Electronic Supplementary Information for

Tunable Photoluminescence Properties of Fluorescein in a Layered Double Hydroxide Matrix and its Application in Sensor

Wenying Shi, Min Wei,* David G. Evans, Xue Duan

State Key Laboratory of Chemical Resource Engineering, Beijing University of Chemical Technology, Beijing 100029, P. R. China

CORRESPONDING AUTHOR FOOTNOTE

∗ Corresponding author. Phone: +86-10-64412131. Fax: +86-10-64425385. E-mail: weimin@mail.buct.edu.cn.

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Figure S6. Evolution of the V (A_1~G_1; x%) and H (A_2~G_2; x%) (x = 1.00×10^{-3}%, 6.80×10^{-3}%, 1.25×10^{-2}%, 2.00×10^{-2}%, 1.00×10^{-1}%, 1.05% and 38.0%, respectively) polarized fluorescence spectra of the FLU-HES/LDH (x%) thin films with the following twist angles δ of the sample: (a) 60°, (b) 50°, (c) 40°, (d) 30°, (e) 20°, (f) 10° and (g) 0°. Spectra were recorded after excitation with vertical polarized light.

Figure S7. Evolution of the fluorescence dichroic ration of the FLU-HES/LDH (x%) thin films with the emission wavelength for different twisting δ angles of the sample (see Figure S6 caption): (A)~(G) x= 1.00×10^{-3}%, 6.80×10^{-3}%, 1.25×10^{-2}%, 2.00×10^{-2}%, 1.00×10^{-1}%, 1.05% and 38.0%, respectively. The linear relationship between the dichroic ration and $\cos^2(\delta+90)$ at 520 nm is included in inset graph.

Figure S8. A schematic representation for the orientation of FLU in the FLU-HES/LDH (x%) materials: (A)~(G) x=1.00×10^{-3}%, 6.80×10^{-3}%, 1.25×10^{-2}%, 2.00×10^{-2}%, 1.00×10^{-1}%, 1.05% and 38.0%, respectively (Zn blue, C grey, H white, Al yellow, O red).

Figure S9. Cyclic voltammograms obtained with FLU-HES/LDH (x%) thin film modified electrodes in 10^{-4} mol/L DA + 0.1 mol/L PBS (pH 7.0) at 100 mV/s.

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Figure S11. The stability of electrodes modified with different materials: (A) pristine FLU, (B) FLU/LDH physical mixture and (C) FLU-HES/LDH (x=1.25×10^{-2}%) in 10^{-5} mol/L DA + 0.1 mol/L PBS (pH 7.4) solution.

Figure S12. The stability of the FLU-HES/LDH (x=1.25×10^{-2}%) modified electrode in 10^{-5} mol/L DA + 0.1 mol/L PBS (pH 7.4) solution by recording cyclic voltammograms curves in consecutive 10 days measurement. a~j: from 1 to 10 days.

Figure S13. Cyclic voltammograms of the FLU-HES/LDH (x=1.25×10^{-2}%) modified electrode in 10^{-5} mol/L DA + 0.1 mol/L PBS (pH 7.4) solution at different scan rates (A) and the linear relationship between the anodic peak current and the scan rate (B).

Table S1: Chemical Compositions of the FLU-HES/LDH (x%) Samples with Different FLU Content

Table S2: Fluorescence Decay Data of FLU in Solution and the FLU-HES/LDH (x%) Samples

