Electronic Supporting Information

The Exploration of Novel Fluorescent Copper-Cysteamine Nanosheets for Sequential Detection of Fe^{3+} and Dopamine and Fabrication of Molecular Logic Circuit

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Materials and methods

Copper(II) chloride (≥99%), iron(III) chloride (≥99%), cysteamine hydrochloride (≥98%), and dopamine hydrochloride (≥99%) were obtained from Sigma-Aldrich. Tetrabutylammonium cyanide was purchased from Shanghai Aladdin Bio-Chem Technology Co., Ltd. All other reagents were purchased from Sinopharm Chemical Reagent Co., Ltd.

Fluorescence spectra were acquired by using a Shimadzu RF-5301PC fluorometer. Time-resolved fluorescence and absolute quantum yield measurements were performed on an Edinburgh FS 920 fluorometer. Fourier transform infrared (FTIR) spectroscopy was performed on a Thermo Nicolet 6700 FTIR spectrometer. X-ray diffraction (XRD) of Cu-Cy powder was performed on a PANalytical B.V., Empyrean X-Ray Diffractometer. Atomic force microscope (AFM) measurement was performed by Bruker-Fastscan AFM. X-ray photoelectron spectrometry (XPS) study was acquired by a Thermo Scientific Escalab 250 XPS spectrometer with Al Kα X-ray radiation (1486.6 eV). The XPS sample was prepared by pressing the Cu-Cy powder directly onto the surface of an electrically conductive adhesive tape. Scanning electron microscopy (SEM) and energy-dispersive X-ray spectroscopy (EDS) were carried out on a FEI Nova NanoSEM 450 microscope equipped with an EDS spectrometer at an accelerating voltage of 10 kV. For SEM/EDS study, the sample was prepared by dropping 20 μL of Cu-Cy (50 μg/mL) dispersion onto a silicon wafer and dried in a vacuum oven at 40 ^{o}C overnight.

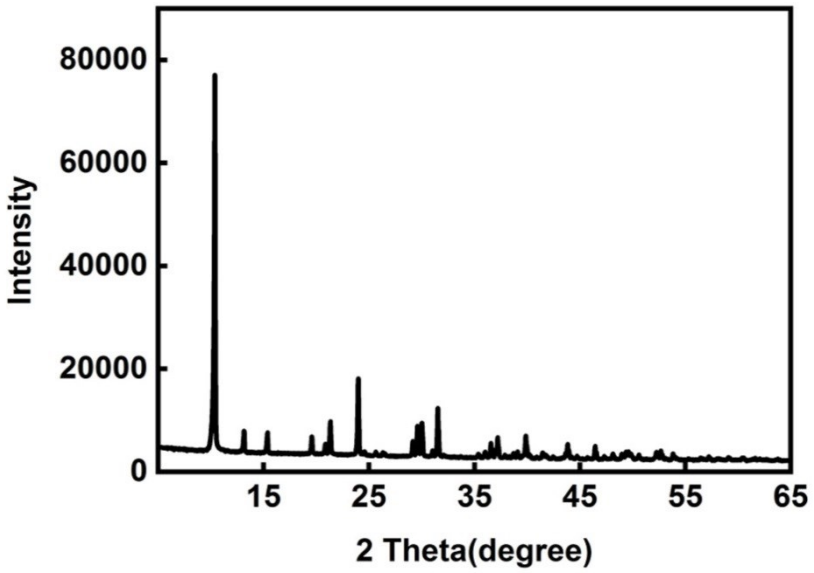

Fig. S1 XRD pattern of Cu-Cy.

