Electronic Supplementary Information

Nanostructured carbon-fiber surfaces for improved neurochemical detection

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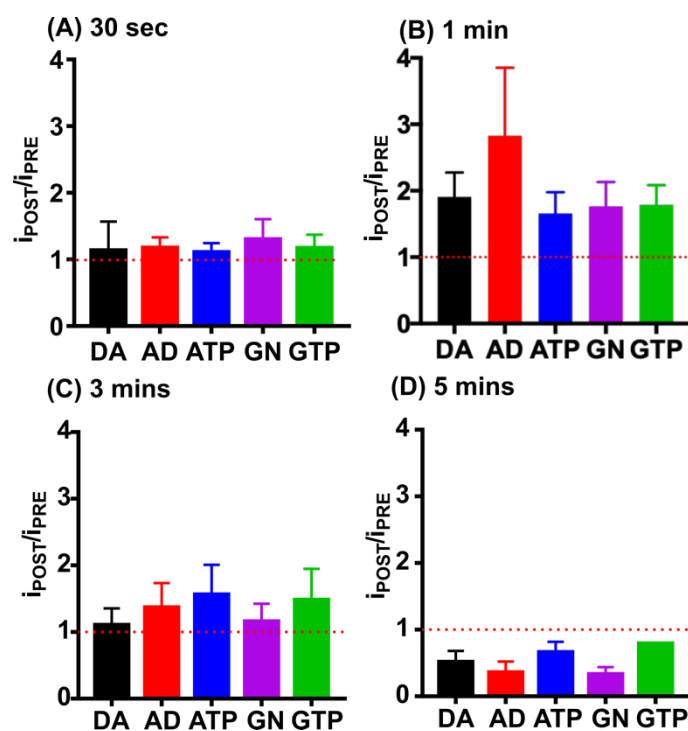Email: Ashley.ross@uc.edu

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Figure S-1. Treatment time impacts the measured change in oxidative current for purines and dopamine. The power and gas flow rate was held constant (100 Watts and 100 sccm) while the plasma treatment time was changed from (A) 30 s (B) 1 min (C) 3 mins and (D) 5 mins (n = 9). Overall, we show that 1 min treatment times are optimal for modifying the carbon-fiber surface.
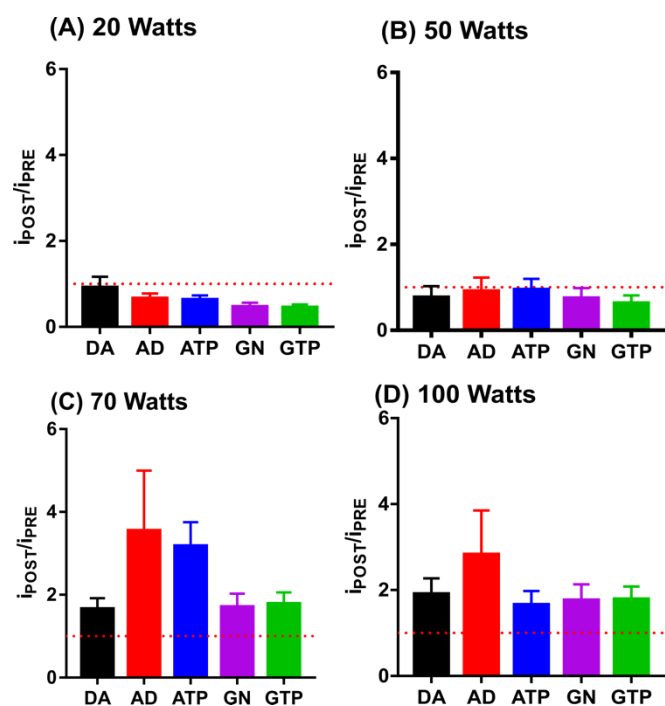
Figure S-2. Treatment power impacts the measured impacts in electrochemical detection of purines and dopamine. The treatment time and gas flow rate was held constant (1 min and 100 sccm) while changing the plasma power (A) 20 Watts (B) 50 Watts (C) 70 Watts and (D) 100 Watts (n = 9). Although 100 Watts enabled measured increases in oxidative current, the treatment was more irreproducible with some electrodes needing to be excluded from the analysis due to the surface being destroyed. Overall, we show that 70 Watts is optimal for modifying the carbon-fiber surface.
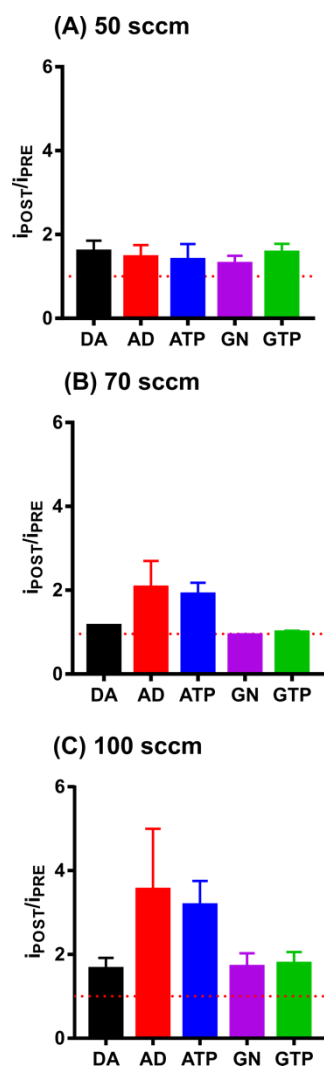
(A) 50 sccm