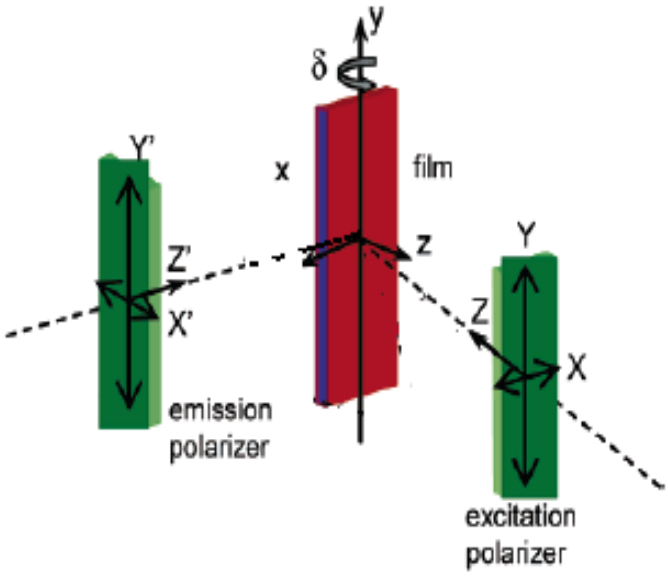


Figure S1. Three-dimensional perspective for the experimental setup to record fluorescence spectra with linear polarized light in the front-face configuration of a PTI Fluorescence instrument. The twist angle δ of the sample with respect to the excitation beam is also illustrated.

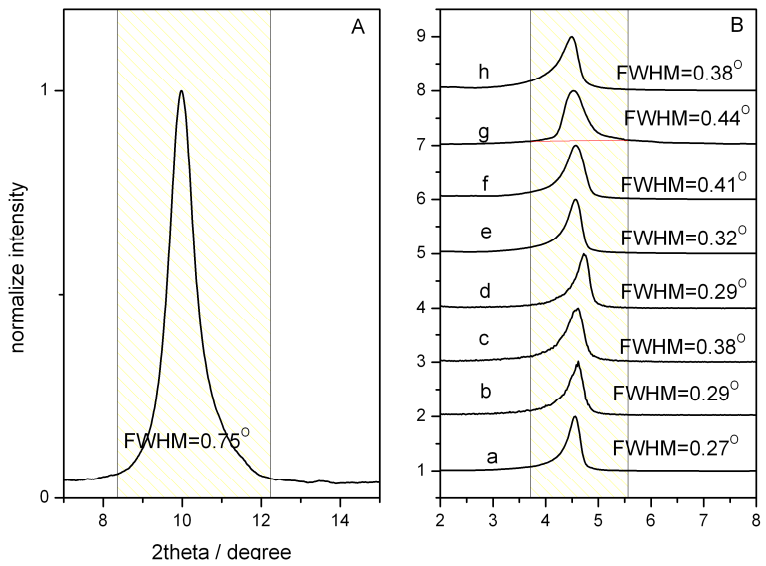


Figure S2. The FWHM of XRD patterns for (A) Zn_2Al-NO_3-LDH and (B) FLU-HES/LDH (x%): (a)~(h) x=1.00×10^{-3}%, 6.80×10^{-3}%, 1.25×10^{-2}%, 2.00×10^{-2}%, 1.00×10^{-1}%, 1.05%, 38.0% and 100%, respectively.