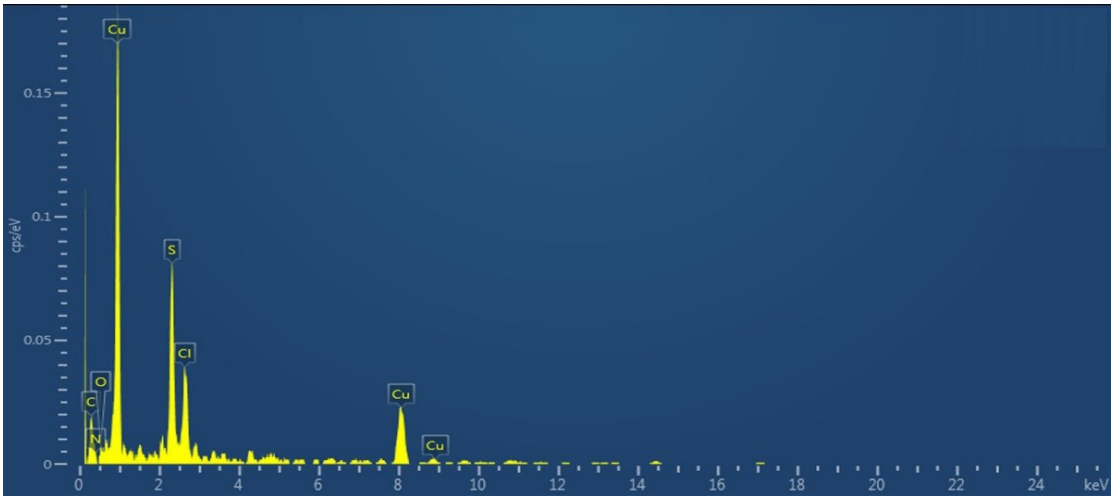

Fig. S2 EDS spectrum of Cu-Cy.

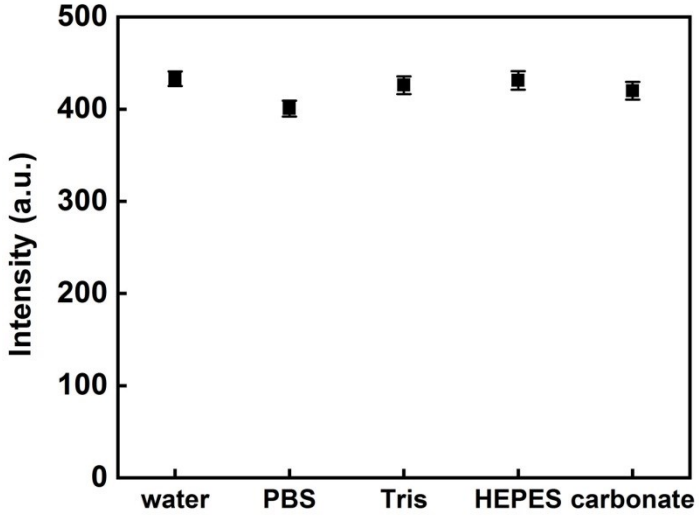

Fig. S3 Fluorescence emission intensity of Cu-Cy (50 μg/mL) in different buffer solutions.

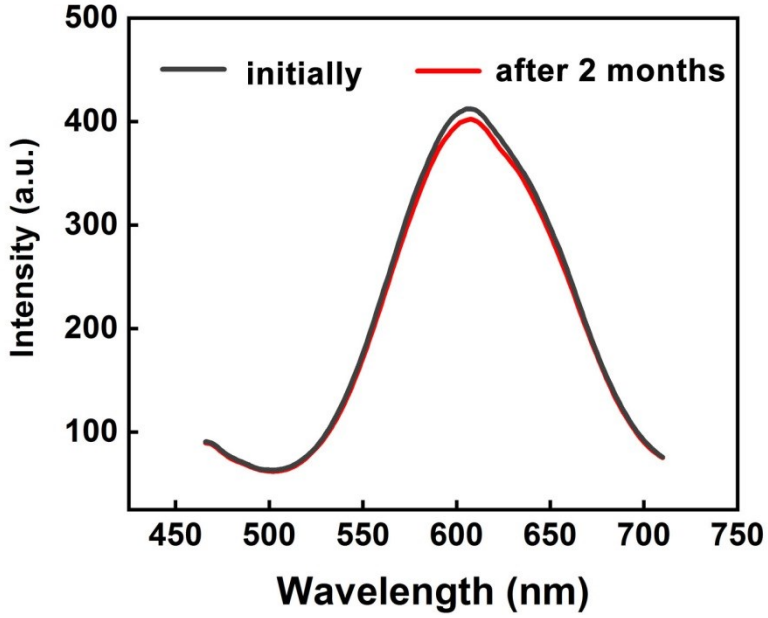

Fig. S4 Fluorescence emission spectra of Cu-Cy dispersion (50 μg/mL) initially and after 2 months of storage.

