Supporting Information

Insight into the Unique Fluorescence Quenching Property of Metal-Organic Frameworks upon DNA Binding

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Materials and reagents

The DNA oligonucleotides were synthesized by Shanghai Sangon Biological Engineering Technology & Services Co., Ltd. (China). The sequences of the DNA oligonucleotides were as follows:

FAM-P1: 5′-CTGTCTTGAACATGAGTT-FAM-3′

TAMRA-P1: 5′-CTGTCTTGAACATGAGTT-TAMRA-3′

T1: 5′-AACTCATGTTCAAGACAG-3′

$Cr(NO_3)_3 \cdot 9H_2O$, terephthalic acid and polyethyleneimine (PEI, branched, M.W. 10,000) were purchased from Alfa Aesar. $HAuCl_4 \cdot 4H_2O$ was from Aladdin Reagent Company (Shanghai, China). Sodium dodecylbenzenesulfonate (SDBS) and Hexadecyltrimethylammonium bromide (CTAB) were purchased from Sinopharm Chemical Reagent Co. Ltd (Shanghai, China). Graphene and amino-functionalized carbon nanotubes (CNT-NH_2) were purchased from JCNANO Tech Co., Ltd (Nanjing, China). Other reagents and chemicals were of analytical grade. All aqueous solutions were prepared from deionized water (18 $M\Omega \cdot cm^{-1}$, PURELAB Classic, PALL, USA).

Apparatus and measurements

The X-ray diffraction patterns were obtained on an X-ray powder diffractometer (XRD, X'TRA, Cu Kα radiation, Switzerland). The morphology of MOF nanosheets and nanoparticles were characterized by transmission electron microscopy (TEM, JEM-200CX, Japan) and scanning electron microscope (SEM, S-4800, Japan). IR spectra were collected on a Nicolet 6700 FT-IR spectrometer (Thermo Scientific, U.S.A.). Fluorescence spectra were recorded on a RF-5301PC spectrophotometer (Shimadzu, Japan). Zeta potential measurements were performed on a Zetasizer Nano-Z system (USA).