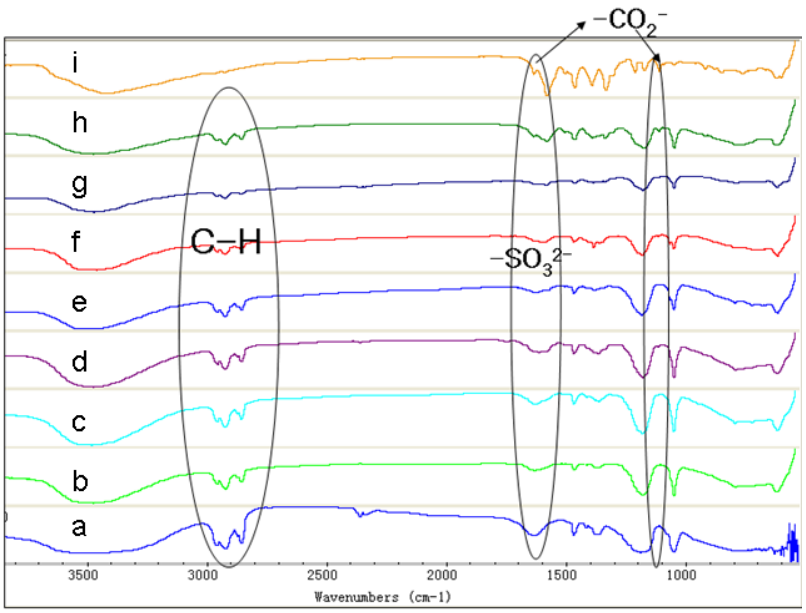


Figure S3. FT-IR spectra (4000~400 cm^{-1} region) for the FLU-HES/LDH (x%): (a)~(i)x=0, 1.00×10^{-3}%, 6.80×10^{-3}%, 1.25×10^{-2}%, 2.00×10^{-2}%, 1.00×10^{-1}%, 1.05%, 38.0% and 100%, respectively.

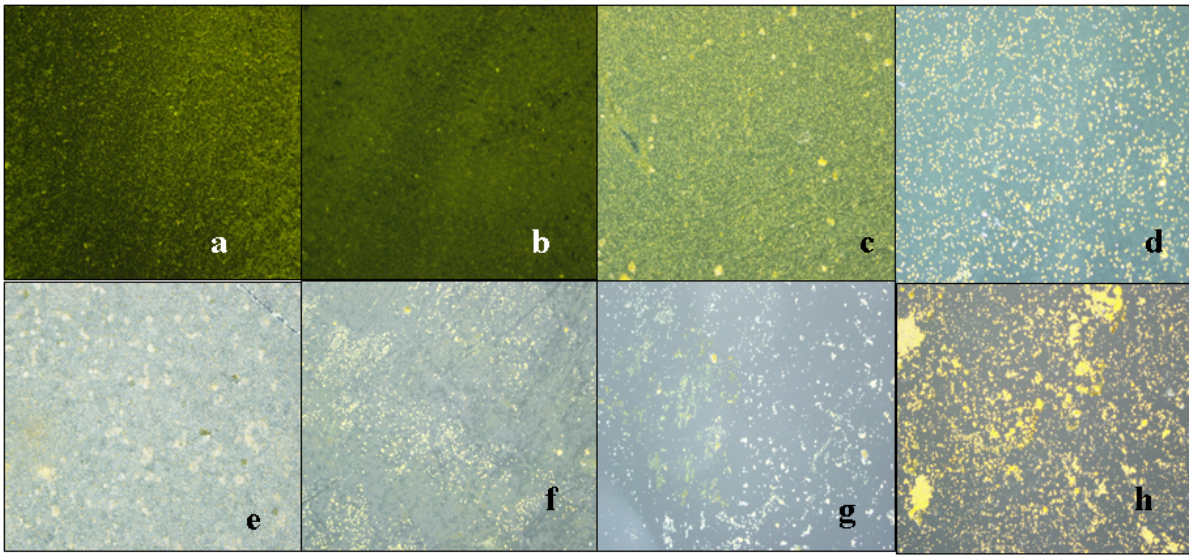
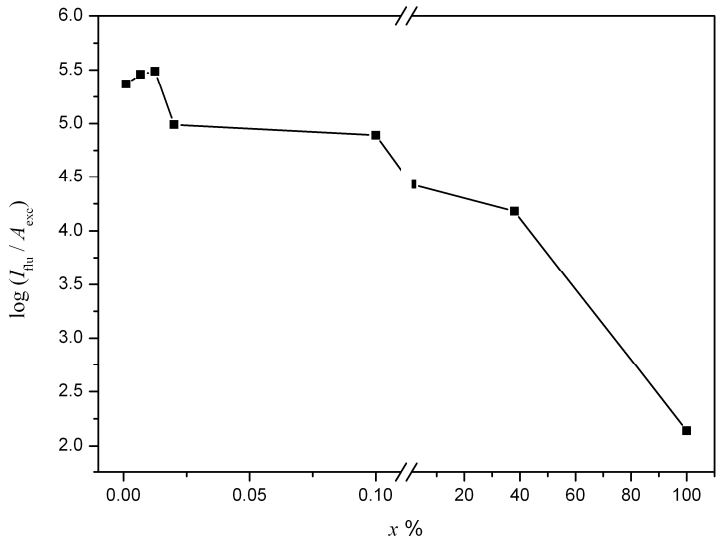


