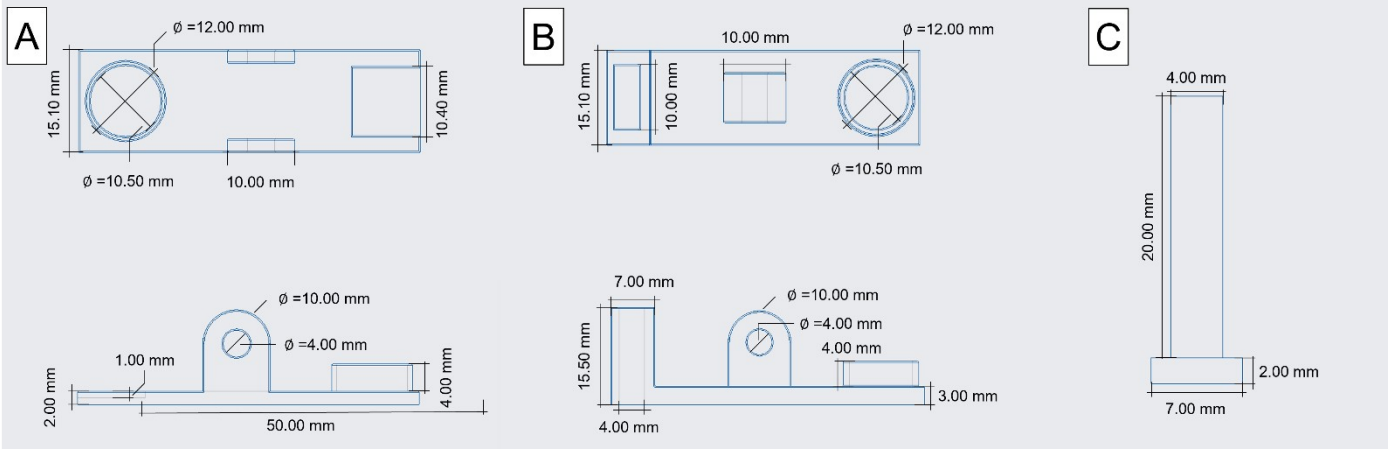

Figure S2. Detailed dimensions of (A) the bottom electrode connector, (B) the top electrode connector, and (C) the pin connector.

Surface cleaning processes

We investigated electrode treatment optimisation by using several surface cleaning methods: cyclic voltammetry using 1 M sulfuric acid, for 10 cycles, cyclic voltammetry using 1 M NaCl, and oxygen plasma treatment.

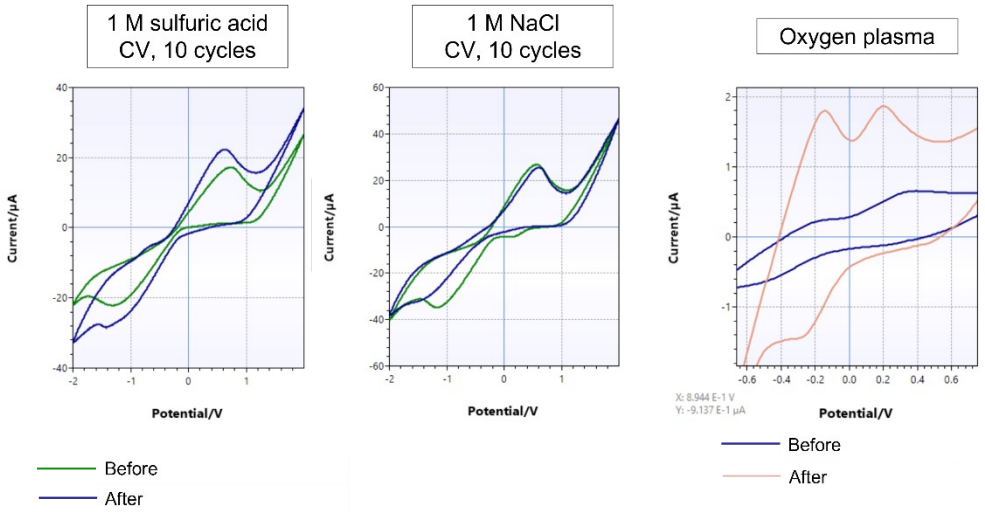

Figure S3. Before and after cyclic voltammetry measurements 0f 100 µL of 1 mM potassium ferricyanide in 100 mM KCl. Secondary peaks in plasma oxygen are attributed to the presence of residual hexaammineruthenium (III) chloride in the solution.

