Supporting Information

Evaluating diverse electrode surface patterns of 3D printed carbon thermoplastic electrochemical sensors

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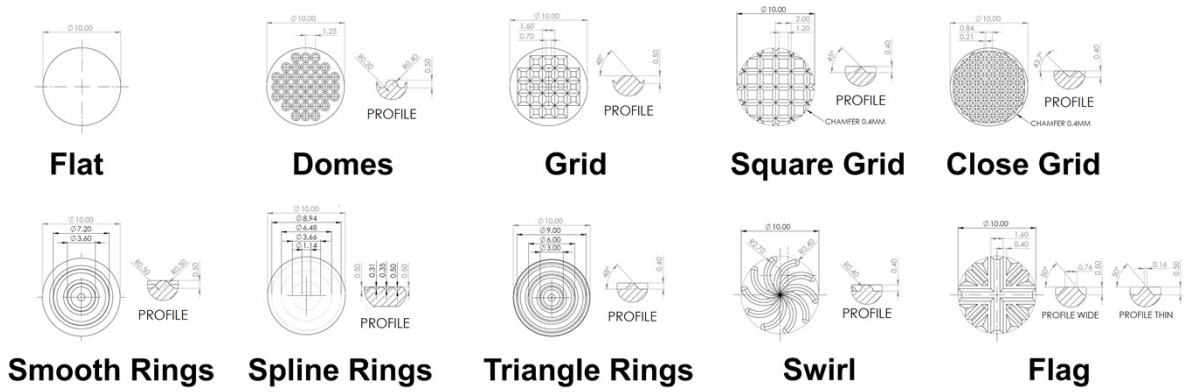

Figure S1. CAD schematics of the patterned surface electrodes to show that the geometric surface area is 10mm.

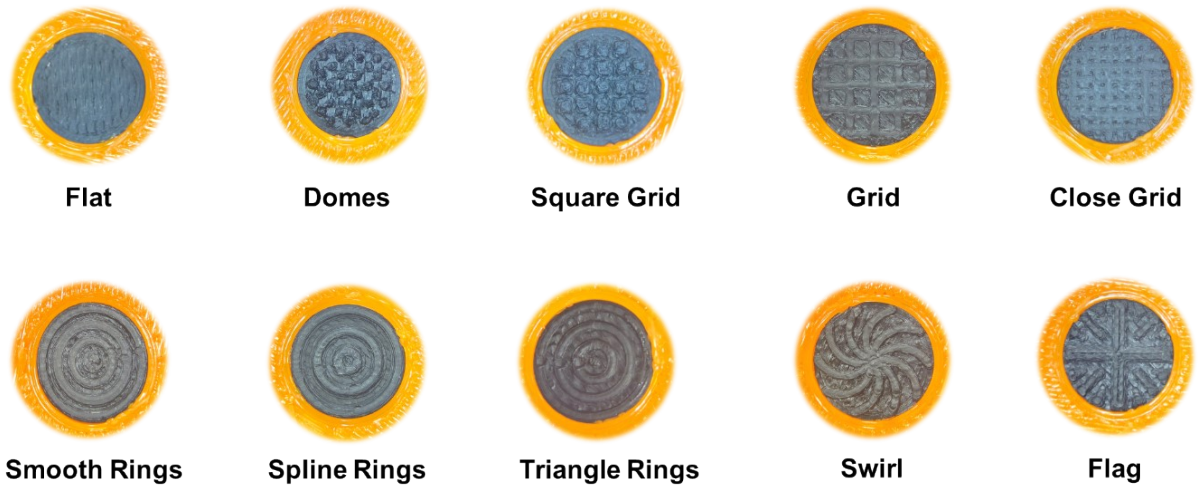

Figure S2. Light microscopy images of the patterned surfaces of the 3D printed CB/PLA electrodes before electrochemical pre-treatment.

