Electronic Supplementary Material (ESI) for RSC Advances.

Supporting Information

A simple photoluminescent strategy for pH and amine vapors detection based on Eu(III)-complex functionalized material

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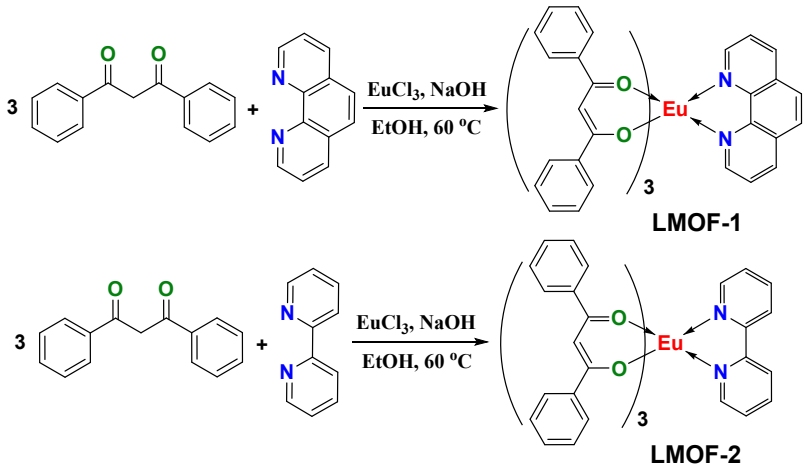


Scheme S1. The synthetic route of LMOF-**1** and LMOF-**2**.

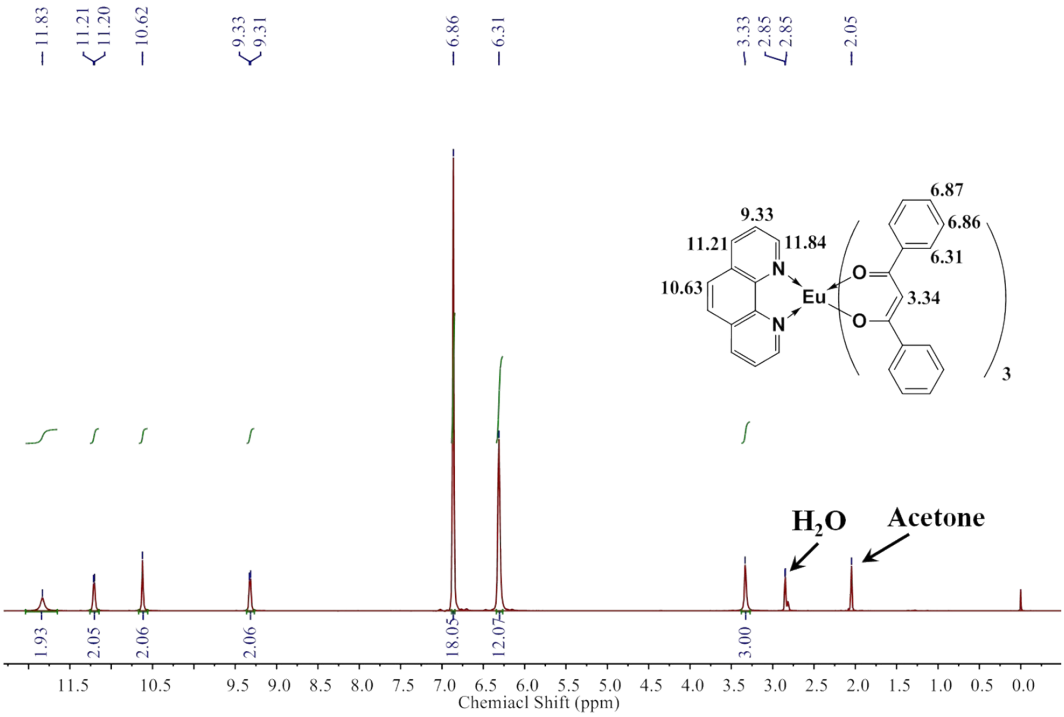


Fig. S1. The ^{1}H NMR spectrum of LMOF-**1** (acetone-d_6, 500 MHz).

