Electronic Supplementary Information

Electrospun TiO_2-Nanofibers Integrated Lab-on-a-Disc for Ultrasensitive Protein Detection from Whole Blood

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Fig. S1. Experimental set up for chemiluminescence detection on a disc. The chemiluminescence signal is measured by a home built detection system equipped with a cooled PMT module (PMC-100-1, Becker & Hickl GmbH)

Fig. S2. Microscopic analyses of the electrospun TiO_2 NFs prepared at various flow rates (a, d) 0.3 mL h^{-1}, (b, e) 1 mL h^{-1}, and (c, f) 3 mL h^{-1} at an applied voltage of 15 kV and a fixed distance of 10 cm between the needle and the grounded substrate.

Fig. S3. Comparison of the TiO_2 NF mats on PDMS pre-cured for 3 min and 30 min: (a) TiO_2 NF mat submerged into PDMS pre-cured for 3 min and (b) detachment of the TiO_2 NF mat from the PDMS pre-cured for 30 min at 65°C.

Fig.S4. Tack test to measure the adhesion force of the pre-cured PDMS layer, cured for different lengths of time.

Fig. S5. TEM–EDS analysis of electrospun TiO_2 NFs.

Fig. S6. Histogram of the TiO_2 NF diameter for NFs fabricated at a flow rate of 0.3 mL h^{-1}, an applied voltage of 15 kV, and a distance of 10 cm between the needle and the grounded substrate.

Fig. S7. Standard curves for the optimization of capture and secondary antibody concentrations.

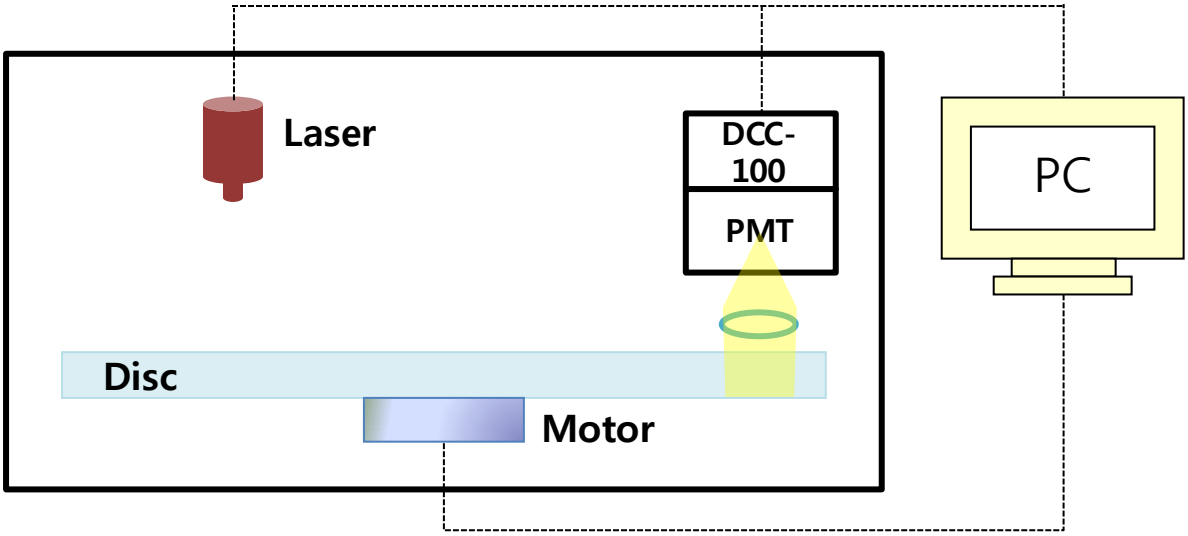
Fig. S8. Calibration graphs for the detection of CRP spiked in a CRP-free serum created by plotting the RLU versus the CRP concentration for a 96-well plate [LOD: 286 pg/mL (2288 fM)], LD TiO_2 NFs assembled on a Si substrate [LOD: 8 pg/mL (64 fM)], HD TiO_2 NFs assembled on a Si substrate [LOD: 2.5 pg/mL (20 fM)], and HD TiO_2 NFs assembled on a lab-on-a-disc [LOD: 0.8 pg/mL (~6 fM)]. Error bars indicate the standard deviation of at least three independent measurements.

