Supporting Information for:

Highly sensitive FET-type aptasensor using flower-like MoS_2 nanospheres for real-time detection of arsenic(III)

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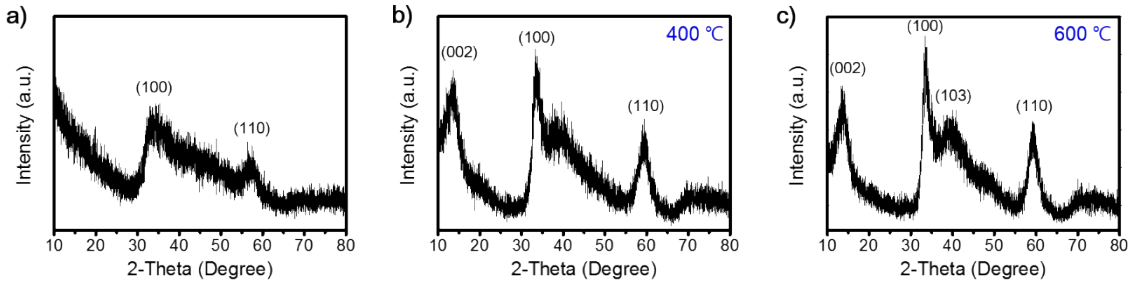

Fig. S1. XPS patterns of FMNSs a) before annealing, b) after annealing at 400℃, and c) after annealing at 600℃.

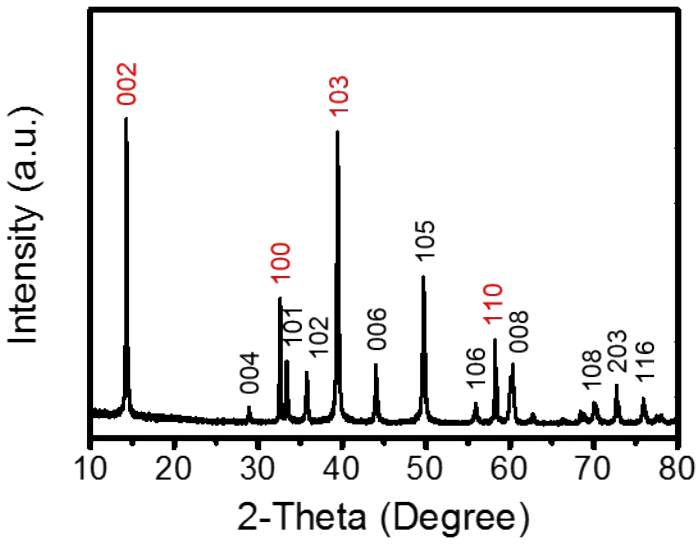

Fig. S2. XPS pattern of bulk-MoS_2.

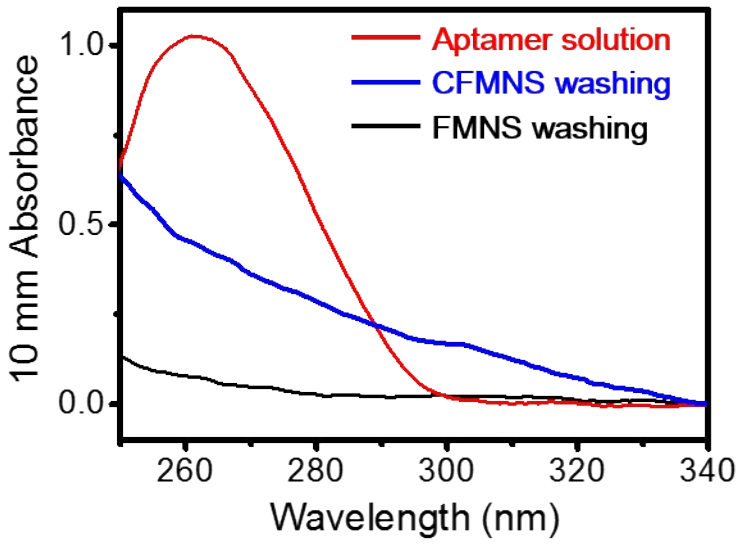

Fig. S3. The absorbance of immobilized aptamer on FMNS and CFMNS surfaces before and after washing.

- NanoDrop 2000/2000c spectrophotometer was used to evaluate the concentration of immobilized aptamer on the FMNS and CFMNS surfaces. The solution of Ars-3 aptamer (1 μM) was measured before introduced into the FMNS and CFMNS surfaces (Fig. S3, red-line), revealing 32.2 ng/mL concentration. The aptamer solution was exposed to the surfaces for 6h, and then rinsed with buffer solution. The washed solutions for the FMNS and CFMNS samples were measured (Fig. S2, black and blue lines). Each of concentrations after washing was 15.1 ng/μL and 2.6 ng/μL. From these results, 17.1 and 29.6 ng/μL concentrations of aptamer were immobilized on the FMNS and CFMNS surfaces, respectively.