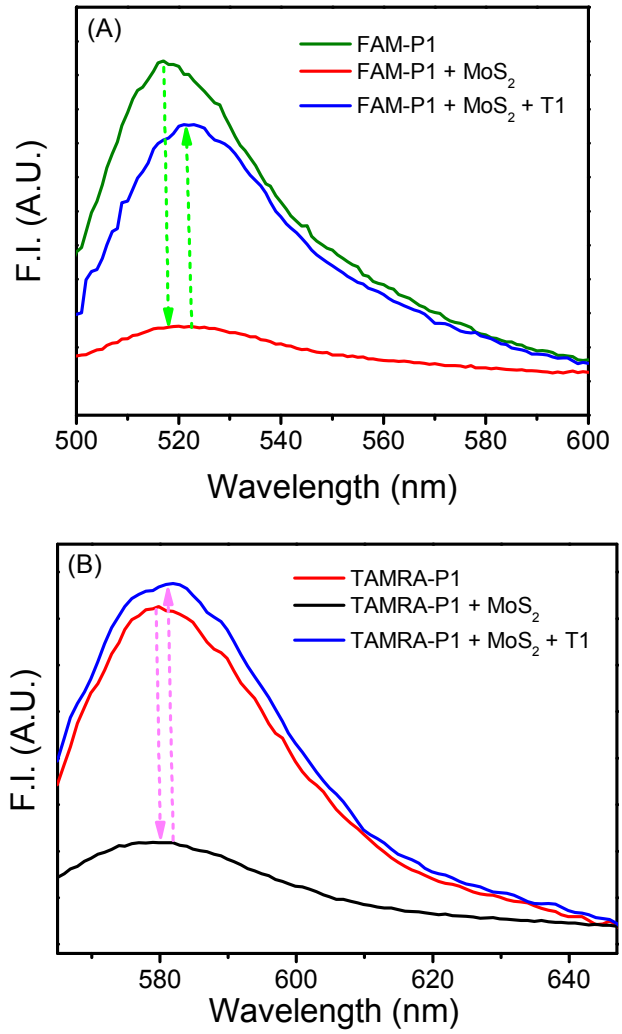

Figure S1. Fluorescence quenching properties of MoS_2 nanosheets toward dye-labeled P1. (A) Fluorescence spectra of FAM-P1 (15 nM) in the presence of 20 nM T1 mixed with 0.2 mg·mL^{-1} MoS_2 nanosheets in 10 mM PBS (pH 7.38). (B) The fluorescence spectra of TAMRA-P1 (15 nM) in the presence of 20 nM T1 mixed with 0.2 mg·mL^{-1} MoS_2 nanosheets in 10 mM PBS (pH 7.38). FAM-P1 and TAMRA-P1 were probes for a *Homo sapiens* tumor suppressor gene.

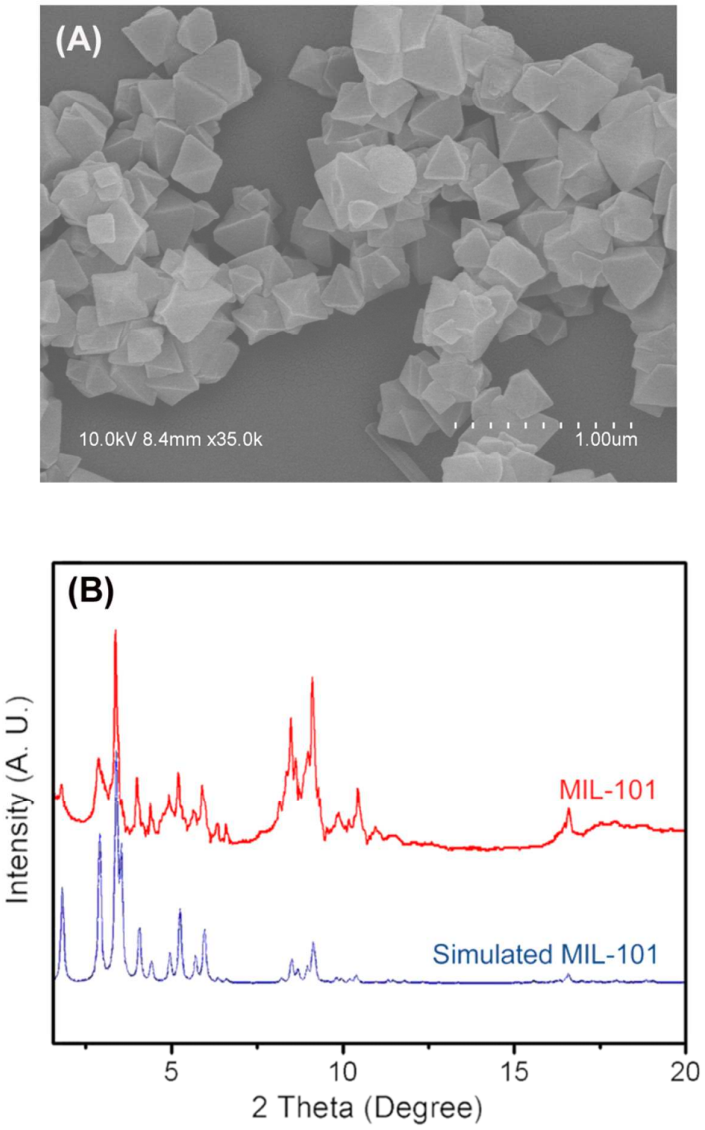

Figure S2. Characterization of MIL-101. (A) SEM image of MIL-101 and (B) the experimental and simulated XRD patterns of MIL-101.

