

Supporting Information for

Logic circuits constructed with an ion-sensitive fluorescent molecule 1,2-di[5-methoxy-2-(2-pyridyl)thiazoyl]ethyne

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Determination of the quantum yields

The fluorescent quantum yields were determined following Equation 1^{S1} with Rhodamine B ethanol solution ($\Phi_{fr} = 0.96$) as the reference. Φ_{fr} and Φ are the quantum yield of the reference and the test sample, respectively; A_r and A are the absorbance at the excitation wavelength of the reference and the test sample, respectively; L_r and L are the light path length in the absorption cells of the reference and the test sample, respectively; N_r and N are the indexes of refraction of the solvents in reference sample and the test sample, respectively; and D_r and D are the integrated areas of the emission peaks of the reference and the test sample, respectively. Sample and reference were prepared with the absorbance of 0.1 at the excitation wavelength.

$$\Phi = \Phi_{fr} \times \frac{1 - 10^{-A_r L_r}}{1 - 10^{-A L}} \times \frac{N_r^2}{N^2} \times \frac{D}{D_r} \quad (\text{Equation 1})$$

Ref. S1 J. N. Demas and G. A. Grosby, *J. Phys. Chem.*, 1971, **75**, 991.

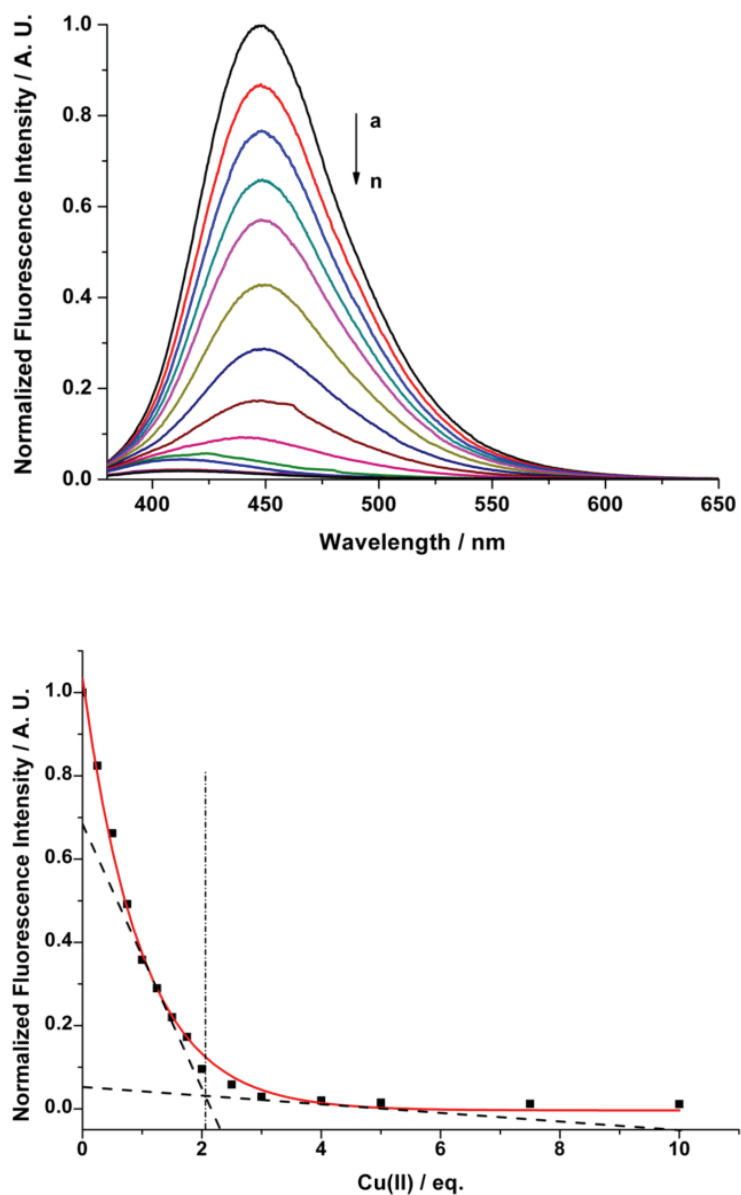


Fig. S1 Fluorescence spectrum ($\lambda_{\text{ex}}=350$ nm) of DMPTE ($0.02 \text{ mmol}\cdot\text{L}^{-1}$ in dichloromethane) in the presence of different amounts of Cu^{2+} introduced. From a to n: the amount of Cu^{2+} is 0.00, 0.25, 0.50, 0.75, 1.0, 1.25, 1.5, 1.75, 2.0, 2.5, 3.0, 4.0, 5.0, 7.5, and 10 equivalents respectively. (Bottom) Fluorescent intensity at 450 nm versus the introduced equivalents of Cu^{2+} .