NaCl cleaning did not seem to improve the signal significantly, so this cleaning process was discarded. Sulfuric acid cleaning showed a considerable increase of the current generated as well as a slight reductio of the voltage difference between the oxidation and reduction peaks. Finally, plasma treatment was observed to drastically improve the current generated, as well as to both define the peaks better and bring them closer together. Hence, both plasma treatment and sulfuric acid CV were combined.

Scanning electron microscopy

The surface of the 3D-printed electrodes was examined by scanning electron microscopy. Two representative images are shown in Fig. S7.

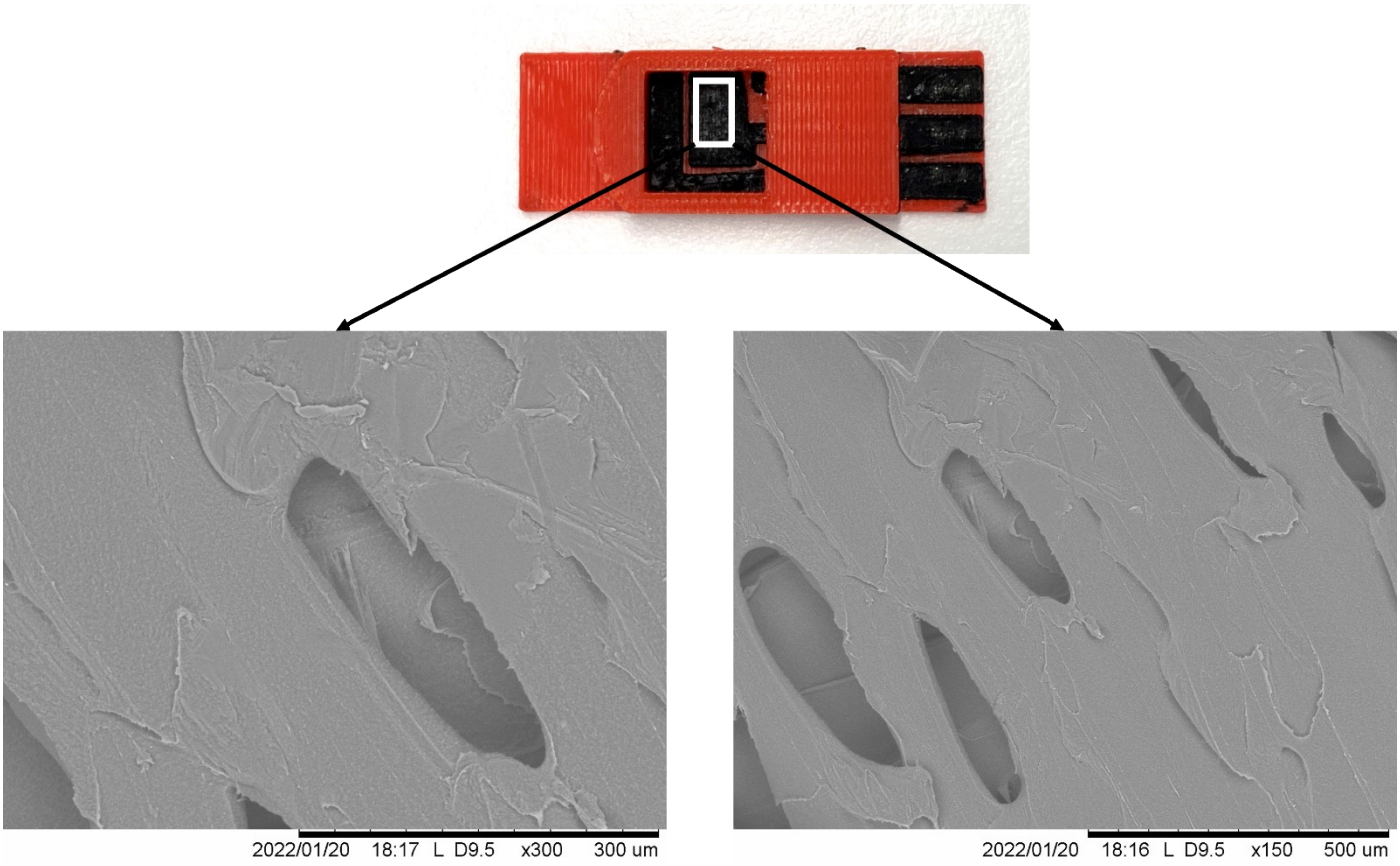

Figure S4. Surface images of the carbon black polylactic acid 3D-printed electrode. An uneven surface can be clearly observed.