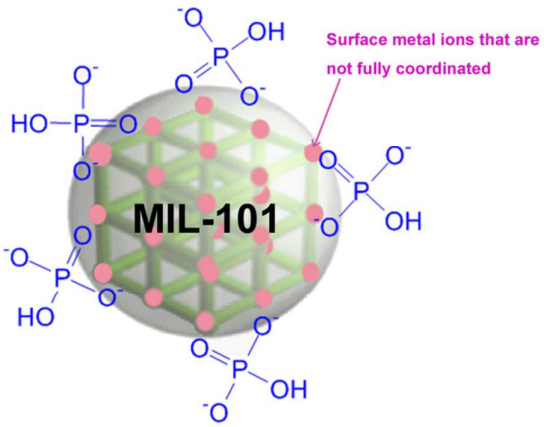

Figure S3. Schematic illustration of the adsorption/coordination of HPO_4^{2-} on MIL-101.

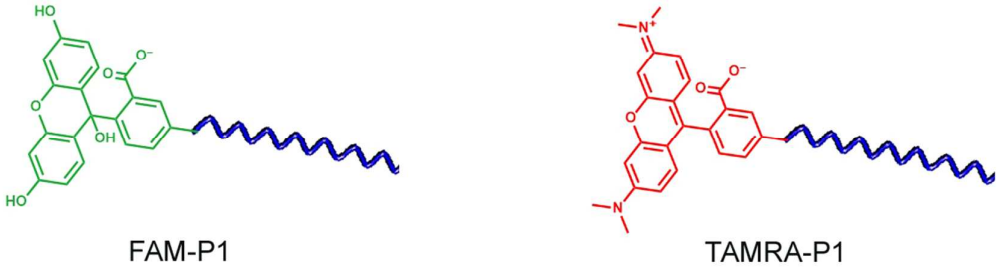

Figure S4. Structures of the labeled fluorophores (FAM and TAMRA) on P1.

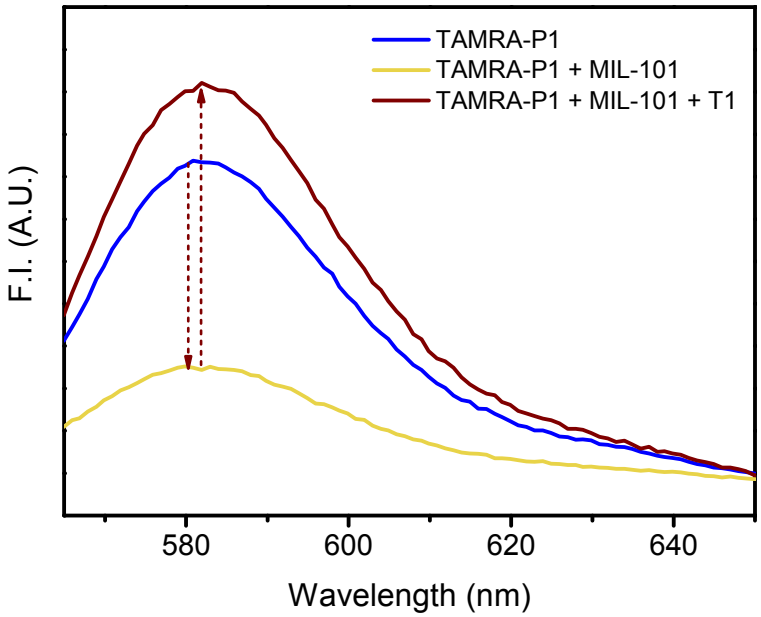

Figure S5. Fluorescence spectra of TAMRA-P1 (20 nM) with T1 (30 nM) in 10 mM PBS (pH 7.38) containing 0.2 mg·mL^{-1} MIL-101.