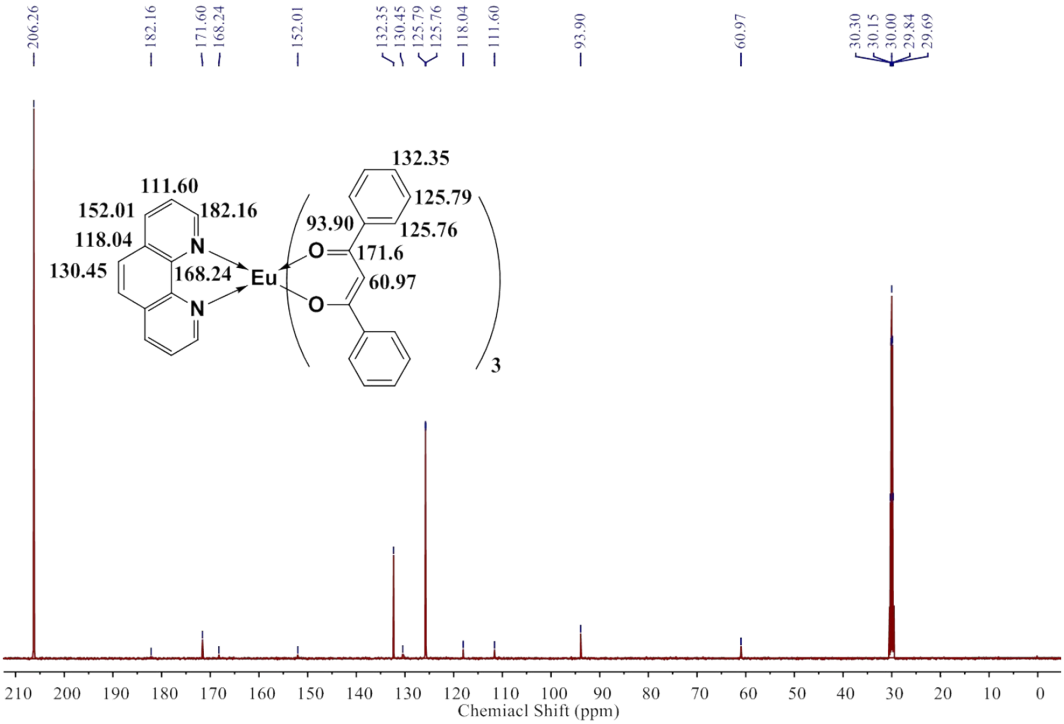


Fig. S2. The ^{13}C NMR spectrum of LMOF-**1** (acetone-d_6, 125 MHz).

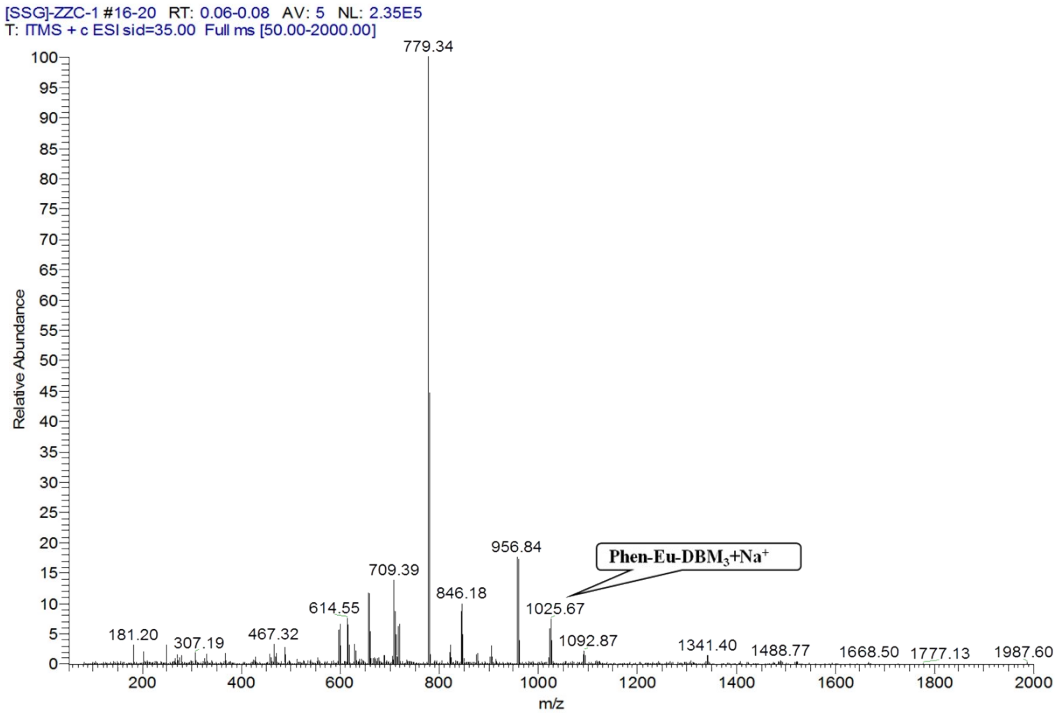


Fig. S3. ESI-MS spectrum of LMOF-**1**.