Fig. S9. Calibration graphs for the detection of cTnI spiked in healthy serum and PBS created by plotting the RLU versus the cTnI concentration in serum for HD TiO_2 NFs assembled on a disc [LOD: 37 pg/mL (1.5 pM)], 96-well plate [LOD: 824 pg/mL (33 pM)], HD TiO_2 NFs assembled on a Si substrate [LOD: 64 pg/mL (2.6 pM)], and cTnI in PBS for HD TiO_2 NFs assembled on a Si substrate [LOD: 4.4 pg/mL (0.18 pM)]. Error bars indicate the standard deviation of at least three independent measurements.

Table S1. Weight and atomic composition of a single TiO_2 NF by TEM–EDS analysis.

Table S2. Surface atomic composition of TiO_2 NFs from XPS

Table S3. Spin program for the immunoassay in a centrifugal microfluidic disc.



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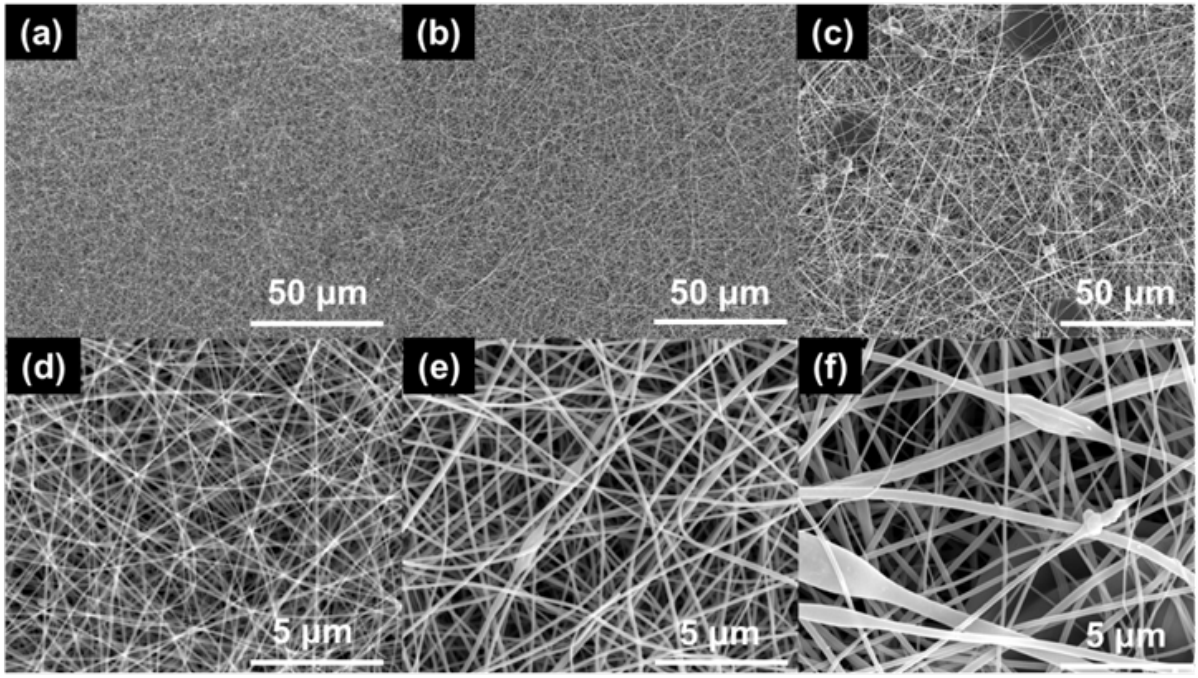

