Electronic Supporting Information

Detection of Prostate Specific Antigen (PSA) in Human Saliva Using an Ultra-Sensitive Nanocomposite of Graphene Nanoplatelet with Diblock-co-Polymer and Au Electrodes

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Table S1. Performance of the previously reported POC biosensor chips to evaluate PSA in

serum/whole blood/PSA aqueous solution.

| Biosensor method and materials	Technique	Sample/Vol./Time	RoD	LoD	Ref (year)
Si/IDμE/DTSP/Anti-PSA/EA	EIS	Plasma/NA/45min	0.1-100pg/mL	1pg/mL	23 (2011)
AuNPs-Anti-PSA/tPSA/PSA capture antibody	SPR	Serum/NA/3min	0.29-150ng/mL	0.29ng/mL	24 (2012)
GS-MB-CS	CV	Serum/NA/NA	0.05-5mg/mL	13pg/mL	25 (2012)
Paper-SPE/GS/HRP-Ab$_2$/AuNPs	CV, EIS	Serum/10μL/40min	2pg/mL-1000ng/mL	2pg/mL	26 (2012)
Ab/AgMSNs/GCE/AuNPs	CV	Serum/5μL/1hr	0.05-50ng/mL	15pg/mL	27 (2013)
GCE/IL/MWCNTs/Chit/GC/AuNPs–PAMAM	DPV, EIS, CV	Serum/10μL/20min	0.2-40ng/mL	20pg/mL	28 (2013)
DNA/Anti-PSA/DTSP/AuNPs	CV, Amperometric	Serum/NA/1hr	1pg/mL-10ng/mL	1pg/mL	29 (2014)
MHA/EG$_3$SH/AminePEG$_3$biotin/Avidin/GME	EIS	Serum/NA/NA	5-100ng/mL	0.6ng/mL	30 (2014)
Microfluidic ELISA- Fluoroplymer MCF	Calorimetric	Blood/100μL/15min	0.9-60ng/mL	0.08ng/mL	31 (2014)
MWCNTs/IL/Chit/AuNPs–PAMAM	DPV, EIS	Serum/10μL/20min	2pg/mL-80ng/mL	1pg/mL	32 (2014)
Fluoroplymer MCF sandwich assay	Fluorescent assay	Blood/100μL/13min	80pg/mL-60ng/mL	0.08ng/mL	33 (2015)
PSA-MIP-Capacitive Sensor	Electrical capacitance	Serum /250μL/15min	80fg/mL-100ng/mL	80fg/mL	34 (2015)
AgNH$_2$-MCM48/ NH$_2$-GSFCA/GCE	EIS	Serum/NA/2hr	0.01-10ng/mL	2pg/mL	35 (2015)