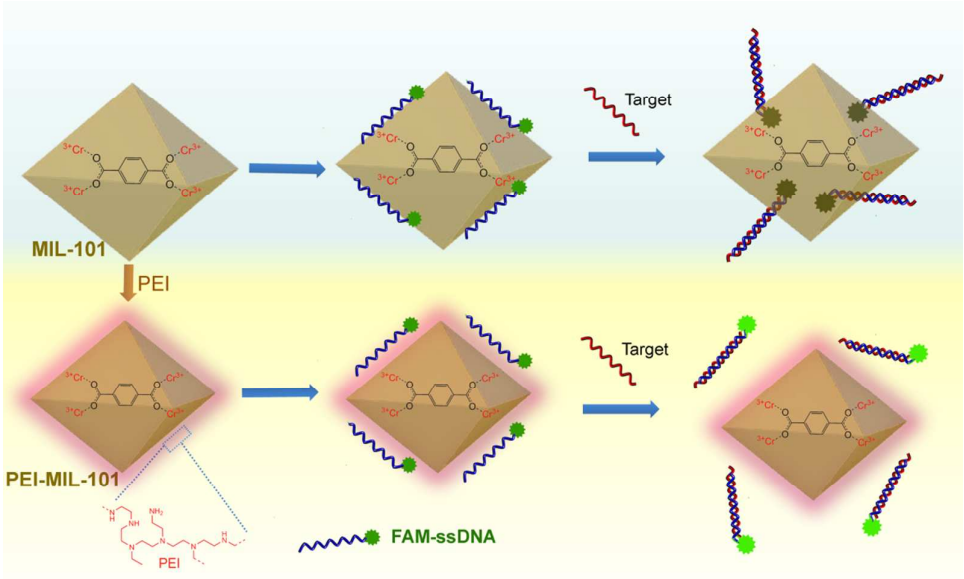

Figure S6. Schematic illustration of the fluorescent DNA assay using MIL-101 and PEI-MIL-101 as the sensing platforms.

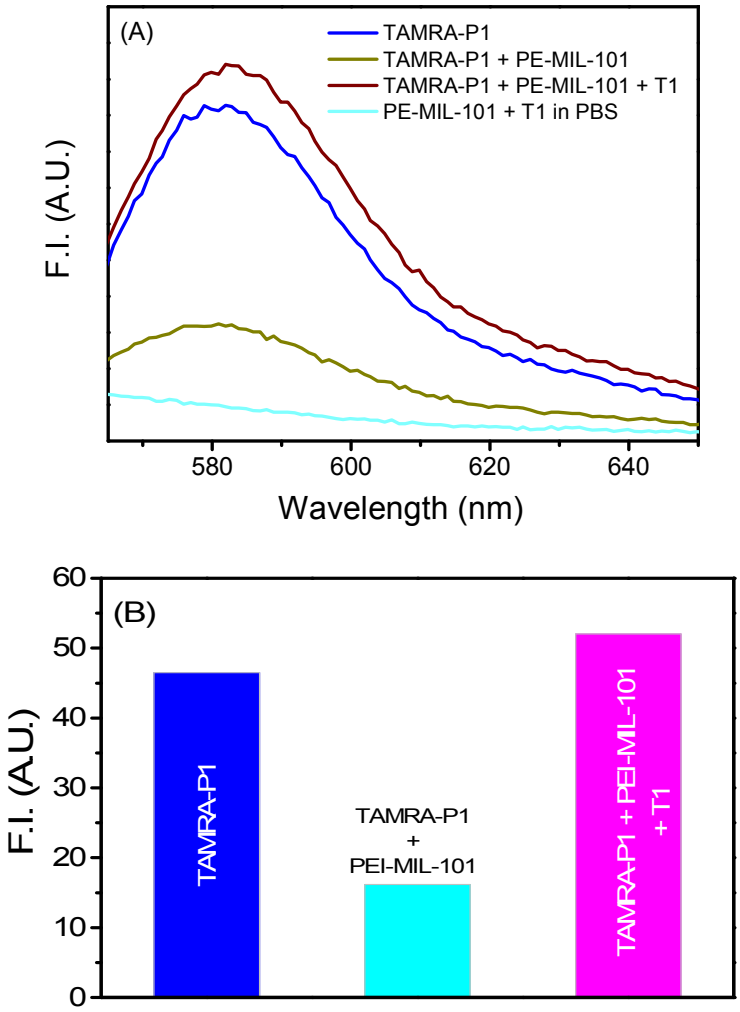

Figure S7. Fluorescence spectra (A) and peak intensity (B) of TAMRA-P1 (20 nM) with T1 (25 nM) in 10 mM PBS (pH 7.38) containing 0.2 mg·mL^{-1} PEI-MIL-101.