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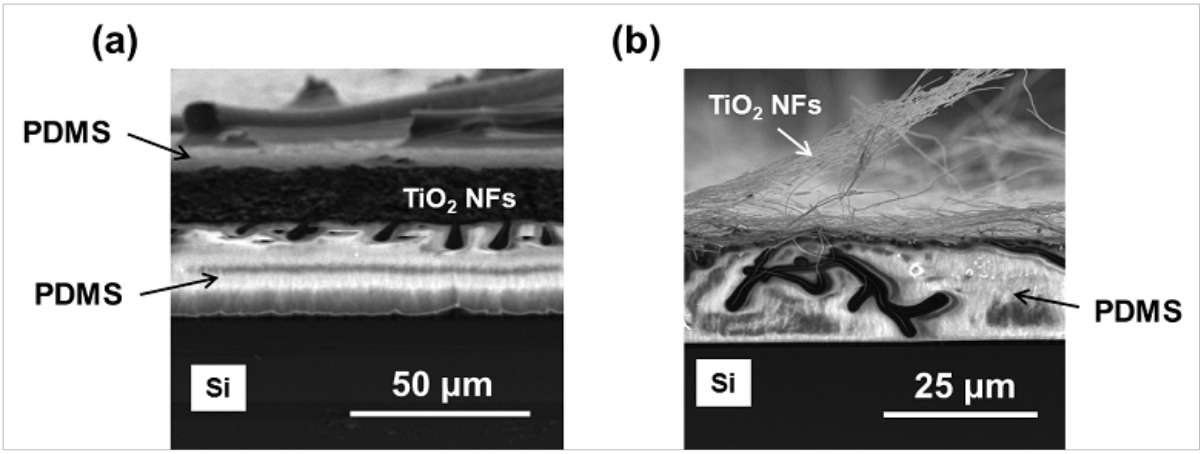

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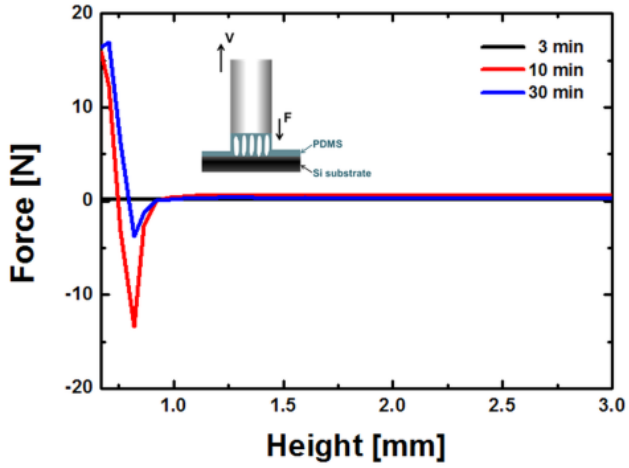

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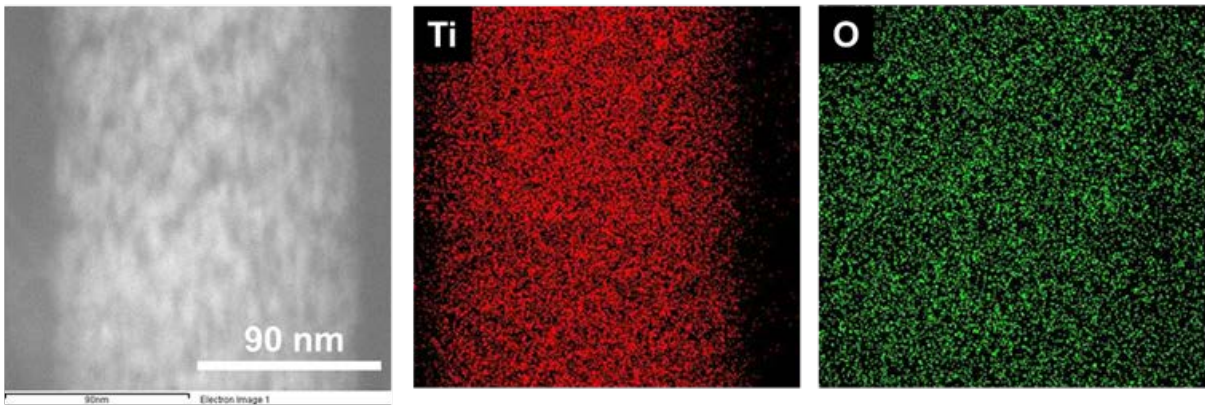