Figure S4. Fluorescent microscopic photographs of the FLU-HES/LDH films (x%): (a)~(h) x= 1.00×10^{-3}%, 6.80×10^{-3}%, 1.25×10^{-2}%, 2.00×10^{-2}%, 1.00×10^{-1}%, 1.05%, 38.0% and 100%. All the samples were excited by blue light.



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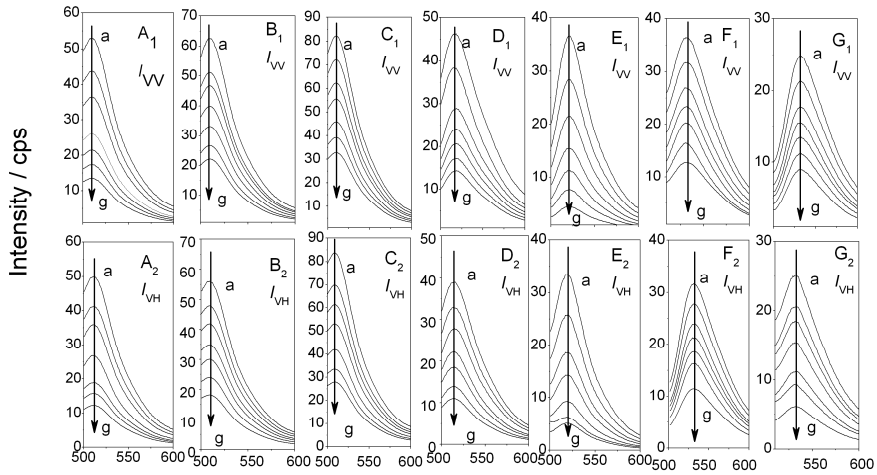

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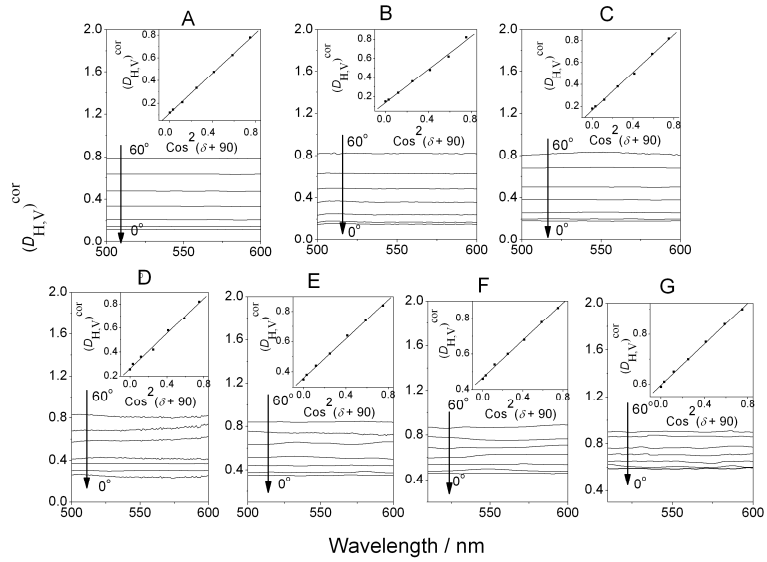