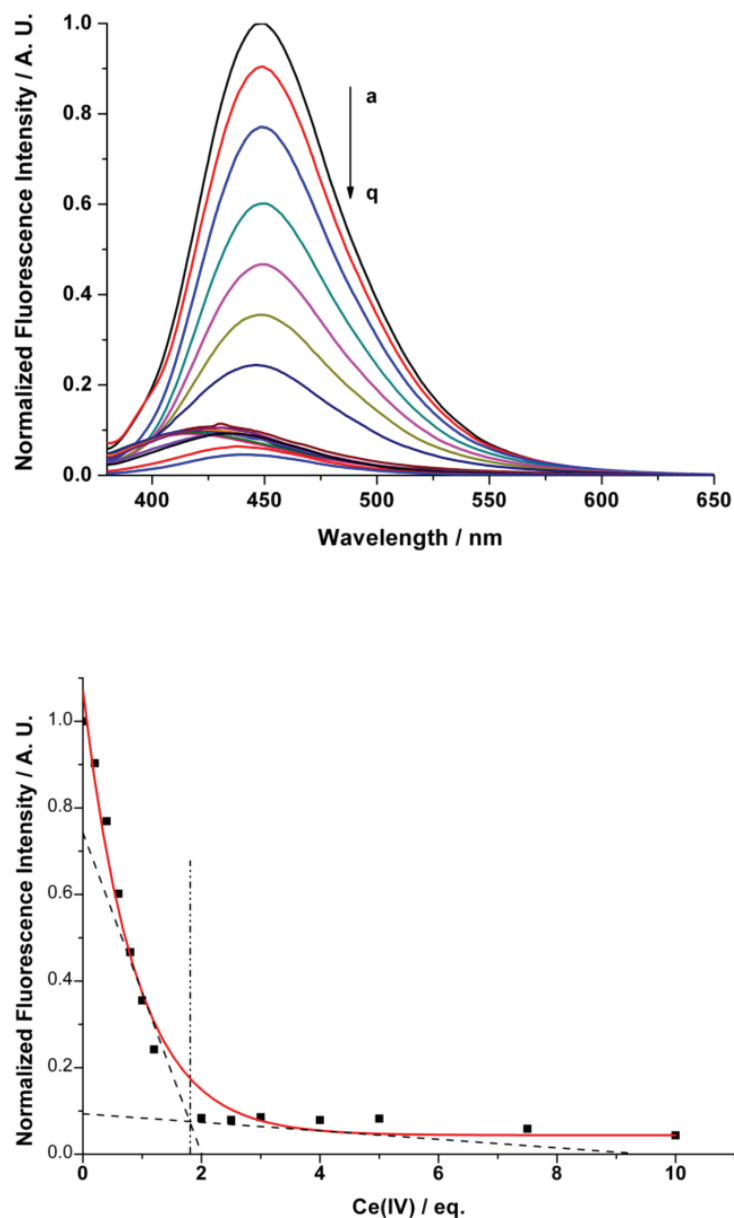


Fig. S2 (Top) Fluorescence spectrum ($\lambda_{\text{ex}}=350$ nm) of DMPTE ($0.02 \text{ mmol}\cdot\text{L}^{-1}$ in dichloromethane) in the presence of different amounts of Ce^{4+} introduced. From a to q: the amount of Ce^{4+} is 0.0, 0.2, 0.4, 0.6, 0.8, 1.0, 1.2, 1.4, 1.6, 1.8, 2.0, 2.5, 3.0, 4.0, 5.0, 7.5, and 10 equivalents respectively. (Bottom) Fluorescent intensity at 450 nm versus the introduced equivalents of Ce^{4+} .