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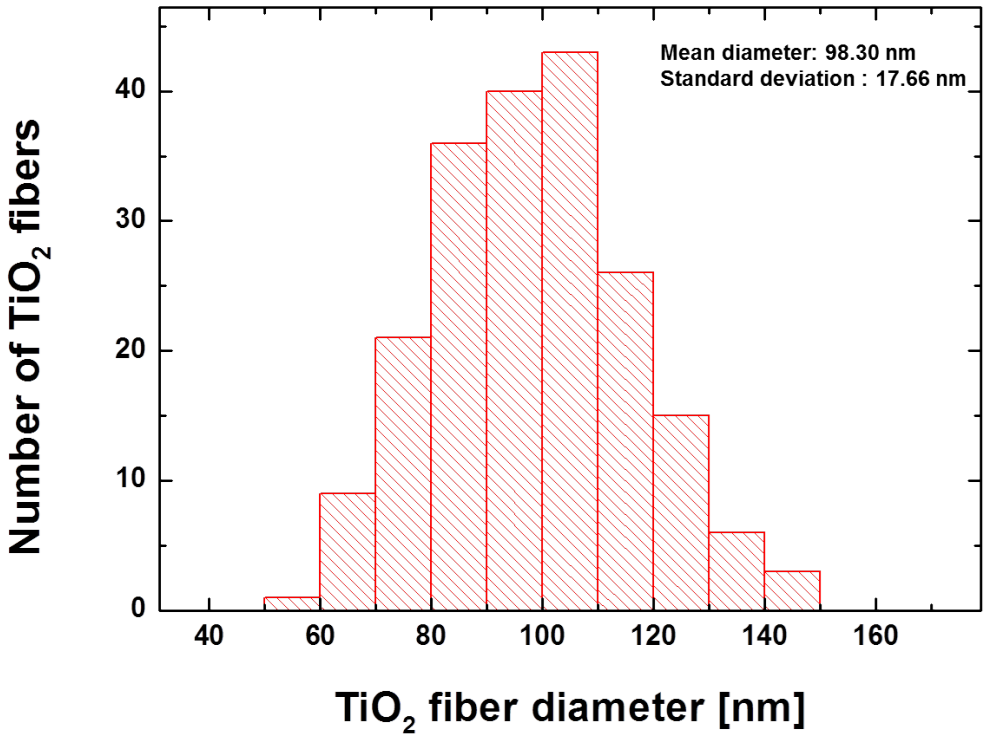