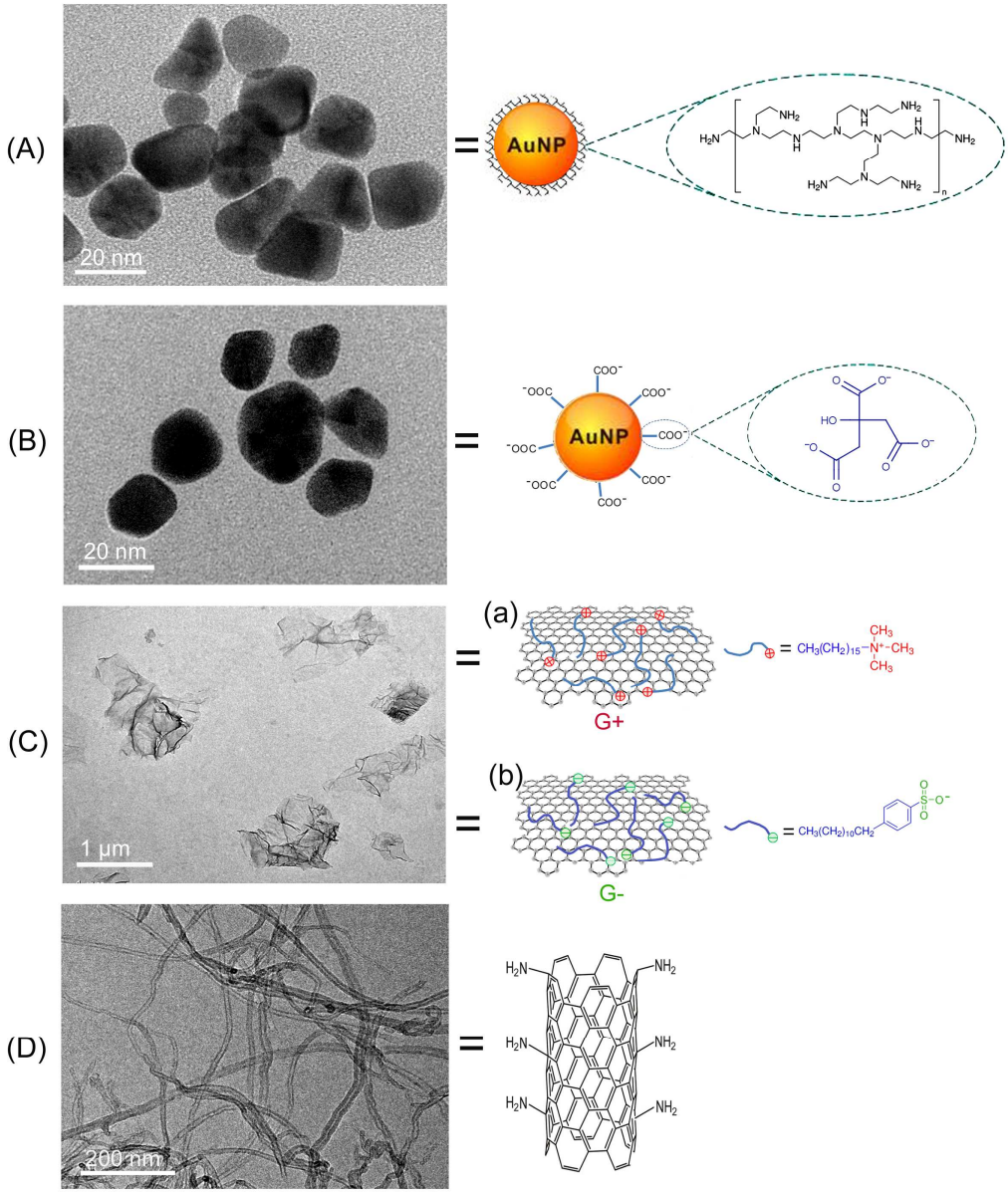

Figure S8. TEM images and schematic representations of AuNPs+ (A), AuNPs- (B), G+ (C-a), G- (C-b), and CNTs (D).

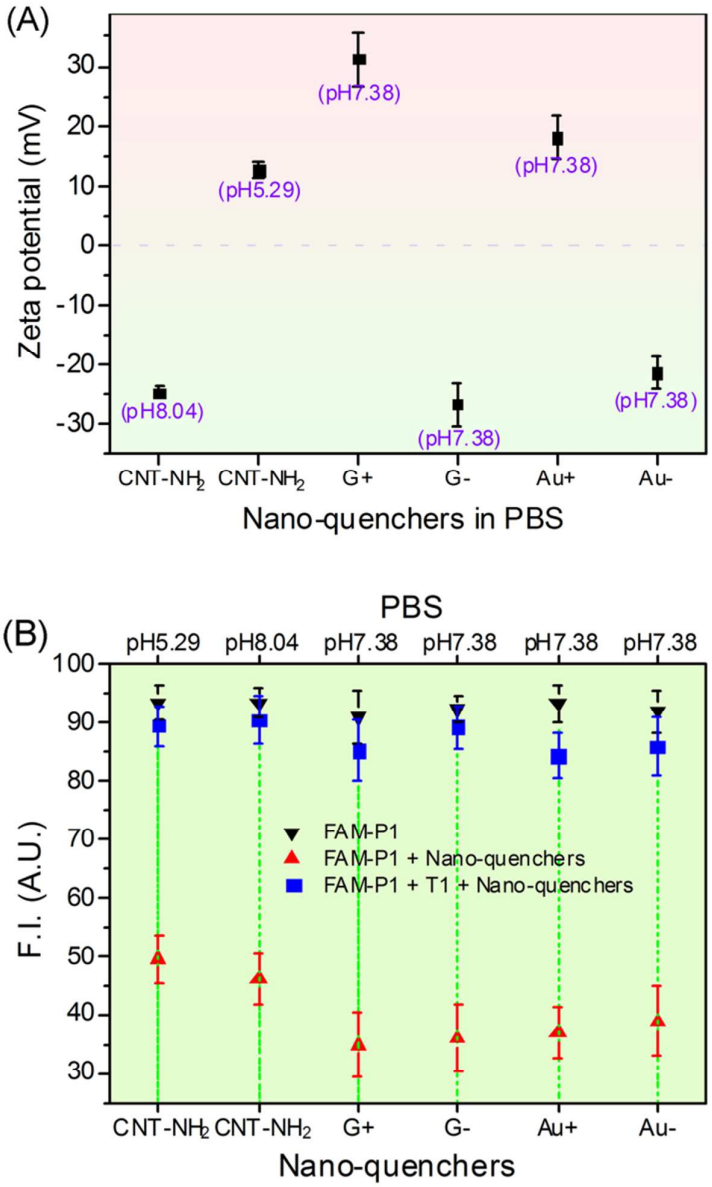

Figure S9. Nano-quenchers with positively or negatively charged surfaces for fluorescent DNA assay. (A) Zeta potentials of the nano-quenchers. (B) Fluorescence peak intensity of FAM-P1 (20 nM) with and without T1 (30 nM) in 10 mM PBS buffer (pH 7.4) with AuNPs+ (or AuNPs-, G+, G-), or in 10 mM PBS buffer (pH 5.29 or 8.04) with CNT-NH_2 (0.03 mg·mL^{-1}).