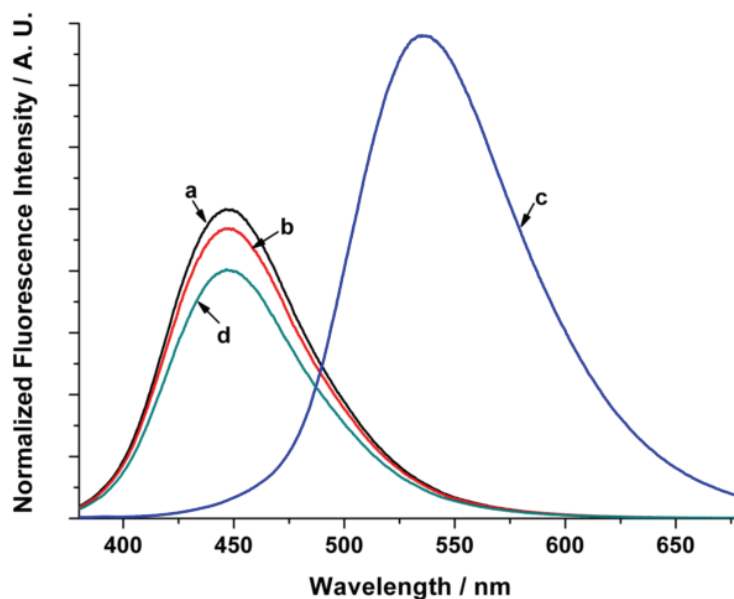


Fig. S3 Fluorescence spectrum ($\lambda_{\text{ex}}=350$ nm) of DMPTE ($0.02 \text{ mmol}\cdot\text{L}^{-1}$ in dichloromethane) in the presence of different chemical introduction: (a) no chemical, (b) $0.06 \text{ mmol}\cdot\text{L}^{-1} \text{ Ce}(\text{NO}_3)_3$, (c) $0.15 \text{ mol}\cdot\text{L}^{-1}$ trifluoroacetic acid, (d) $0.06 \text{ mmol}\cdot\text{L}^{-1} \text{ Ce}(\text{NO}_3)_3$ and $0.15 \text{ mol}\cdot\text{L}^{-1}$ trifluoroacetic acid.

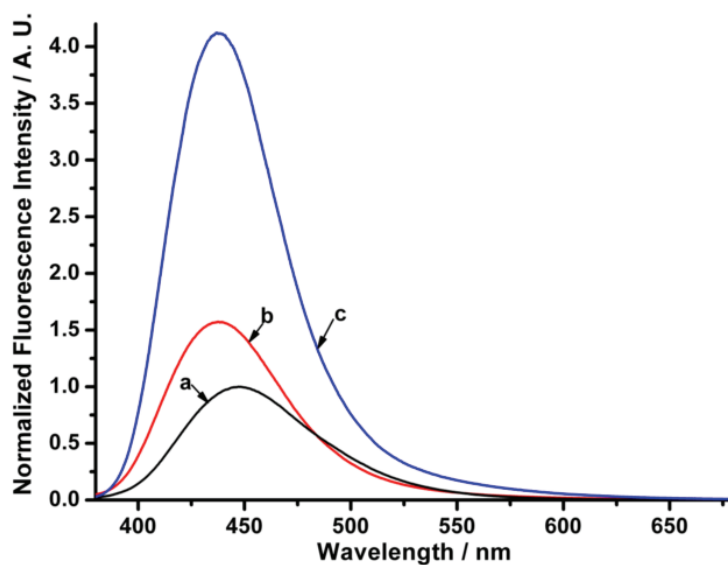


Fig. S4 Fluorescence spectrum ($\lambda_{\text{ex}}=350$ nm) of DMPTE ($0.02 \text{ mmol}\cdot\text{L}^{-1}$ in dichloromethane) in the presence of different chemical introduction: (a) no chemical, (b) $0.06 \text{ mmol}\cdot\text{L}^{-1} (\text{NH}_4)_2\text{Ce}(\text{NO}_3)_6$ and $0.12 \text{ mol}\cdot\text{L}^{-1}$ trifluoroacetic acid, (c) $0.04 \text{ mmol}\cdot\text{L}^{-1} \text{ NOBF}_4$.