Supporting experimental data: hexaammineruthenium (III) chloride in 100 mM KCl

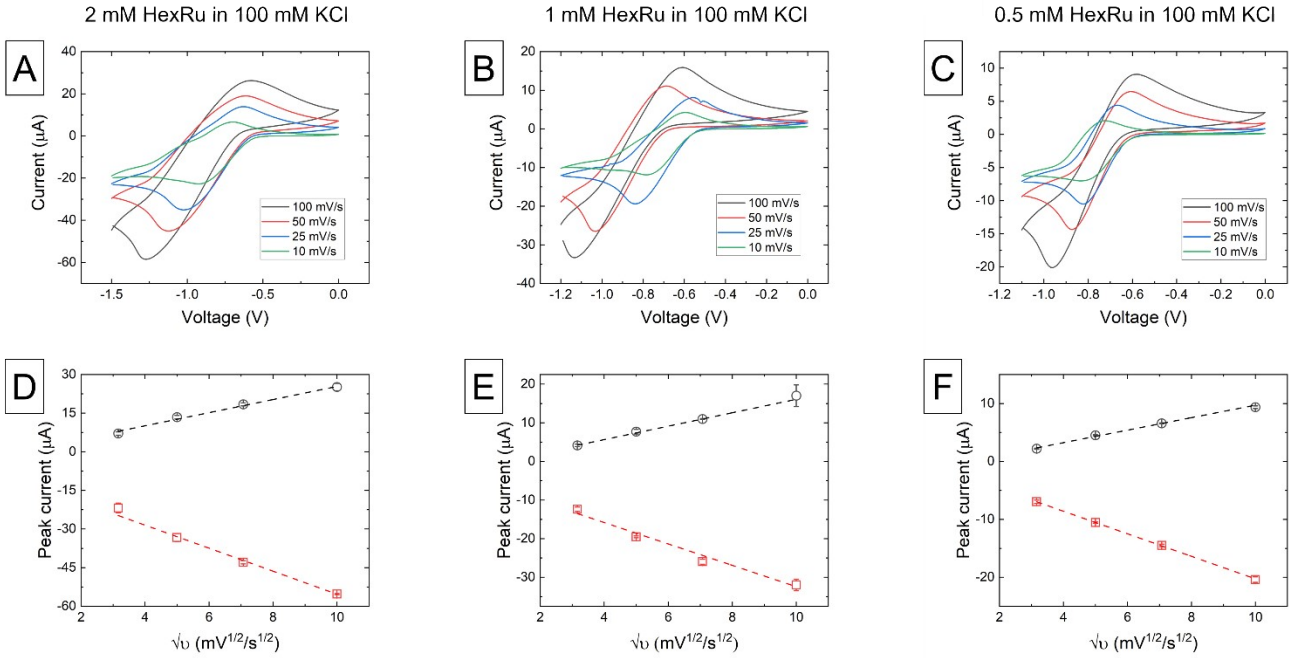

Figure S5. (A)-(C) CV measurements of HexRu in 100 mM KCl at HexRu concentrations of 2 mM, 1 mM, and 0.5 mM, respectively, at increasing scan rates (10, 25, 50, and 100 mV/s). (D)-(F) oxidation and reduction peak currents against the square root of the scan rate for HexRu in 100 mM KCl at HexRu concentrations of 2 mM, 1 mM, and 0.5 mM respectively. Error bars represent ±s.d. (n = 4).

