Electronic Supplementary Information (ESI)

Ratiometric luminescent sensing for ascorbic acid based on mixed Ce/Eu metal-organic framework

Dan Yue, Yike Huang, Ling Zhang, Ke Jiang, Xin Zhang, Yuanjing Cui,* Yu Yang, and Guodong Qian*

State Key Laboratory of Silicon Materials, Cyrus Tang Center for Sensor Materials and Applications, School of Materials Science and Engineering, Zhejiang University, Hangzhou 310027, China.

E-mail: cuiyj@zju.edu.cn, gdqian@zju.edu.cn

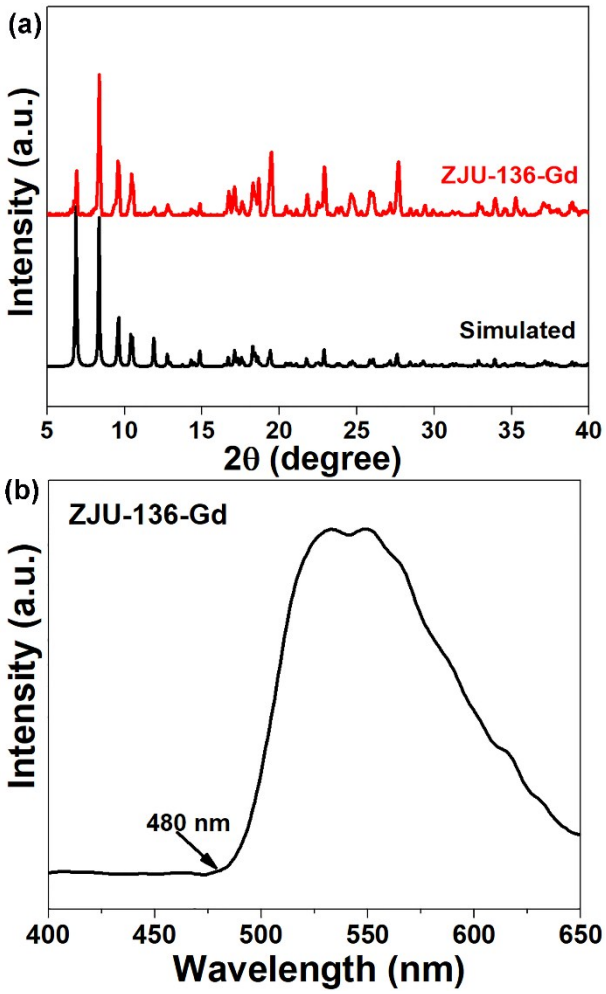

Fig. S1 (a) PXRD patterns of ZJU-136-Gd; (b)Phosphorescence spectra of ZJU-136-Gd at 77 K.

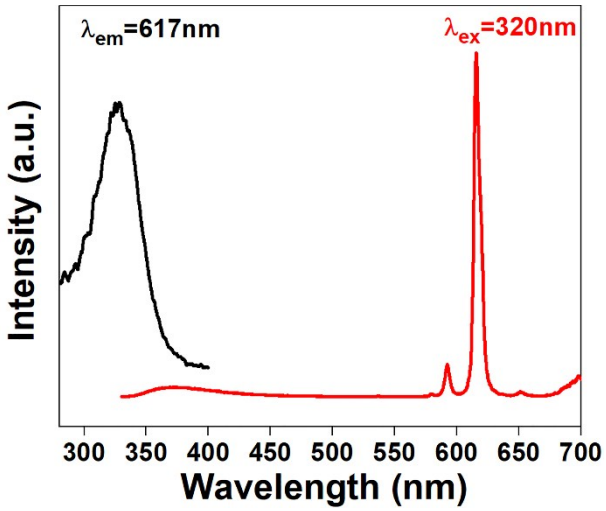

Fig. S2 The excitation (black line) and emission (red line) spectra of ZJU-136-Eu in aqueous solution.