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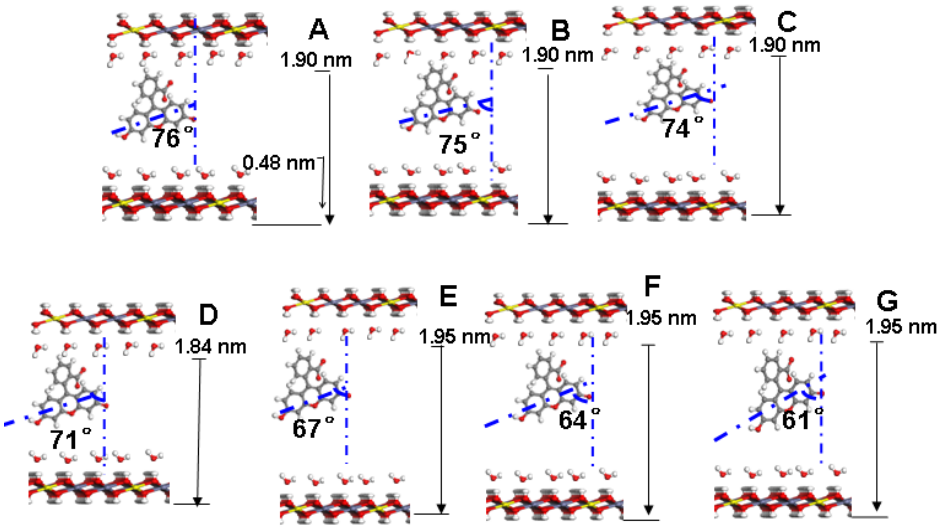

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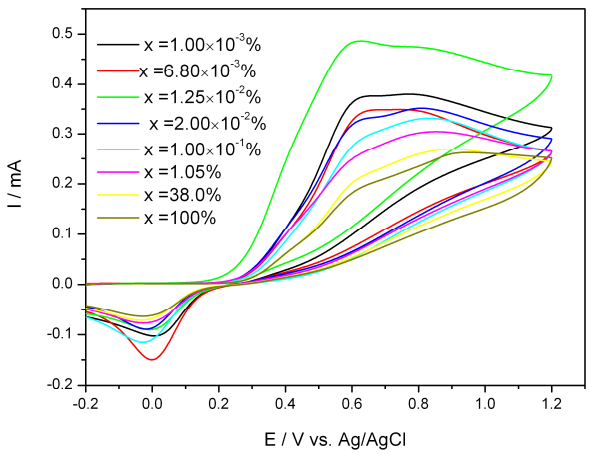

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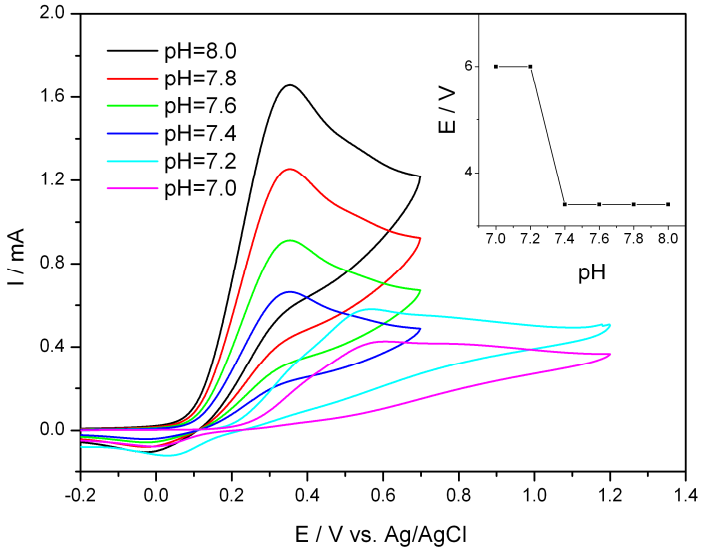