Supporting experimental data: potassium ferricyanide in 100 mM KCl

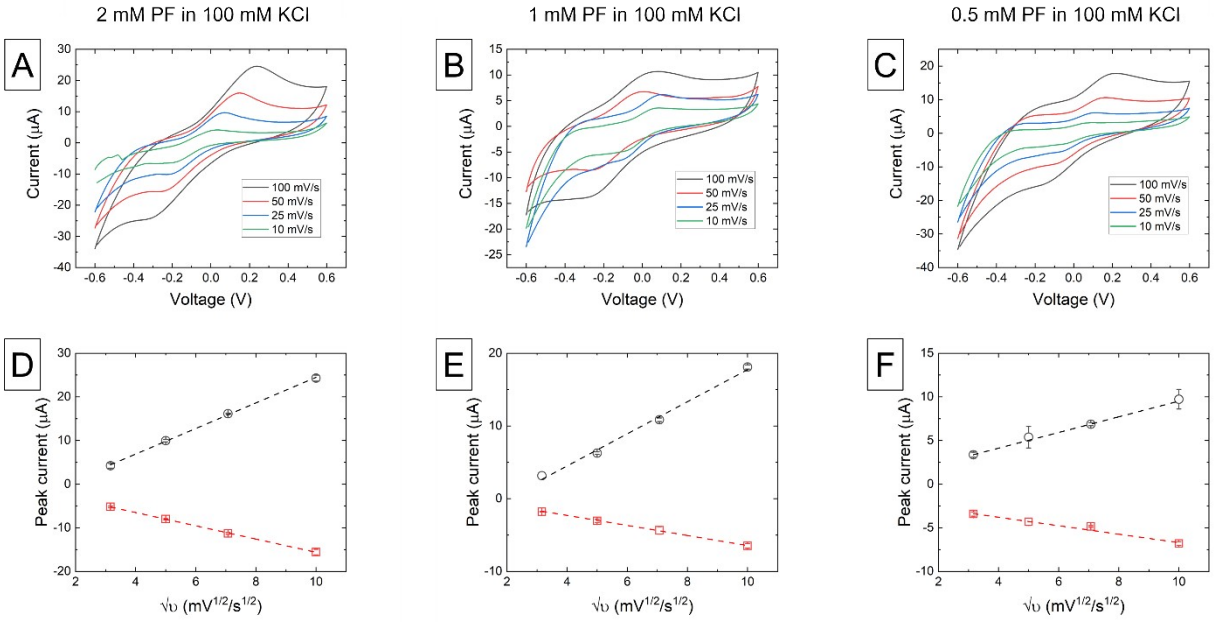

Figure S6. (A)-(C) CV measurements of potassium ferricyanide in 100 mM KCl at potassium ferricyanide concentrations of 2 mM, 1 mM, and 0.5 mM, respectively, at increasing scan rates (10, 25, 50, and 100 mV/s). (D)-(F) oxidation and reduction peak currents against the square root of the scan rate for potassium ferricyanide in 100 mM KCl at potassium ferricyanide concentrations of 2 mM, 1 mM, and 0.5 mM respectively. Error bars represent ±s.d. (n = 4).

Supporting experimental data: dopamine in 1xPBS

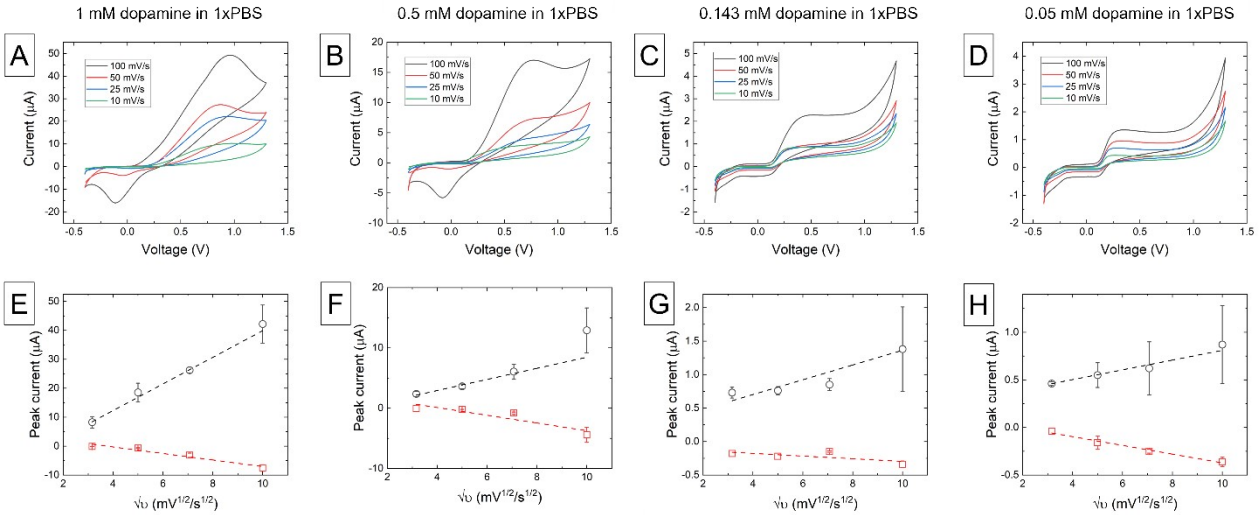

Figure S7. (A)-(D) CV measurements of dopamine in 1xPBS at dopamine concentrations of 1 mM, 0.5 mM, 0.143 mM, and 0.05 mM respectively, at increasing scan rates (10, 25, 50, and 100 mV/s). (D)-(H) oxidation and reduction peak currents against the square root of the scan rate for dopamine in 1xPBS at dopamine concentrations of of 1 mM, 0.5 mM, 0.143 mM, and 0.05 mM respectively. Error bars represent ±s.d. (n = 4).