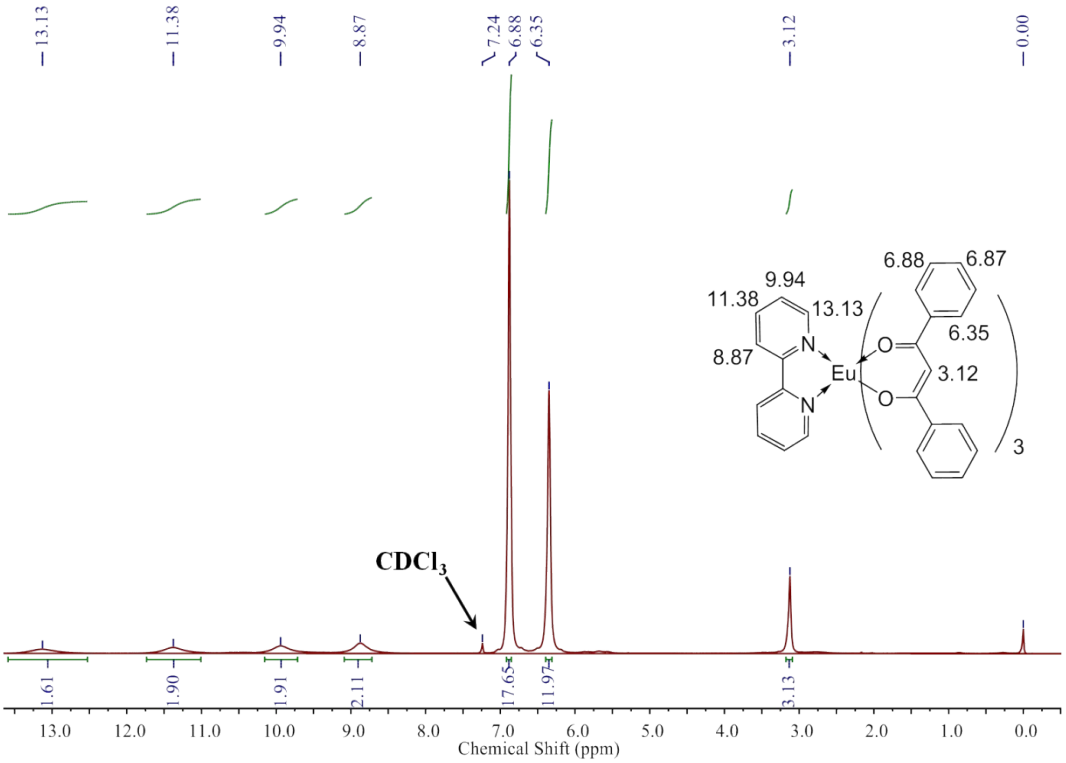


Fig. S4. The ^{13}C NMR spectrum of LMOF-**2** ($CDCl_3$, 500 MHz).