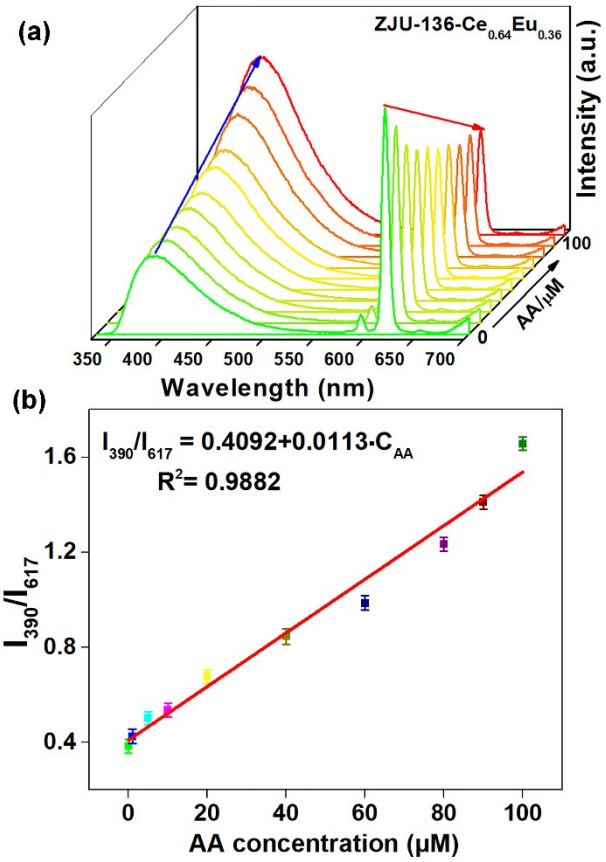

Fig. S3 (a, b) Fluorescence response and linear relationship of the normalized I_{390} and I_{617} of ZJU-136-$Ce_{0.64}Eu_{0.36}$ with the addition of different concentrations of AA (0-100 μM).

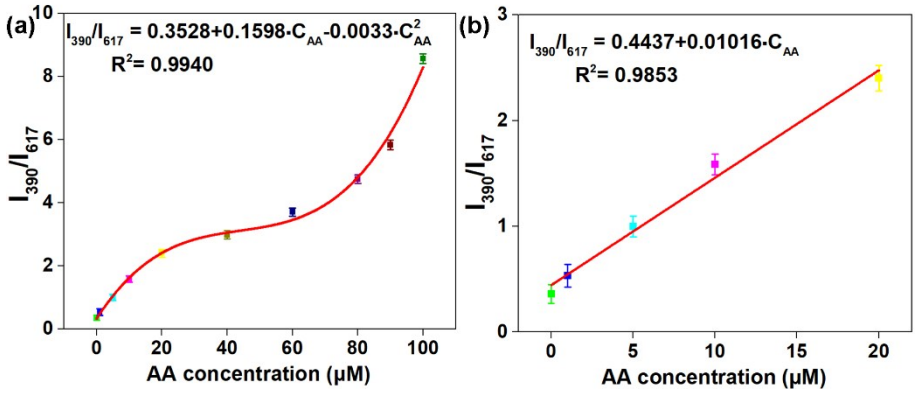

Fig. S4 Concentration dependence of the fluorescence intensity ratio (I_{390}/I_{617}), the concentration (a) 0-100 μM and (b) 0-20μM.