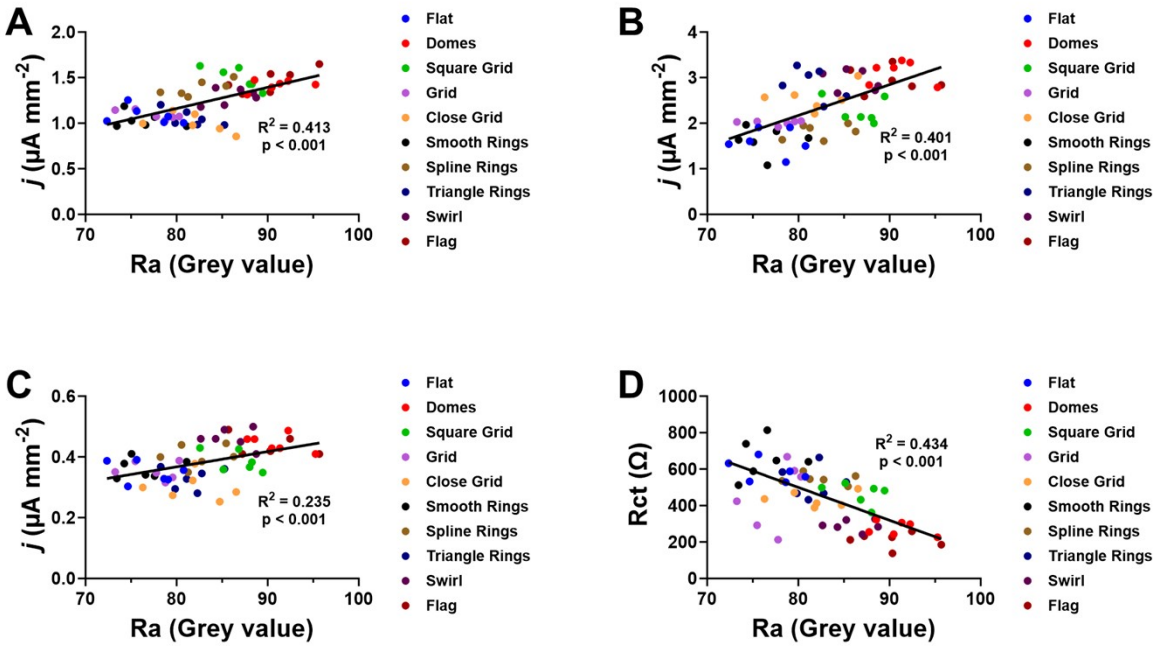

Figure S3. Correlations of electrode surface roughness with electrochemical behaviour of the different patterned electrodes. Current values from measurements conducted in (A) 1 mM FcMeOH in 1 M KCl, (B) 1 mM ferricyanide in 1 M KCl, (C) 1 mM dopamine in 0.1 M PBS buffer and (D) Rct values obtained from EIS measurements in 1 mM ferricyanide and 1 mM ferrocyanide mixture solution 1 M KCl.

1 mM FcMeOH in 1 M KCl

vs	Domes	Square Grid	Grid	Close Grid	Smooth Rings	Spline Rings	Triangle Rings	Swirl	Flag
Domes									
Square Grid									
Grid	p<0.001	p<0.001							
Close Grid	p<0.001	p<0.001							
Smooth Rings	p<0.001	p<0.001							
Spline Rings			p<0.001	p<0.001	p<0.001				
Triangle Rings	p<0.001	p<0.001				p<0.001			
Swirl		P<0.01	p<0.05	p<0.001	p<0.001		p<0.01		
Flag			p<0.001	p<0.001	p<0.001		p<0.001	p<0.05	

1 mM FeCN in 1 M KCl

vs	Domes	Square Grid	Grid	Close Grid	Smooth Rings	Spline Rings	Triangle Rings	Swirl	Flag
Domes									
Square Grid									
Grid									
Close Grid									
Smooth Rings		p<0.05							
Spline Rings									
Triangle Rings	P<0.05	p<0.01							
Swirl					p<0.01		p<0.01		
Flag									

1 mM Dopamine in 0.1 M PBS buffer

vs	Domes	Square Grid	Grid	Close Grid	Smooth Rings	Spline Rings	Triangle Rings	Swirl	Flag
Domes									
Square Grid	p<0.001								
Grid	p<0.001								
Close Grid	p<0.05		p<0.05						
Smooth Rings	p<0.001	p<0.01		p<0.001					
Spline Rings	p<0.001			p<0.001					
Triangle Rings		p<0.01	p<0.001		p<0.001	p<0.001			
Swirl		p<0.01	p<0.001		p<0.001	p<0.001			
Flag		p<0.01	p<0.001		p<0.001	p<0.001			

Figure S4. Tables to show the statistical analysis of the patterned surfaces against the others. Two different inner and outer sphere redox probes were used alongside Dopamine to determine if there were any significant differences between the patterned surfaces to aid in the decision of which electrode had the overall better performance.