Silica-NPs/POEGMA-co-GMA/Au-NS	DPV, EIS, CV	PSA/NA/2hr	5pg/mL-1000ng/mL	2.3pg/mL	36 (2015)
Aptamer based MoS$_2$ nano-sheets	Fluorescent assay	Serum/100μL/40min	0.5-300ng/mL	0.2ng/mL	37 (2015)
GQDs@Ag-Ab$_2$/H$_2$O$_2$	Fluorescent assay	Serum/50μL/150min	0.001-20ng/mL	0.3pg/mL	38 (2015)
Graphene quantum dots (Au/Ag-rGO)	ECL	Serum/NA/30min	1-10ng/mL	29pg/mL	39 (2016)
PSA-MIP-SPR Sensor	SPR	Serum/150μL/50min	100pg/mL-10ng/mL	91pg/mL	40 (2016)
Ag-coated SiNPs/Anti-PSA	SERS	Serum/15μL/3hr	0.001-1000ng/mL	0.11pg/mL	41 (2016)
(TMDC)MoS$_2$/EHDA/IDT	Electrical impedance	Serum/100μL/40sec	1-800ng/mL	0.1ng/mL	42 (2017)
PSA-AuNPs-Dpa-melanin CNSs	CV, EIS	Serum/10μL/50min	0.01-100ng/mL	2.7 pg/mL	43 (2017)
rGO-MWCNT/AuNPs nanocomposite	DPV, EIS	Serum/NA/40min	5pg/mL-100ng/mL	1pg/mL	44 (2017)
ITO glass/SnS$_2$@mpg-C$_3$N$_4$ nanocomposite	PEC	Serum/6μL/1hr	50fg/mL-10ng/mL	21fg/mL	45 (2017)
Ag@SiO$_2$@SiO$_2$-RuBpy core-shell NPs	Fluorescent assay	Serum/30μL/1hr	0.1-100ng/mL	27pg/mL	46 (2017)
WO$_3$-Au/ITO/Ab$_1$/PSA/rGO-Ca:CdSe-Ab$_2$	PEC	Serum/NA/NA	5pg/mL-50ng/mL	2.6pg/mL	47 (2017)
Paper/GRP/PS-b-PAA/Au/DTSP/EA	Electrical impedance	Saliva/10μL/3-5min	40fg/mL-100ng/mL	40fg/mL	This work
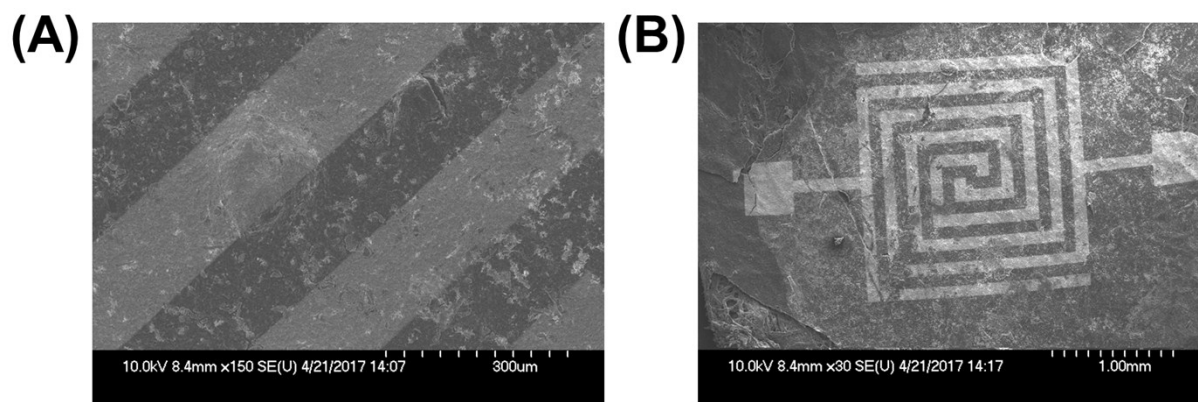
Figure S1. SEM images of the developed paper-based electrical biosensor chip. (A) Au electrodes immobilized with anti-PSA antibody. (B) Sensor chip tested with human saliva sample.
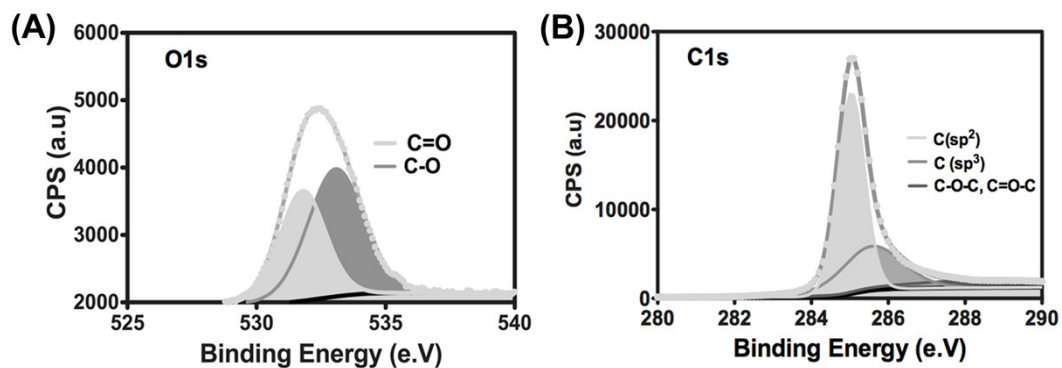
Figure S2. XPS narrow scan regions for C1s and O1s from Figure 3 was de-convoluted showing different bond types present in GRP-polymer.