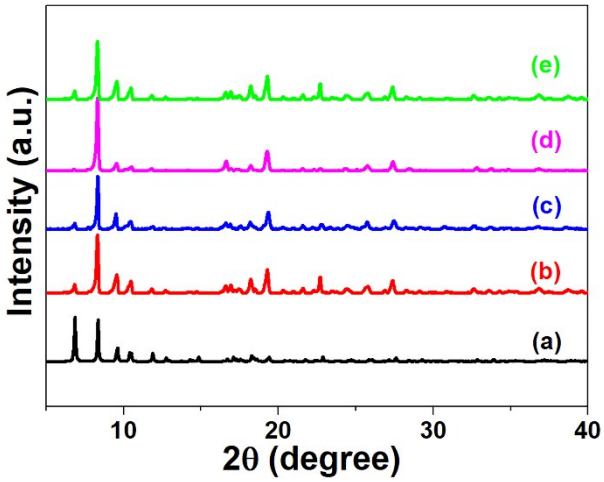

Fig. S5 PXRD patterns of (a) simulated; (b) ZJU-136-$Ce_{0.76}Eu_{0.24}$; (c) ZJU-136-$Ce_{0.76}Eu_{0.24}$ with addition of 100 μM AA for 1 hour; (d) ZJU-136- $Ce_{0.64}Eu_{0.36}$; (e) ZJU-136- $Ce_{0.64}Eu_{0.36}$ in 100 μM AA for 1 hour.

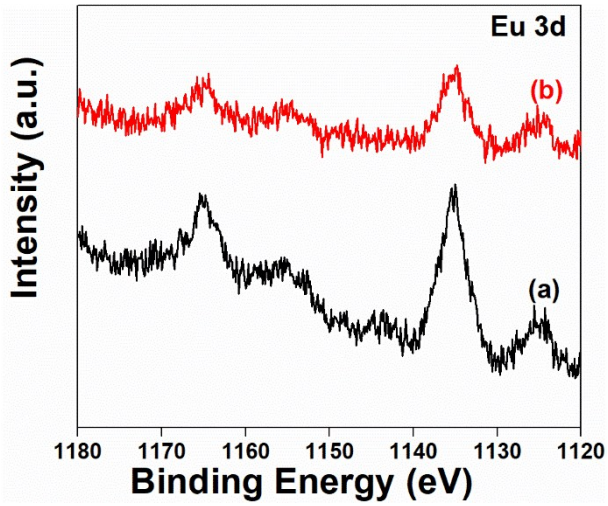

Fig. S6 XPS analysis of the Eu 3d peaks of (a) ZJU-136-$Ce_{0.76}Eu_{0.24}$, (b) ZJU-136-$Ce_{0.76}Eu_{0.24}$ with addition of 100 μM AA, respectively.

Table S1. The molar ratio of the starting Ce/Eu salt and that in the synthesized product calculated by ICP analysis.

Sample	The molar ratio of the starting Ce/Eu salt	The Ce/Eu ratios calculated by ICP analysis
ZJU-136-$Ce_{0.76}Eu_{0.24}$	0.8:0.2	0.76:0.24
ZJU-136-$Ce_{0.64}Eu_{0.36}$	0.7:0.3	0.64:0.36

Table S2 Analyzed peaks and corresponding binding energy, ion states and their initial states of ZJU-136-$Ce_{0.76}Eu_{0.24}$ in the absence and presence of 100 μM AA.

Ce 3d region	Peak assignment	Ce species	ZJU-136-$Ce_{0.76}Eu_{0.24}$			ZJU-136-$Ce_{0.76}Eu_{0.24}$+ 100 μM AA	
			Peak (eV)	Area (%)		Peak (eV)	Area (%)
$3d_{5/2}$	v_0	Ce^{3+}	881.18	5.38		881.25	4.99
	v	Ce^{4+}	882.46	10.87		882.41	10.18
	v '	Ce^{3+}	885.39	31.06		885.69	33.35
	v ''	Ce^{4+}	887.09	7.35		887.38	5.70
$3d_{3/2}$	v '''	Ce^{4+}	896.78	0.91		–	–
	u_0	Ce^{3+}	899.10	6.69		898.60	6.98
	u	Ce^{4+}	900.85	8.19		900.56	10.46
	u '	Ce^{3+}	903.86	22.09		904.06	24.24
	u ''	Ce^{4+}	906.75	5.03		906.80	4.10
	u '''	Ce^{4+}	917.05	2.26		–	–