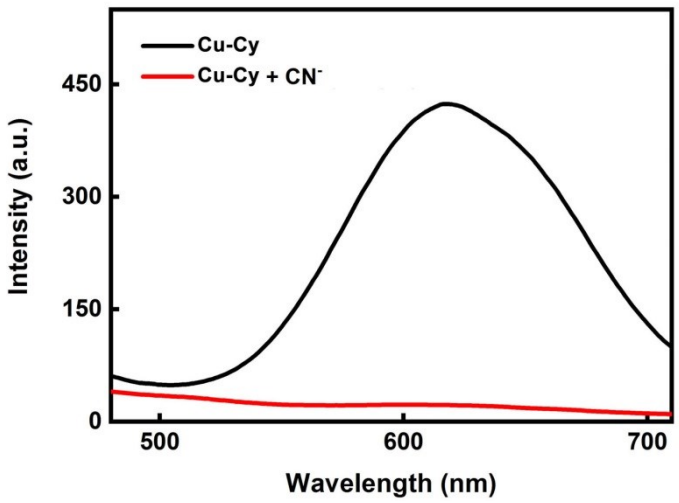

Fig. S5 Fluorescence emission spectra of Cu-Cy dispersion (50 μg/mL) before and after the addition of CN^- (400 μM).

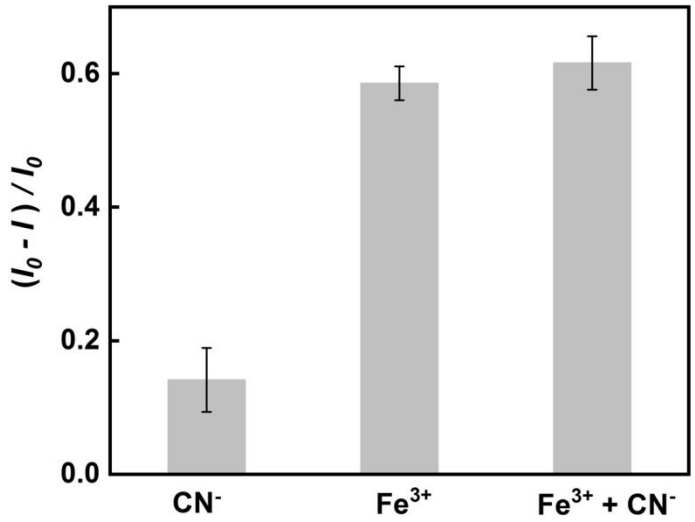

Fig. S6 Fluorescence response of Cu-Cy (50 μg/mL) to CN^- (1.9 μM), Fe^{3+} (400 μM), and Fe^{3+} (400 μM) +CN^- (1.9 μM).