(B) 70 sccm

(C) 100 sccm

Figure S-3. Flow rate of gas flow during plasma treatment impacts the measured impacts on electrochemical detection of purines and dopamine. The treatment time and power was held constant (1 min and 70 Watts) while changing the plasma flow rate (A) 50 sccm (B) 70 sccm (C) 100 sccm (n = 9).
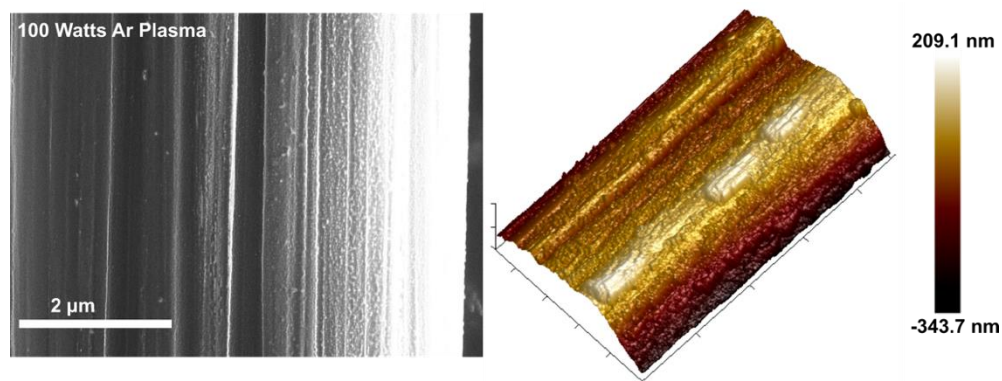
Figure S-4. 100 Watt Ar-plasma treated carbon-fibers were rougher than 70 Watt Ar-plasma treated fibers. The average roughness degree for 100 W was R_a = 79.1 nm.

Table S-1 The percent increase in surface coverage, adsorption strength, and sensitivity after plasma treatment is analyte dependent (n = 5–11)

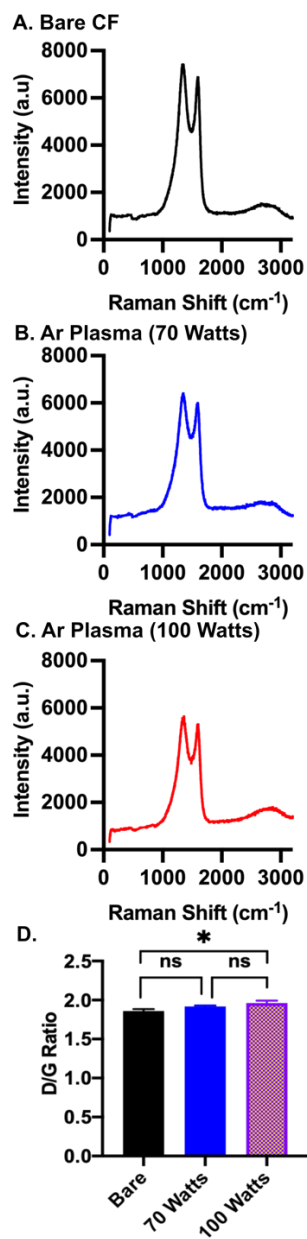|	Surface Coverage (Γ, pmol/cm^2)	Adsorption Strength (b, cm)	Sensitivity (nA/µM)
	% Increase	% Increase	% Increase
AD	33.5%	27.3%	75%
ATP	59.5%	57.1%	320%
GN	30.6%	60.7%	35.7%
GTP	81.8%	100%	42.9%
DA	66.9%	53.2%	68.8%

Figure S-5. The degree of defects on the surface changes after Ar-plasma treatment. Example of Raman spectra for (A) bare carbon-fiber; (B) optimized Ar-plasma (70 Watts) treated carbon-fiber; (C) 100 Watts Ar-plasma treated carbon-fiber. (D)The average D/G ratio was plotted as a function of treatment. Significant changes in the D/G are observed for 100 W Ar-plasma treatments compared to bare carbon-fibers (One-way ANOVA with Bonferroni post-tests, p = 0.0124, n = 12).