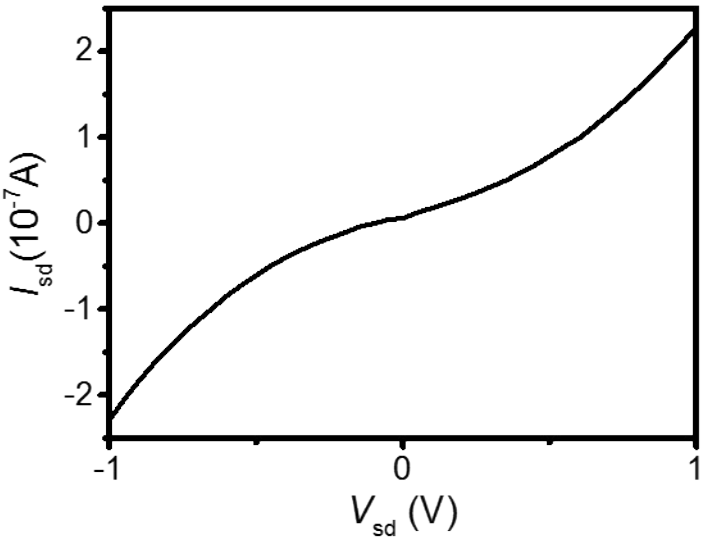

Fig. S4. Current–voltage (*I*–*V*) curve of FMNSs-based electrode.

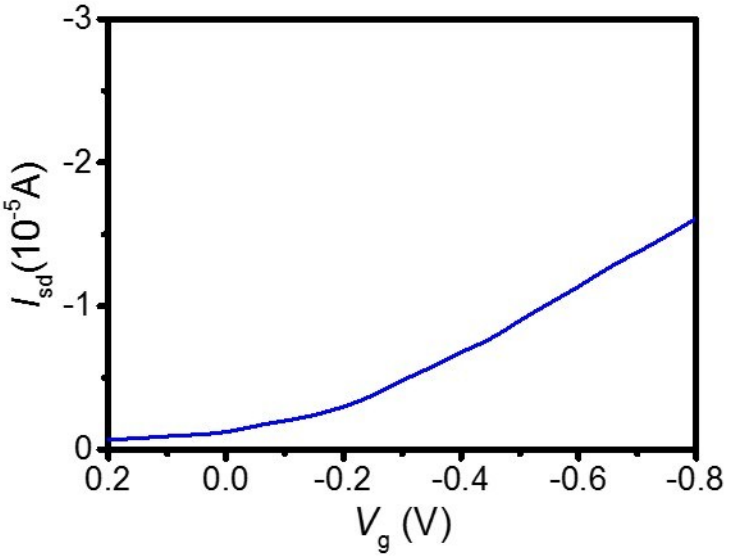

Fig. S5. Transfer characteristics of CFMNS sensor for a constant V_{sd} = – 100 mV (V_g, 0.2 to – 0.8 V).

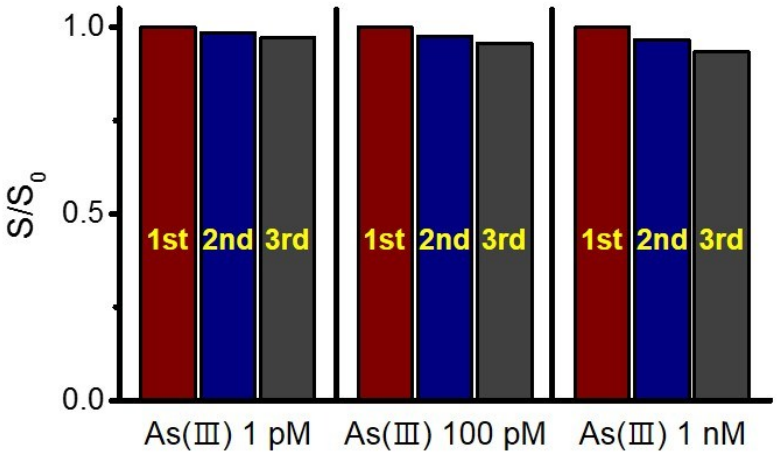

Fig. S6. A re-useable FET system for As(III) detection; the sensitivity changes were measured through the consecutive assay of three times at 1 pM, 100 pM, and 1 nM concentrations of As(III) (the sensitivity change was calculated as S/So, where So is the initial sensitivity and S is the measured sensitivity after washing and rinsing process).

- Fig. S6 demonstrates the reusable property of the FET sensor (the sensitivity changes were calculated as S/S_o, where S_o is the initial sensitivity and S is the measured sensitivity after the washing and rinsing processes). The sensitivity changes were calculated three times at various concentrations of As(III) (1 pM, 100 pM, and 1 nM). The recycle process is composed of two steps: (i) introduction of the As(III) into the aptasensor, (ii) washing with dilute sodium chloride solution and PBS, and then drying under nitrogen stream. The FET-type aptasensors showed an efficient repeatability with various As(III) concentrations by regenerating the aptamer in dilute NaCl solution. Although, the sensitivity decreased slightly at 1 nM concentration of As(III) (*ca*. 6%) due to aptamer degradation, this result indicates that the aptasensor features reproducible and reusable properties.

Table. S1. Zeta potential measurements for FMNS samples.

FMNSs	Zeta Potential (mV)
Sample 1	-73.46
Sample 2	-79.54
Sample 3	-84.60

Table S2. Sensing performance compared with previous researches using electrochemical method.

Detection methods	Sensing materials	Detection limit	References
Electrochemistry	Au nanoparticles	200 pM	19
Electrochemistry	Ag /GO nanocomposites	240 pM	41
Electrochemistry	FePt nanoparticles	10 nM	42
Electrochemistry	SnO_2 nanosheets	50 nM	43
Electrochemistry(FET)	CPPy-coated MoS_2 nanospheres	1 pM	This work

Table S3. Inductively Coupled Plasma-Atomic Emission Spectrometer (ICPS) analysis for Han River.

Metal	Weight concentration (mg/L)	Molar concentration (mM)
As	0.381	0.0052
Mg	8.488	0.3486
Fe	0	0
Zn	0	0
Cu	0	0
Mn	0	0
Li	0	0
Cd	0	0
Co	0	0
Ni	0	0