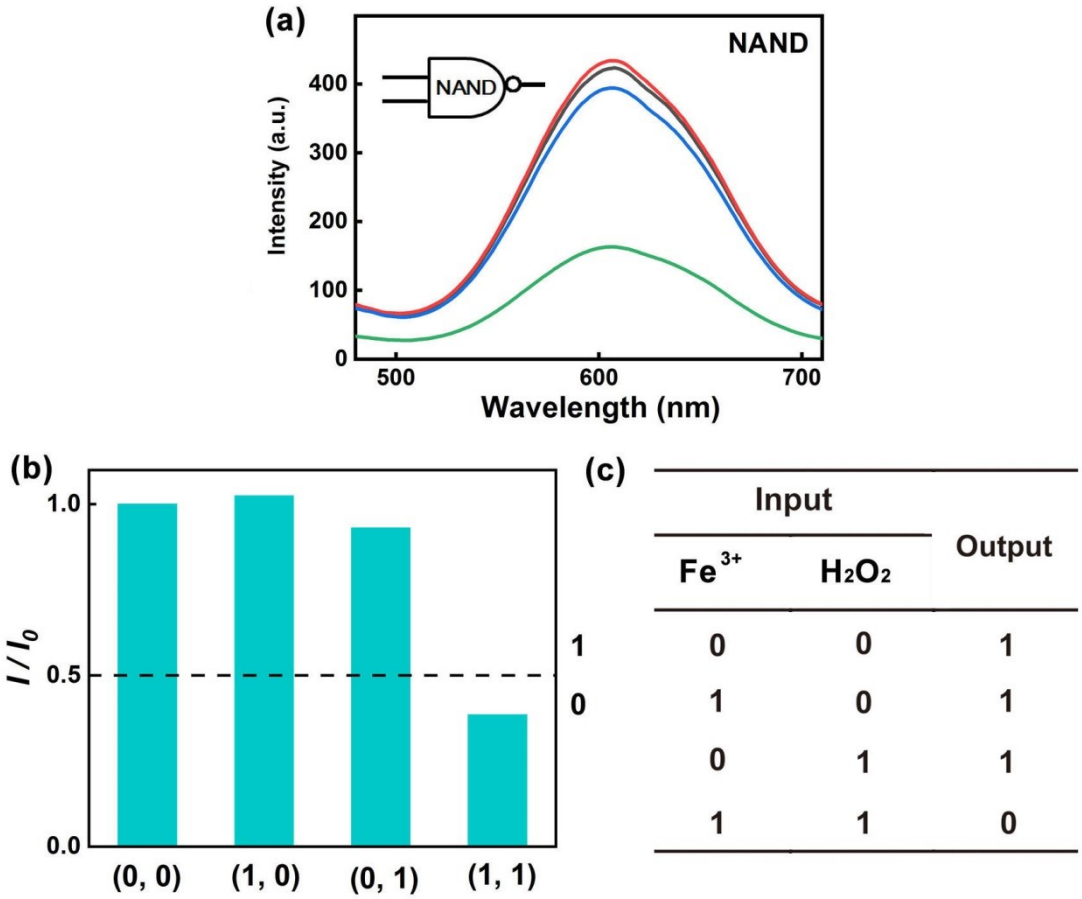

Fig S7. (a) Fluorescence spectra (b) I/I_0, and (c) truth table of Cu-Cy-based NAND gate.

Table S1. Comparison of fluorescent methods for Fe^{3+} determination

Probe	LOD (μM)	Detection range (μM)	Ref.
Phosphazene-based organic probe	4.8	0-50	1
Allylamine-graphene oxide nanosheet	4.6	0–120	2
Tyloxapol	2.2	0-100	3
HfIV-based MOF	0.27	30-70	4
MOF MIL-53(Al)	0.9	3-200	5
Carbon dots	0.32	0-20	6
N/P codoped carbon dots	0.33	1-150	7
B, N Co-doped carbon nanodots	0.1	0-100	8
Ag nanoclusters	0.12	0.5-20	9
Cu-Cy	**0.7**	**1-500**	**this work**

Table S2. Detection of Fe^{3+} in tap water by using the Cu-Cy probe

Sample	Spiked Fe^{3+} (μM)	Determined (μM)	Recovery (%)	RSD (%, n=5)
1	10.0	9.8	98.0	4.8
2	50.0	51.2	102.4	2.2
3	100.0	97.7	97.7	3.1

Table S3 Comparison of fluorescent methods for dopamine determination

Probe	LOD (nM)	Detection range (μM)	Ref.
Doxorubicin-graphene	-	0.83-33	10
Lanthanide-doped nanoparticles	47	0-10	11
Carbon dots	68	0.1-10	6
Graphene quantum dots	160	0.5-30	12
Cu nanoclusters	280	0.5-50	13
Ag nanoclusters -MoS_2 nanosheet	92	0.3-1	14
Au nanoclusters /graphitic carbon nitride nanosheet	18	0.05-8.0	15
Cu-Cy	**20**	**1-20**	**this work**

Table S4. Detection of dopamine in human serum by using the Cu-Cy probe

Sample	Spiked Dopa (μM)	Determined (μM)	Recovery (%)	RSD (%, n=3)
1	2	2.1	105	1.2
2	5	5.2	104	4.6
3	10	10.1	101	3.7

Table S5. Truth table of the Cu-Cy-based four-input molecular logic circuit

Input				Output
dopamine	**Fe^{3+}**	**Fe^{2+}**	**H_2O_2**	
0	0	0	0	1
1	0	0	0	1
0	1	0	0	0
0	0	1	0	1
0	0	0	1	1
1	1	0	0	1
1	0	1	0	1
1	0	0	1	1
0	1	1	0	0
0	1	0	1	0
0	0	1	1	0
1	1	1	0	1
1	0	1	1	1
1	1	0	1	1
0	1	1	1	0
1	1	1	1	1

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