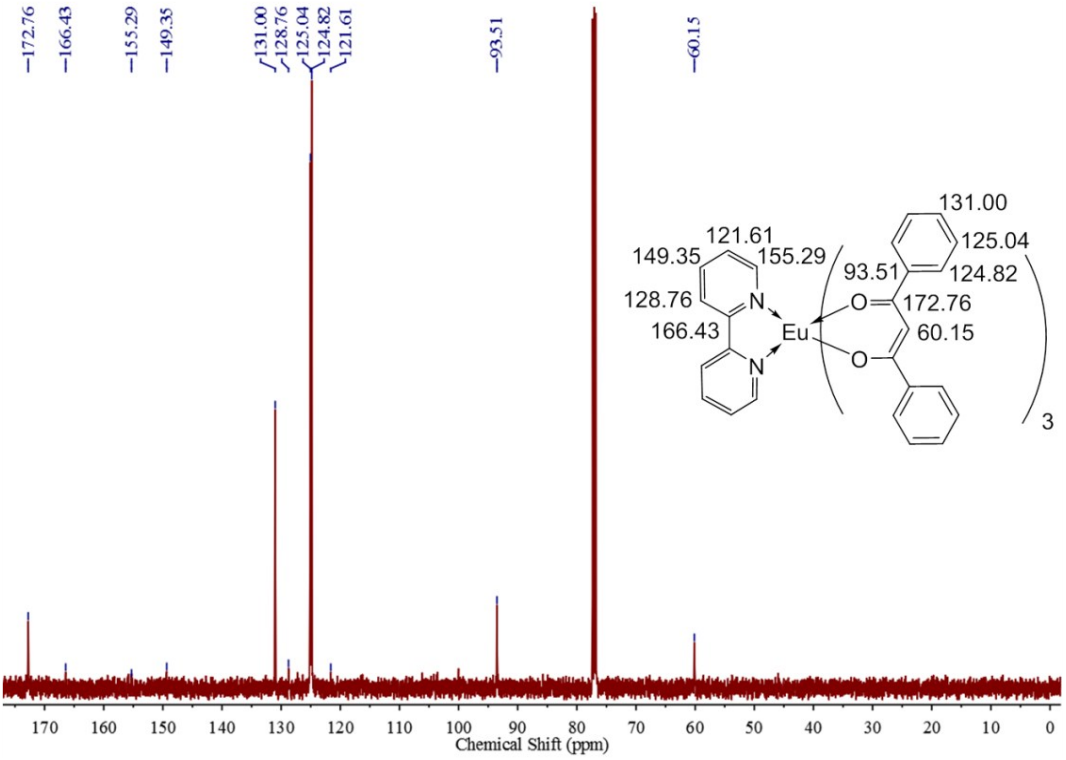


Fig. S5. The ^{13}C NMR spectrum of LMOF-**2** ($CDCl_3$, 125 MHz).

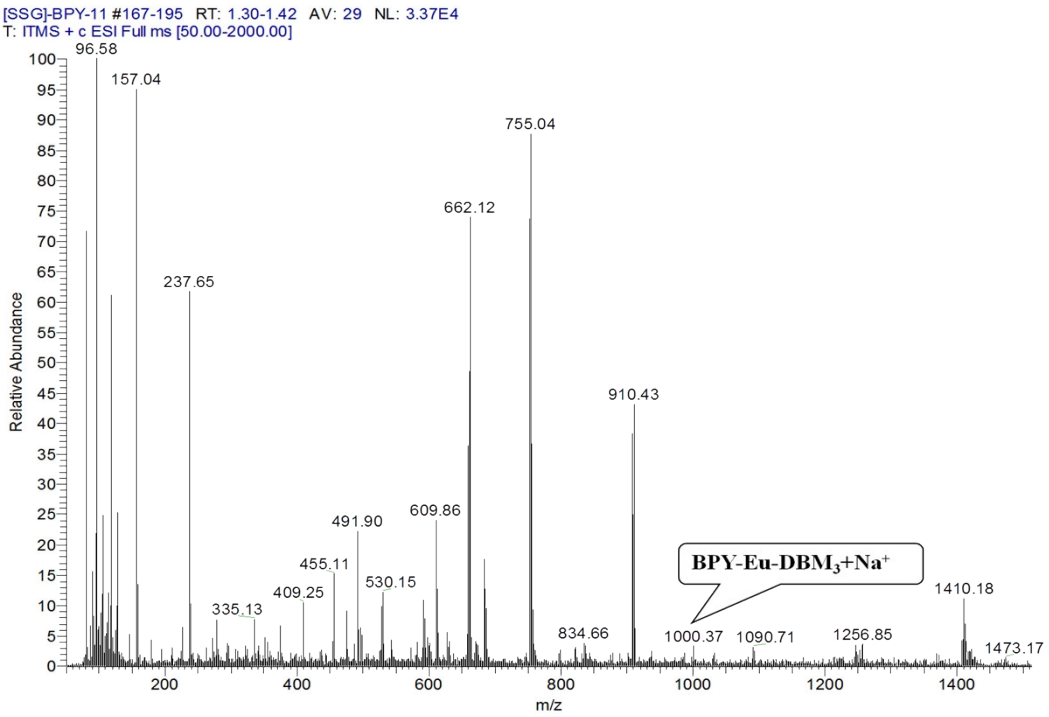


Fig. S6. ESI-MS spectrum of LMOF-**2**.

