Supplementary Information

Carbon Dots-Functionalized Extended Gate Organic Field Effect Transistors-Based Biosensors for Low Abundance Proteins

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1. **Synthesis process of polymer PDBT-*co*-TT**.

The DPP-based polymer PDBT-*co*-TT was synthesized via Stille coupling polymerization.[1]

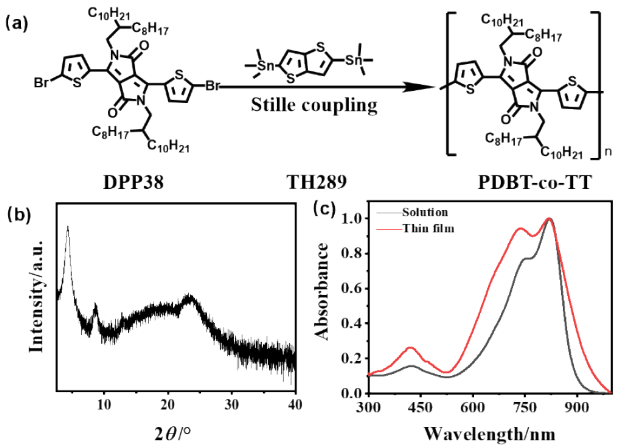

Fig. S1 Synthesis and characterization of PDBT-*co*-TT polymer. (a) Stille coupling polymerization reaction equation. (b) XRD characterization of polymers. (c) UV/vis spectroscopic characterization of polymers.

2. **Synthesis process and characterization of carbon dots**.

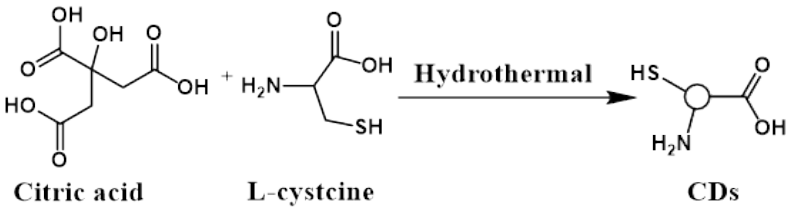

Fig. S2 Synthesis route of CDs material.

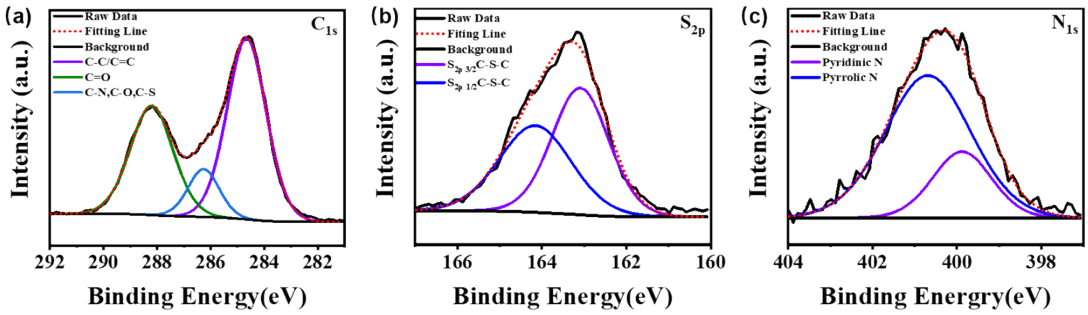

Fig. S3 Characterization of CDs. (a-c) High-resolution spectra of C_{1s} (a), S_{2p} (b), and N_{1s} (c) peaks of the CDs.

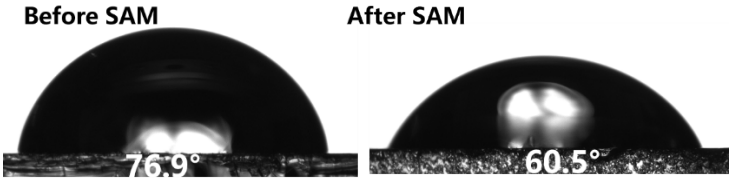

Fig. S4 Contact angle measurement before and after self-assembled of CDs in extended gate.