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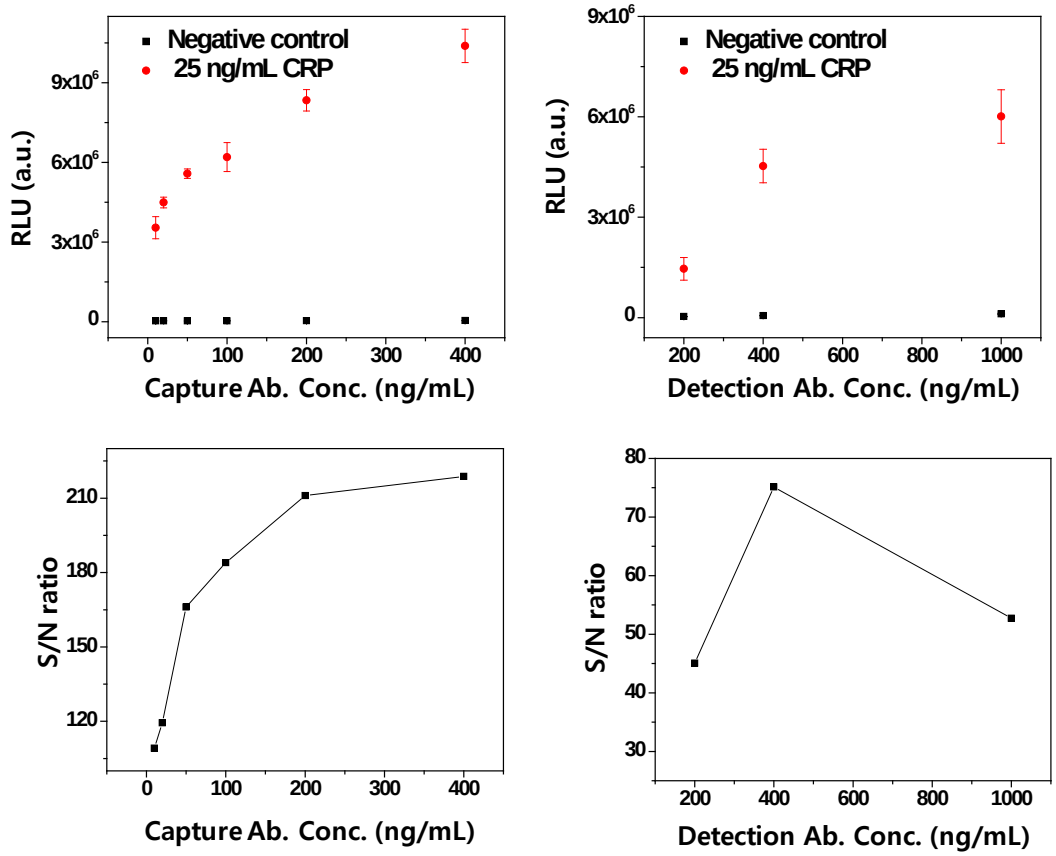

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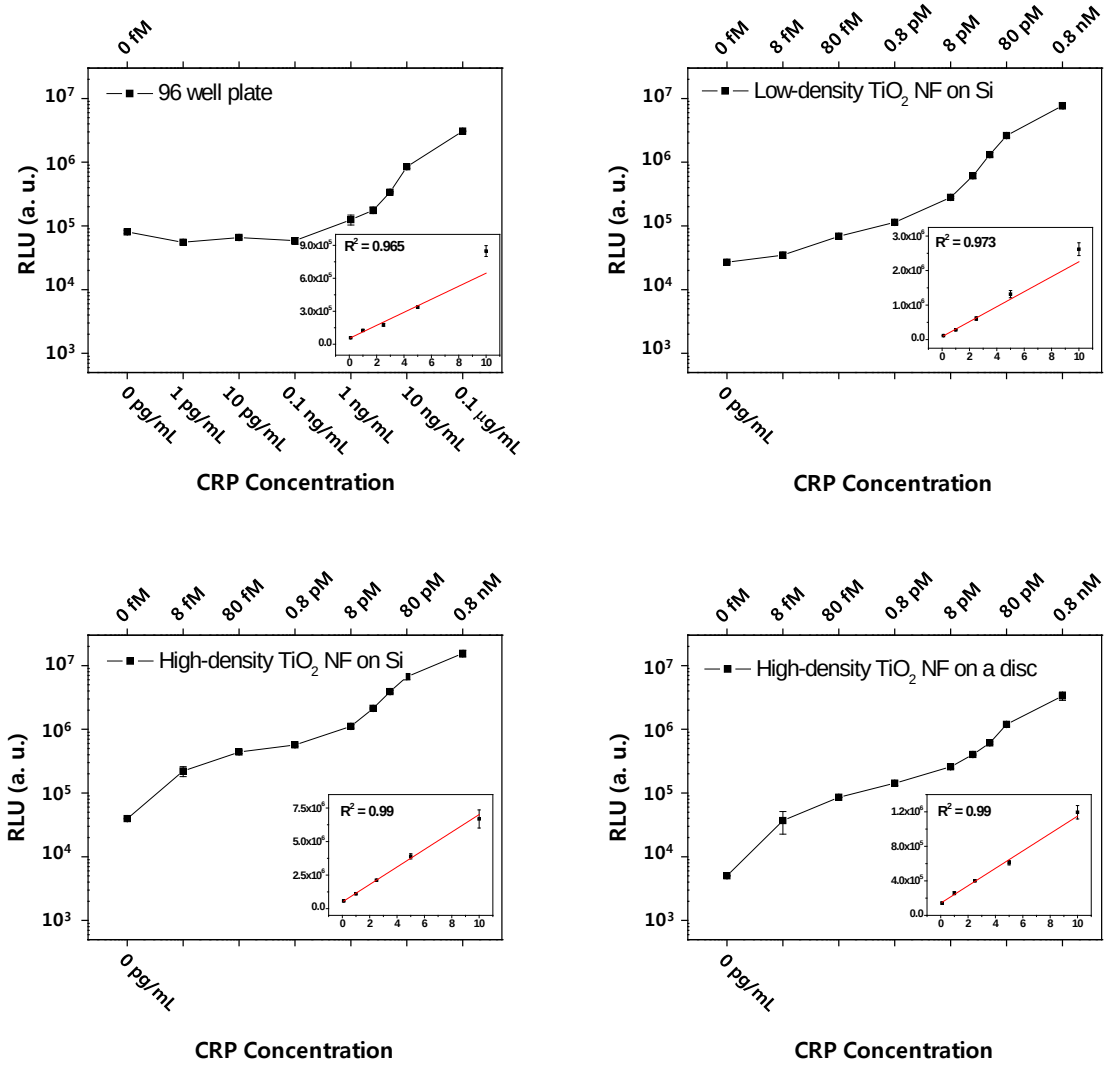