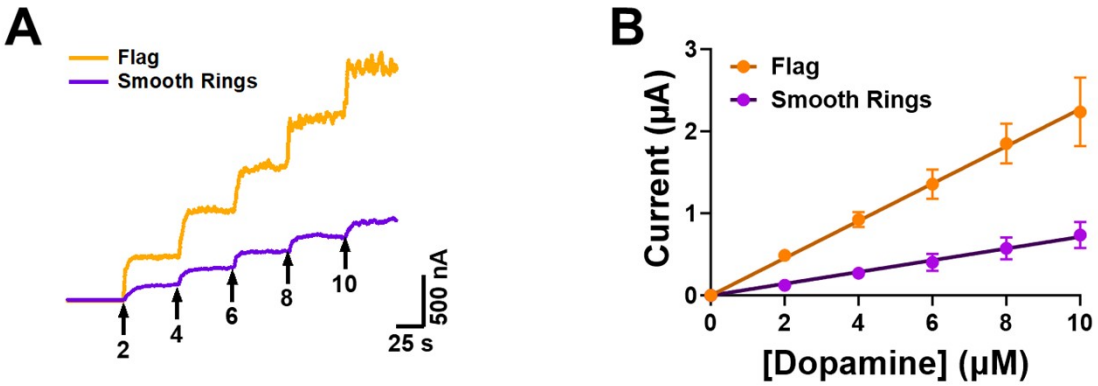

Figure S5. Calibration of dopamine for smooth ring and flag patterned electrodes. (A) Individual Amperometric traces showing the change in the current following the addition of dopamine every 50 seconds. Values are shown in μM with the voltage being held at 0.65 V. (B) Calibration response of flag and smooth ring patterned electrodes. Data is shown as mean ± SD, n = 5.

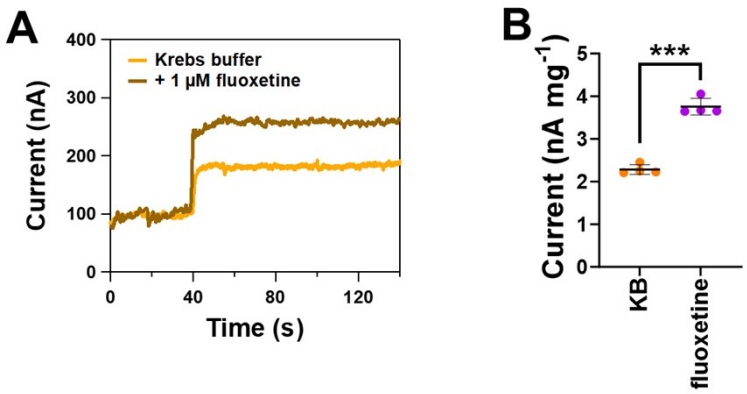

Figure S6: Effect of fluoxetine on colonic tissue measured on the flag patterned CB/PLA electrode. (A) amperometric traces showing the overflow of serotonin from supernatants obtained from colonic tissue incubated in Krebs buffer with and without 1 μM fluoxetine. (B) Differences in the current response in the presence of fluoxetine. Data is shown as mean ± SD, n = 4, ***p<0.001.

Table S1. Table showing the active surface area of the patterned surfaces used to determine the Current Density from the CAD images.

	Area (mm^2)
Flat	78.54
Domes	99.71
Square Draft	100.04
Grid	99.61
Close Grid	100.08
Smooth Rings	100.22
Spline Rings	100.02
Triangle Rings	99.76
Swirl	100.13
Flag	99.9