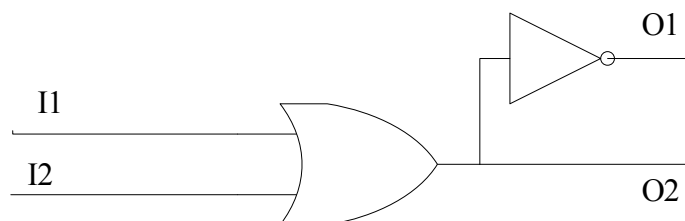


Fig. S5 Digital circuits for OR (O2) / NOR (O1) logic gates.

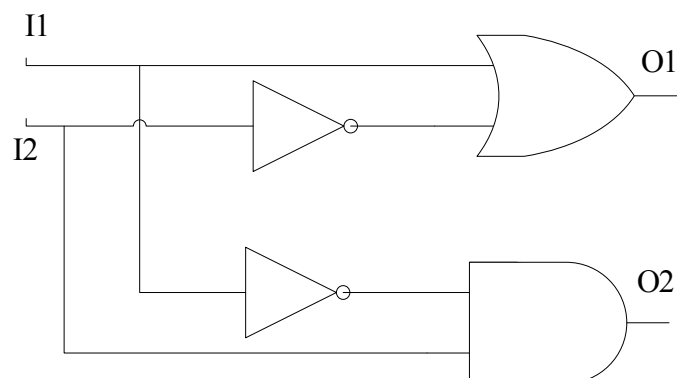


Fig. S6 Digital circuits for INHIBIT (O2) / IMPLICATION (O1) logic gates.

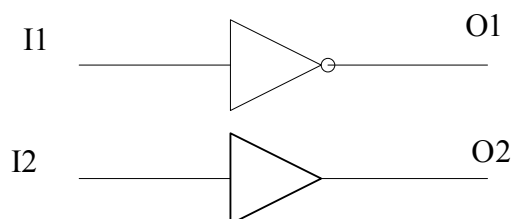


Fig. S7 Digital circuits for YES (O2) / NOT (O1) logic gates.

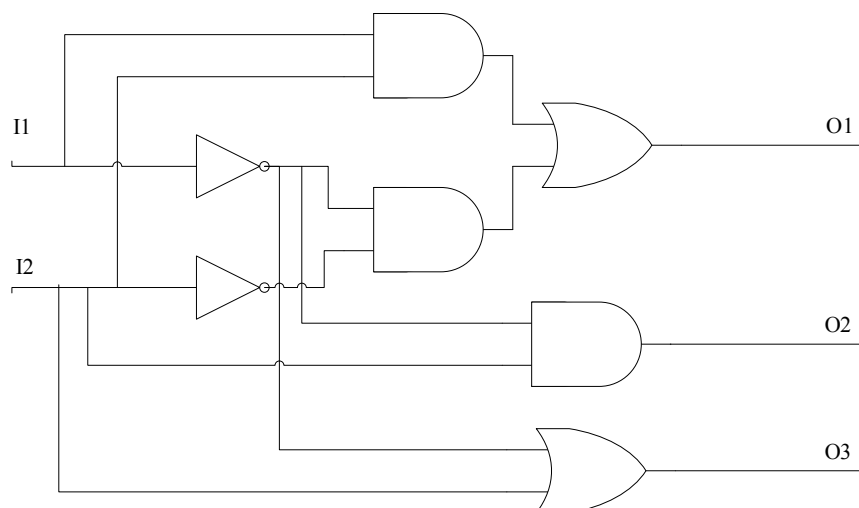


Fig. S8 Digital circuits for XNOR (O1) / INHIBIT (O2) / IMPLICATION (O3) logic gates.