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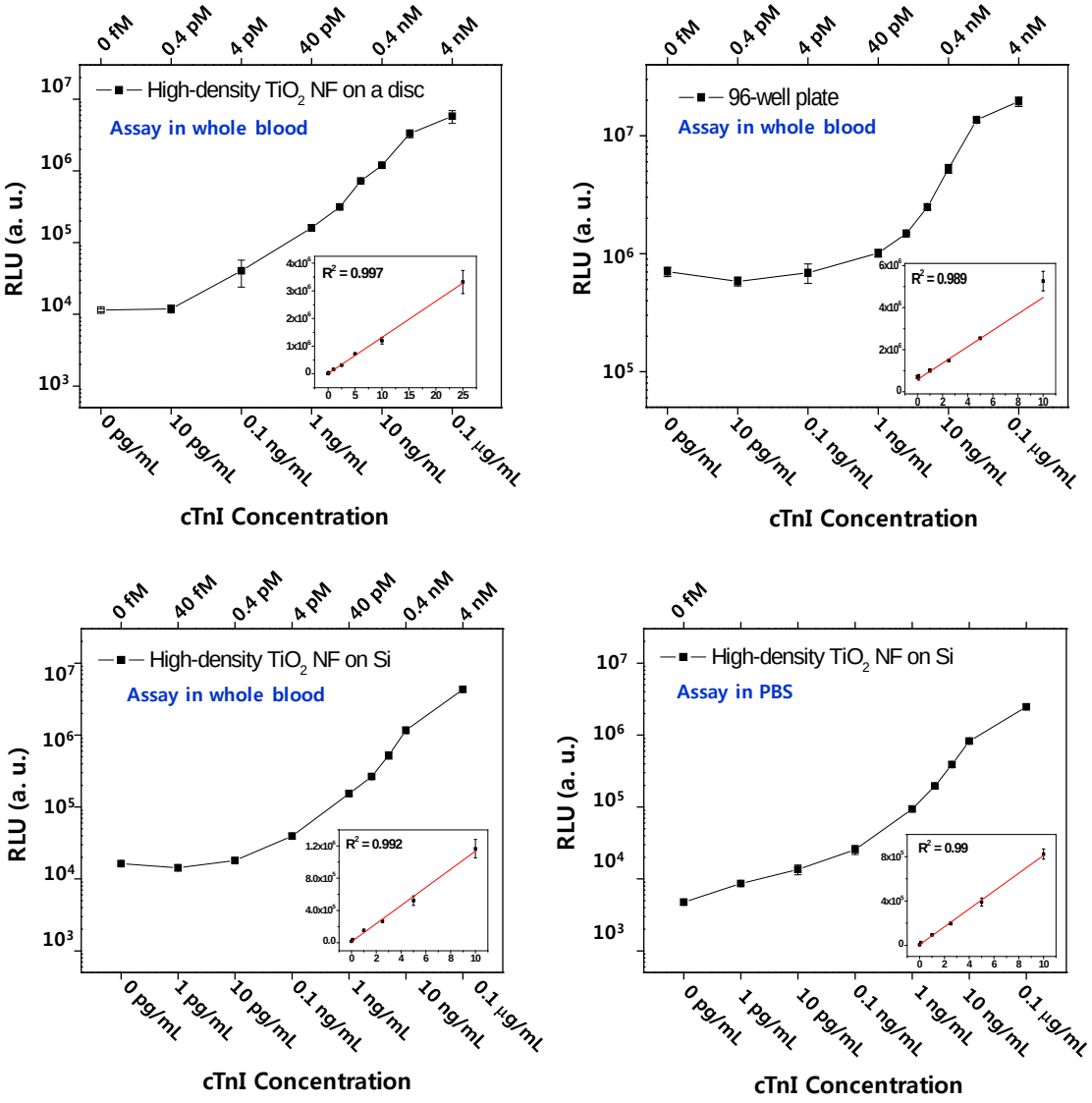