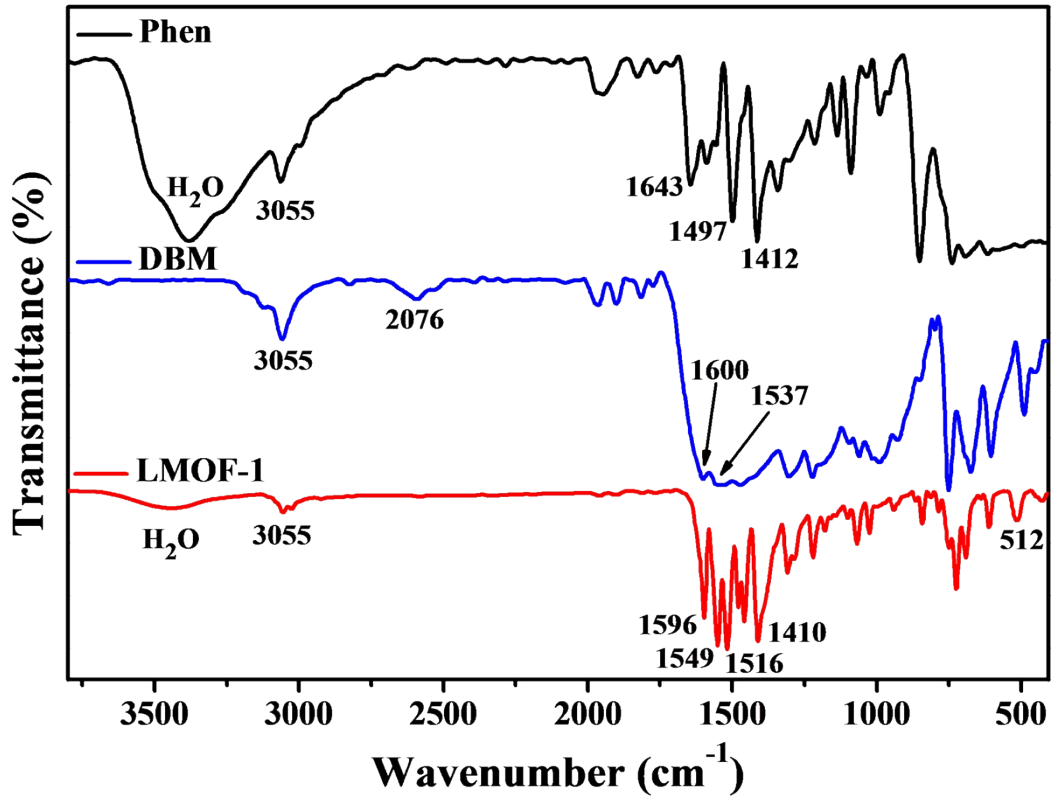


Fig. S7. The IR spectra of Phen, DBM and LMOF-**1**.

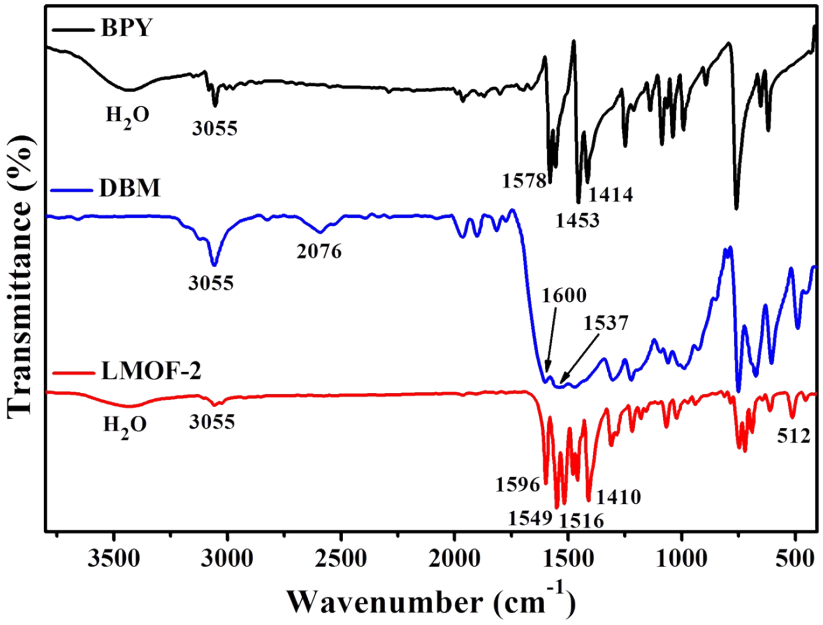


Fig. S8. The IR spectra of BPY, DBM and LMOF-**2**.