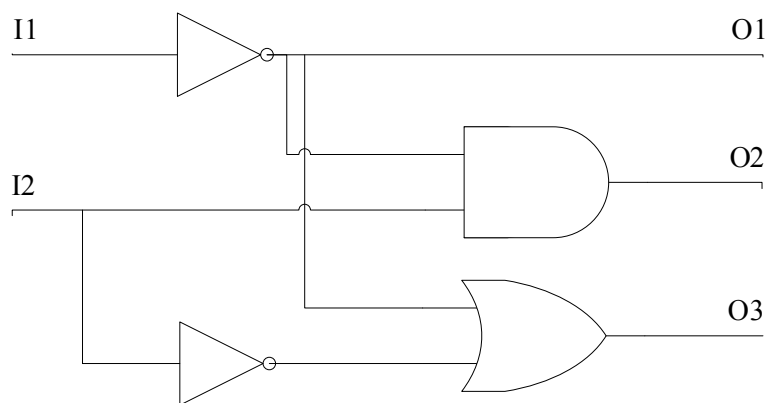


Fig. S9 Digital circuits for NOT (O1) / INHIBIT (O2) / NAND (O3) logic gates.

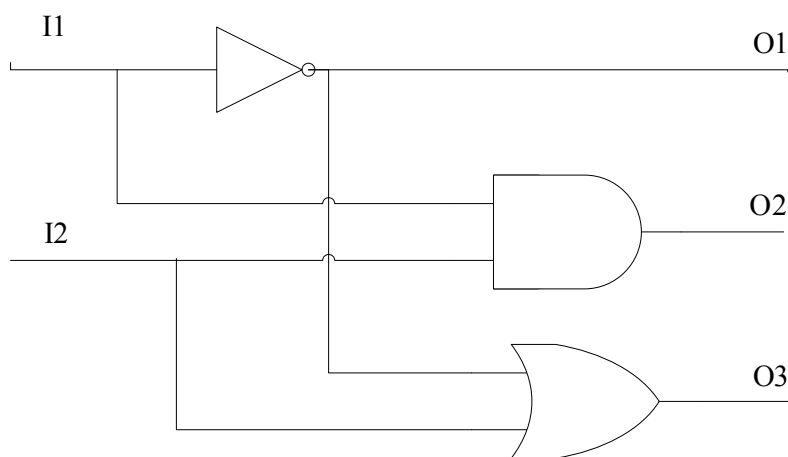


Fig. S10 Digital circuits for NOT (O1) / AND (O2) / IMPLICATION (O3) logic gates.

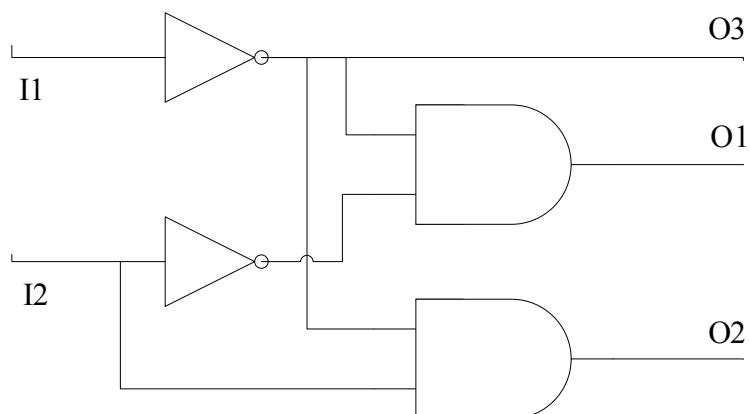


Fig. S11 Digital circuits for NOR (O1) / INHIBIT (O2) / NOT (O3) logic gates.