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Table S1. Weight and atomic composition of a single TiO_2 NF by TEM–EDS analysis.

Element	Weight (%)	Atomic (%)
C K	53.79	72.70
O K	17.22	17.47
Ti K	29.00	9.83
Totals	100.00	100.00

Table S2. Surface atomic composition of TiO_2 NFs from XPS.

Element	TiO_2	Ab_1/TiO_2	$CRP/Ab_1/TiO_2$
	Atomic (%)	Atomic (%)	Atomic (%)
Si2p	15.86	7.88	6.11
S2p	-	0.34	0.59
C1s	23.48	47.36	54.27
N1s	1.17	9.43	12.39
Ti2p	8.09	3.25	1.56
O1s	51.4	31.74	25.07
Totals	100.00	100.00	100.00

Table S3. Spin program for the immunoassay in a centrifugal microfluidic disc.

Spin No.	Speed (rpm)	Valve No.	Time (s)	Operation
1	3600		60	blood separation
2	2400	1	3	open valve to transfer the plasma into the chamber containing 8 μL of detecting antibodies conjugated with HRP
3	15 Hz, 15°		5	mix plasma and detecting antibodies
4	2400	2	3	open valve to transfer the mixture into binding reaction chamber
5	60 Hz, 2°		1200	mix capture antibodies on TiO_2 NF mat and plasma-detecting antibodies mixture
6	2400	3	10	open valve to remove the mixture
7	2400	4	4	open valve to transfer washing buffer
8	30 Hz, 30°		120	mix washing buffer and wash TiO_2 NF mat
9	2400		4	transfer washing buffer
10	30 Hz, 30°		120	mix washing buffer and wash TiO_2 NF mat
11	2400		4	transfer washing buffer
12	30 Hz, 30°		120	mix washing buffer and wash TiO_2 NF mat
13	2400		20	remove the remaining washing buffer
14		5		close valve
15	2400	6	10	open valve and transfer the chemiluminescent substrate
16	30 Hz, 2°		60	mix substrate and the immunoreagents on TiO_2 NF mat
17	2400	7	10	open valve and transfer the reacted substrate to the detection chamber
Total time			~ 30 min	