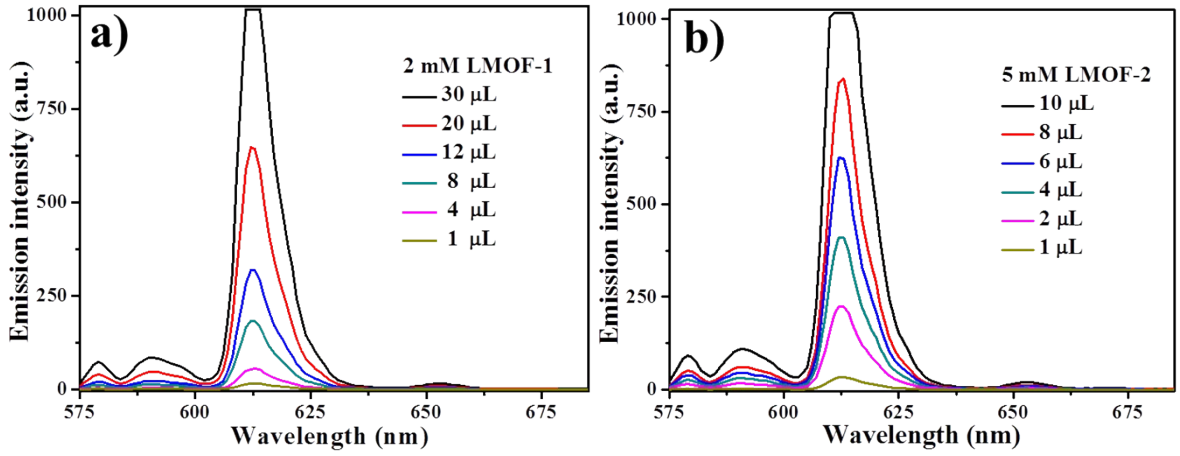


Fig. S9. a) The emission spectra of LMOF-**1** with different added volume to solution (H_2O/DMSO, v/v=5/1, pH=11, λ_{ex}=375 nm). b) The emission spectra of LMOF-**2** different added volume to solution (H_2O/DMSO, v/v=5/1, pH=11, λ_{ex}=385 nm).

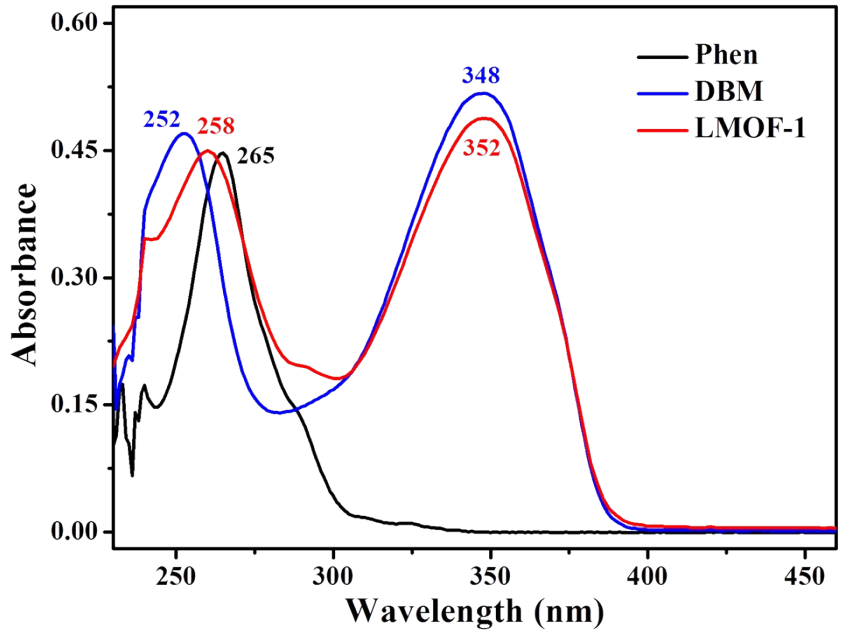


Fig. S10. UV-vis absorption spectra of Phen (12 μM), DBM (30 μM) and LMOF-**1** (8 μM) were recorded in mixed solution of H_2O/DMSO (V/V=5/1).