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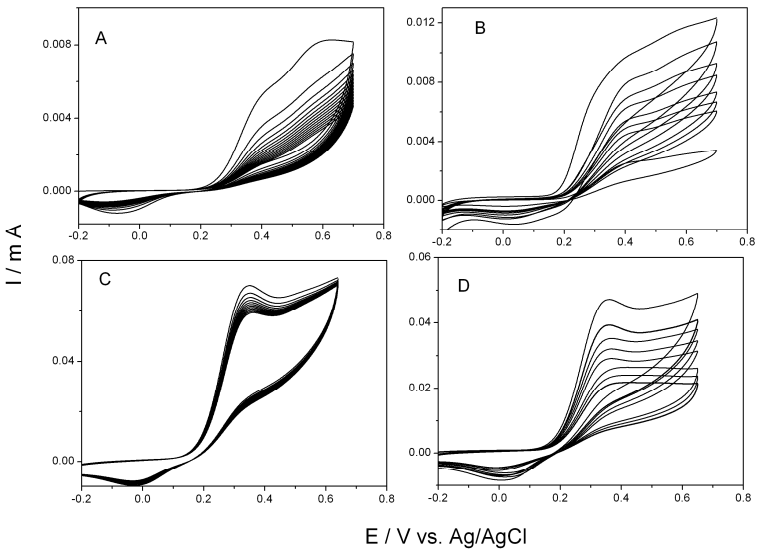

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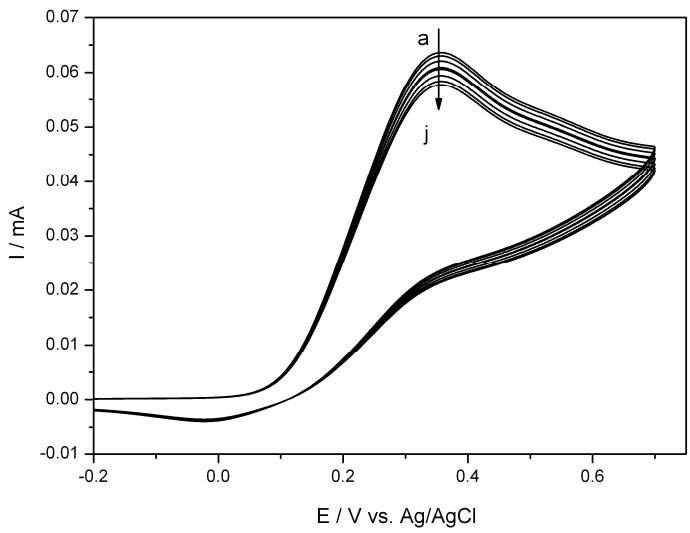

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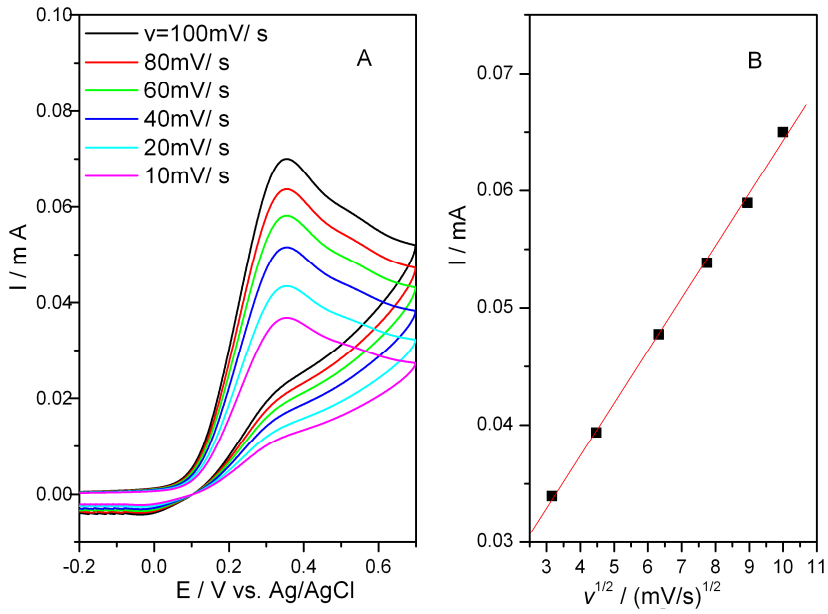