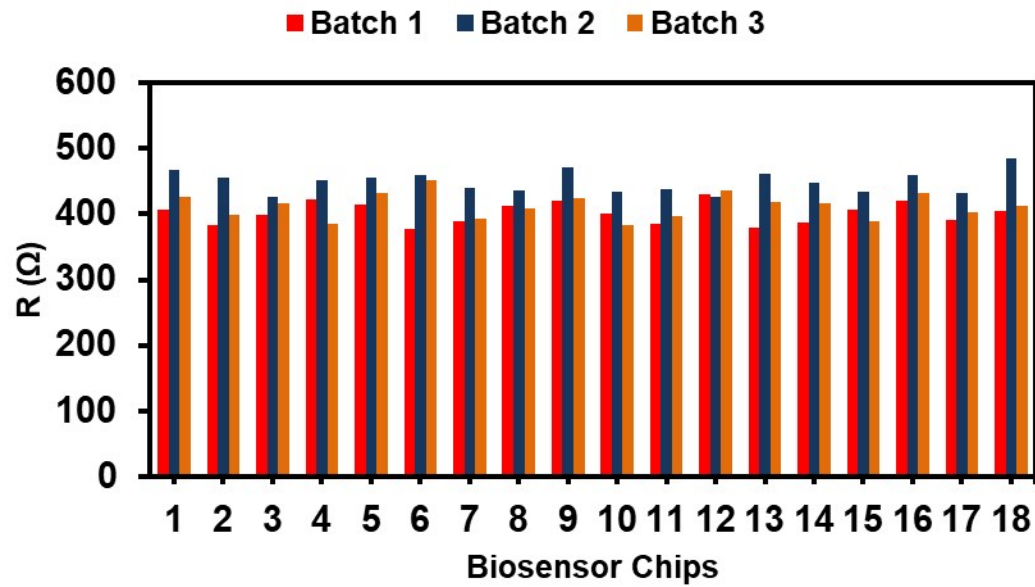
Figure S3. Reproducibility of biosensor chips before immobilizing anti-PSA antibody and testing human saliva sample. For each batch, among 24 sensor chips, 18 sensor chips have shown electrical resistance of 416.52 Ω with SD of ±17.82.
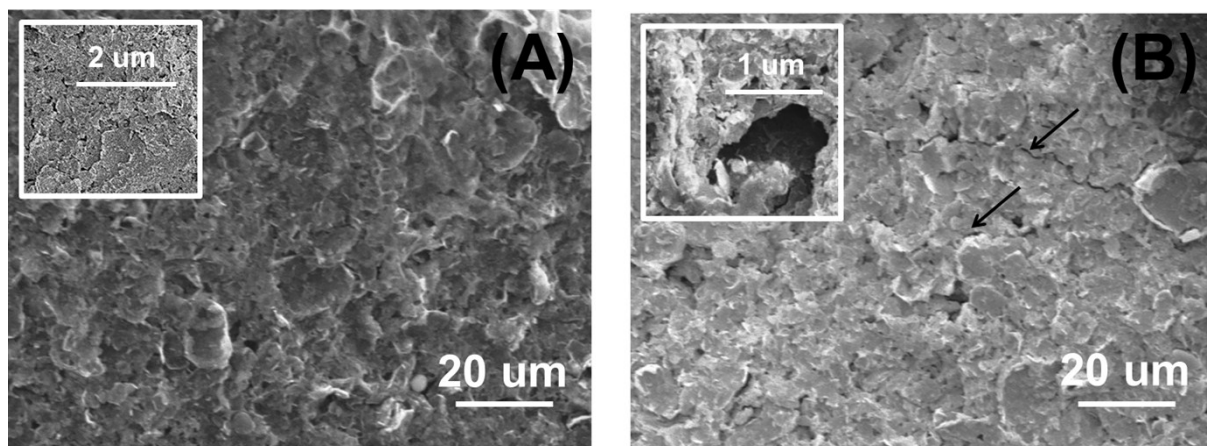
Figure S4. High resolution SEM images of nanocomposite of GRP/PS$_{67}$-b-PAA$_{27}$ coated on filter paper. (A) Week 1. (B) Week 9. Inset reveals high resolution SEM images to study the quality of the nanocomposite. Arrows in (B) clearly reflect the defects at week 9.