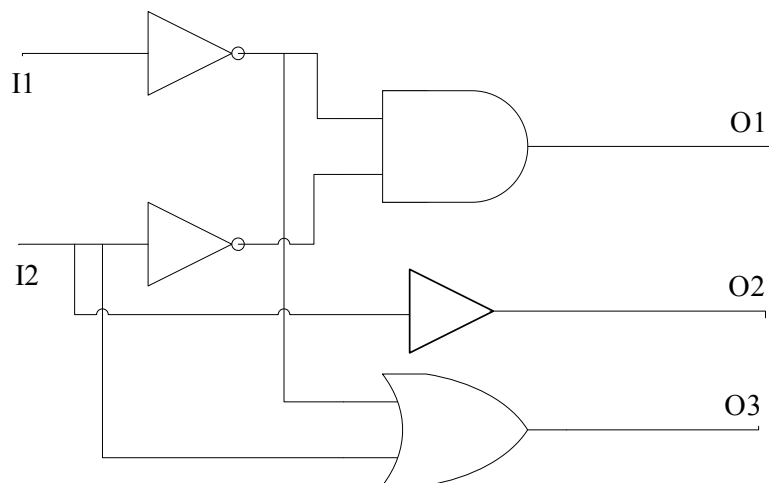


Fig. S12 Digital circuits for NOR (O1) / YES (O2) / IMPLICATION (O3) logic gates.

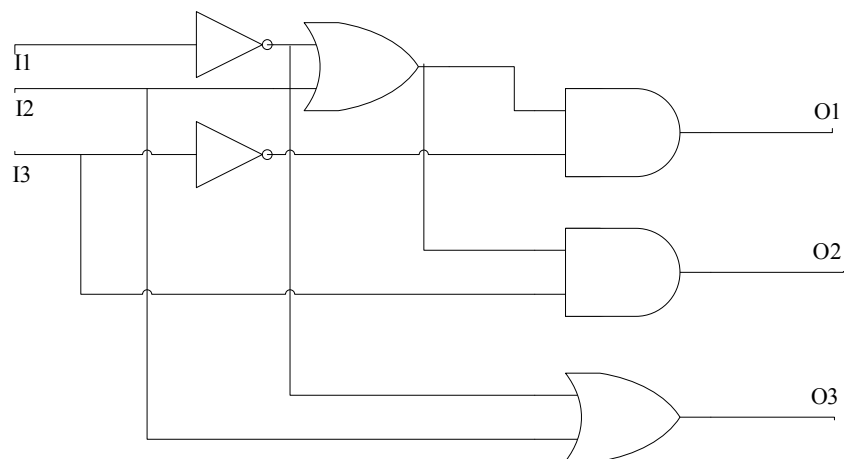


Fig. S13 Digital circuits for the 3-input combinational logic gate in Fig. 11.

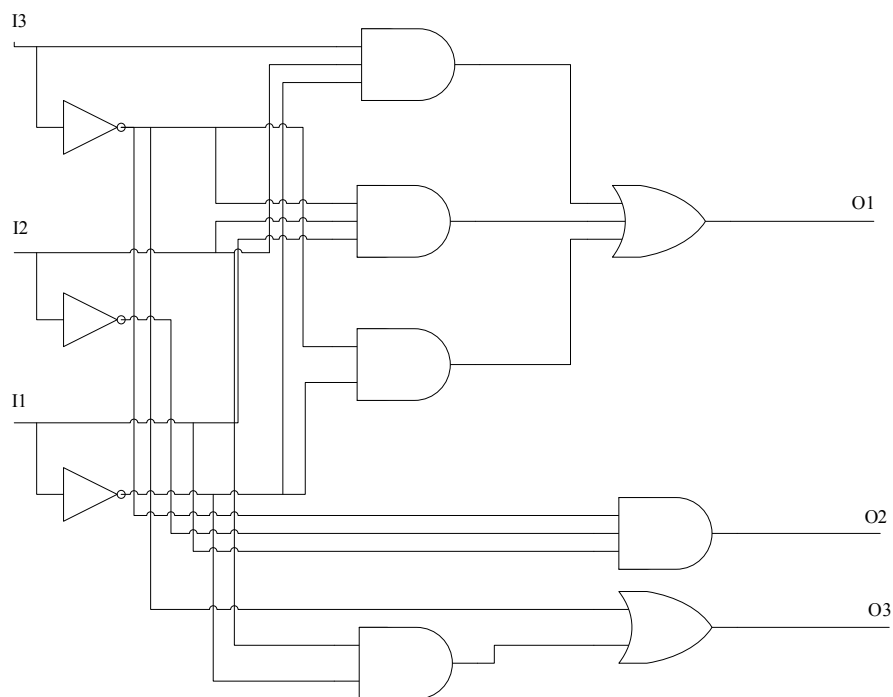


Fig. S14 Digital circuits for the 3-input combinational logic gate in Fig. 12.