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Table S1: Chemical Compositions of the FLU-HES/LDH (x%) Samples with Different FLU Content

nominal content x (%)	chemical composition	Zn/Al ration	experimental content x (%)
0	$[Zn_{0.68}Al_{0.32}(OH)_2](HES)_{0.32}\cdot 1.59H_2O$	2.13	0
1.34×10^{-3}	$[Zn_{0.67}Al_{0.33}(OH)_2](FLU)_{X1}(HES)_{Y1}\cdot 0.49H_2O$	2.03	1.00×10^{-3}
8.00×10^{-3}	$[Zn_{0.68}Al_{0.32}(OH)_2](FLU)_{X2}(HES)_{Y2}\cdot 1.06H_2O$	2.13	6.80×10^{-3}
1.34×10^{-2}	$[Zn_{0.66}Al_{0.34}(OH)_2](FLU)_{X3}(HES)_{Y3}\cdot 0.88H_2O$	1.94	1.25×10^{-2}
2.35×10^{-2}	$[Zn_{0.69}Al_{0.31}(OH)_2](FLU)_{X4}(HES)_{Y4}\cdot 0.33H_2O$	2.22	2.00×10^{-2}
1.18×10^{-1}	$[Zn_{0.67}Al_{0.33}(OH)_2](FLU)_{X5}(HES)_{Y5}\cdot 0.37H_2O$	2.03	1.00×10^{-1}
1.16	$[Zn_{0.68}Al_{0.32}(OH)_2](FLU)_{X6}(HES)_{Y6}\cdot 0.92H_2O$	2.13	1.05
41.0	$[Zn_{0.68}Al_{0.32}(OH)_2](FLU)_{X7}(HES)_{Y7}\cdot 0.92H_2O$	2.13	38.0
100	$[Zn_{0.67}Al_{0.34}(OH)_2](FLU)_{0.34}\cdot 1.31H_2O$	1.97	100

$X_1=3.30\times10^{-6}$, $Y_1=0.329$; $X_2=2.17\times10^{-5}$, $Y_2=0.319$; $X_3=4.25\times10^{-5}$, $Y_3=0.339$; $X_4=6.21\times10^{-5}$, $Y_4=0.309$; $X_5=3.00\times10^{-4}$, $Y_5=0.329$; $X_6=3.40\times10^{-3}$, $Y_6=0.316$; $X_7=0.122$, $Y_7=0.198$.

Table S2: Fluorescence Decay Data of FLU in Solution and the FLU-HES/LDH (x%) Samples

x (%)	n	τ_i (ns)	A_i (%)	$\langle\tau\rangle$ (ns)	Chi^2
1.00×10^{-3}	2	3.32	38.1	1.97	1.23
		1.15	61.9		
6.80×10^{-3}	2	4.82	48.2	2.87	1.34
		1.57	51.8		
1.25×10^{-2}	2	4.36	54.8	3.46	1.49
		2.37	45.2		
2.00×10^{-2}	2	4.83	56.5	3.76	1.19
		1.94	43.5		
1.00×10^{-1}	2	0.29	31.5	1.90	1.80
		2.63	68.5		
1.05	2	0.27	41.7	1.81	1.34
		2.89	58.3		
38.0	2	0.1	53.4	1.43	1.65
		3.0	46.6		
100	2	0.09	65.9	0.12	1.97
		0.17	35.1		
solution/10^{-5}mol/L	1	1.80	100	1.80	1.22

τ is the fluorescence lifetime; $\langle\tau\rangle$ is the intensity average lifetime. The goodness of fit is indicated by the value of Chi^2.