3. **Related characterization of the EG-OFET-based biosensors**.

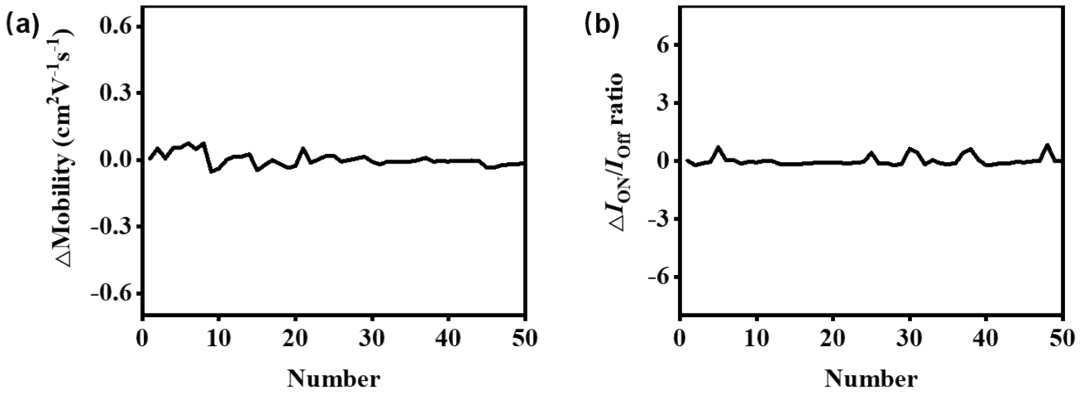

Fig. S5 Electrochemical performances of EG-OFETs (a) The relative change in mobility during 50 consecutive testing cycles of EG-OFET. (b) The relative change in I_{on}/I_{off} ratio during 50 consecutive testing cycles of EG-OFET.

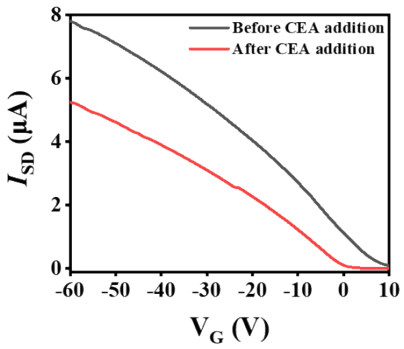

Fig. S6 Change of I_{SD} electrical signals before and after incubation with CEA.

Table S1. Comparison between other biosensors for detecting CEA and the current work.

Biosensor	Technique	Design	LoD	Range	Ref
Electrochemical	EIS	Graphene/PEDOT:PSS modified paper electrode	0.45 ng/mL in standard buffer solutions; 1.06 ng/mL in human serum	0.77–14 ng/mL	2
	DPV	Tetrahedral DNA nanostructures and catalytic hairpin assembly	0.04567 pg/mL	1 - 30000 pg/mL	3
Photoelectrochemical	FL	Polydopamine nanosphere@silver nanocluster system	5.6 nM	0-1000 nM	4
		Polydopamine-coated upconversion nanoparticles	0.031 ng/mL in aqueous solution; 0.055 ng/mL in human serum samples	0.1-100 ng/mL	5
ELISA	Spectroscopic detection	"Carrier-free" nanoparticles	0.005 ng/mL	0.005 - 1 ng/mL	6
SERS	Raman spectroscopy	Silver nanoforest substrate	0.02 pM	100 μM-0.1 nM	7

Electrochemical	OFET	Carbon dots-functionalized	2.7 pg/mL	0.01-1000 ng/mL	This work

Note: EIS = electrochemical impedance spectroscopy; DPV = differential pulse voltammetry; FL = fluorescence; ELISA = enzyme-linked immunosorbent assay; SERS = surface enhanced raman scattering；

4. References

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