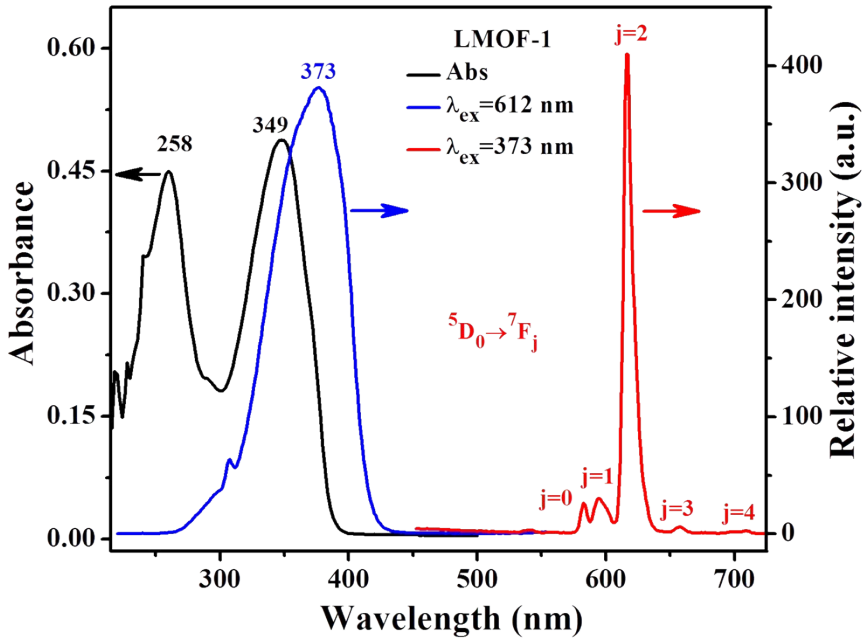


Fig. S11. The absorption, excitation and emission spectra of LMOF-**1** (8 μM) were recorded in mixed solution of H_2O/DMSO (V/V=5/1).

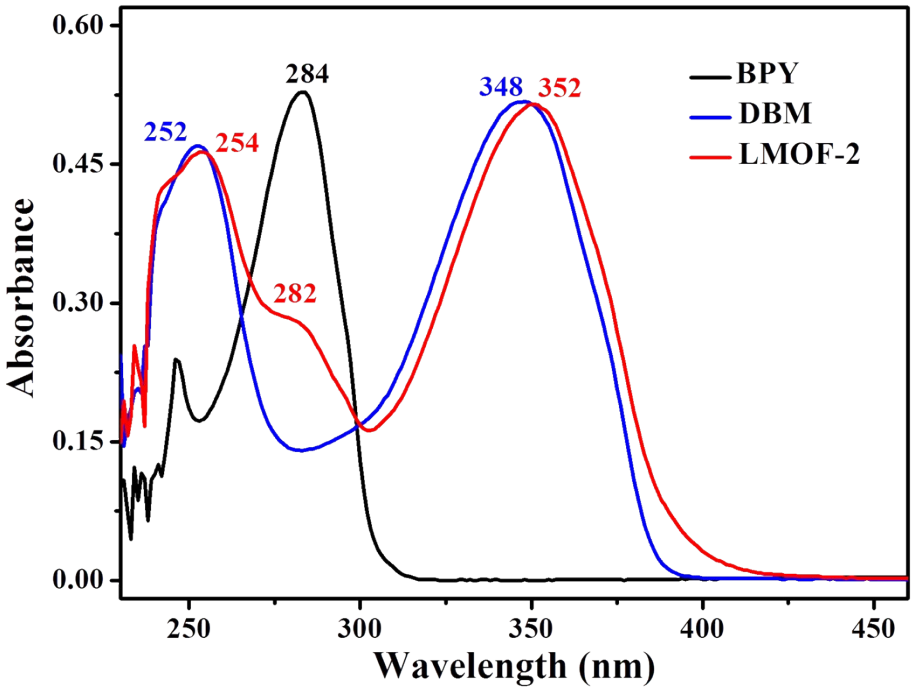


Fig. S12. The UV-vis absorption spectra of BPY (40 μM), DBM (30 μM), and the LMOF-**2** (10 μM) were recorded in mixed solution of H_2O/DMSO (V/V=5/1).

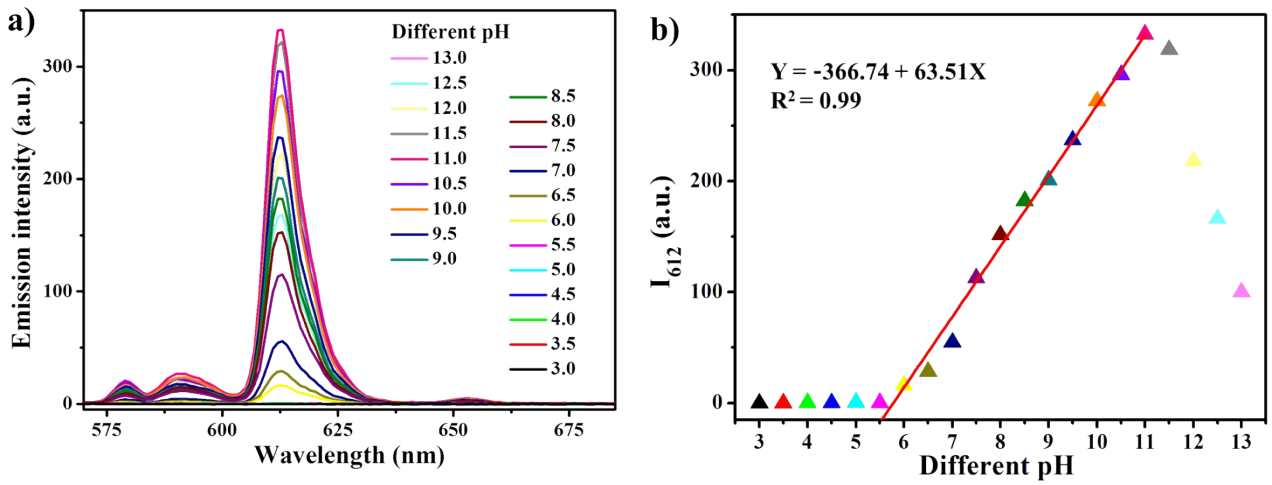


Fig. S13. a) The emission spectra of LMOF-**1** (8 μM) under different pH conditions in solution (H_2O/DMSO, v/v=5/1). b) Relationship between the emitting intensity at 612 nm and pH values (λ_{ex}=375 nm, slits: 3/3 nm).

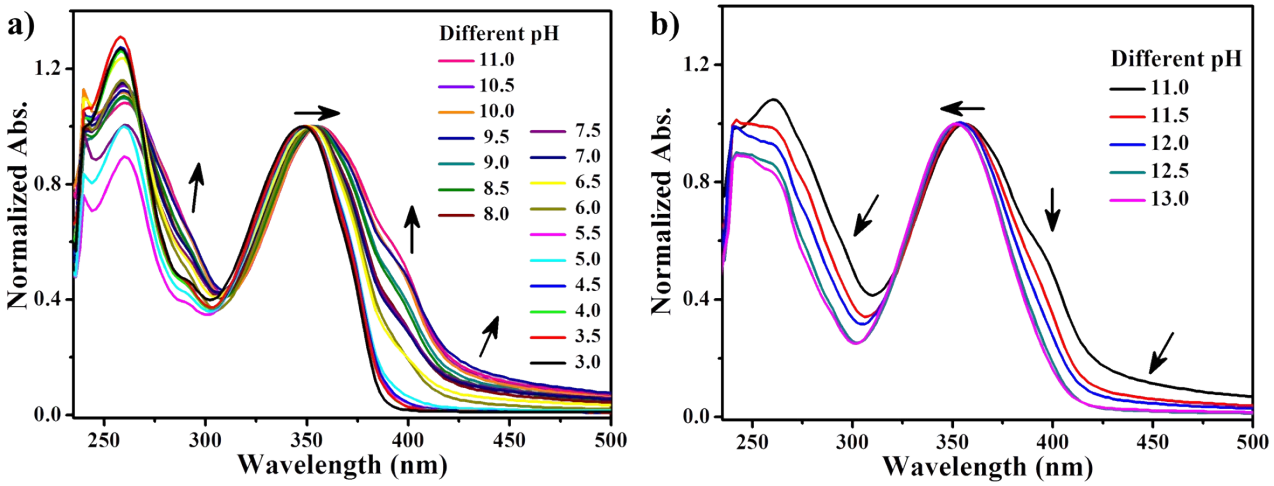
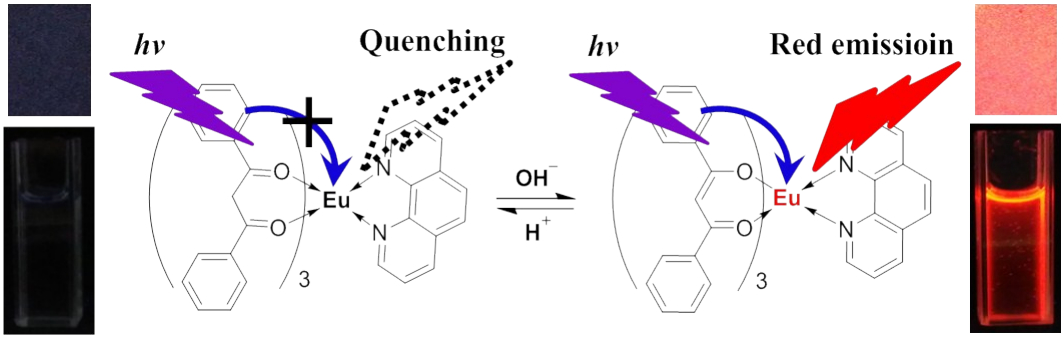


Fig. S14. Normalized absorption spectra of LMOF-**1** (8 μM) under different pH conditions in solution (H_2O/DMSO, v/v=5/1).



Scheme S2. The response mechanism of the LMOF-**1** to different pH.

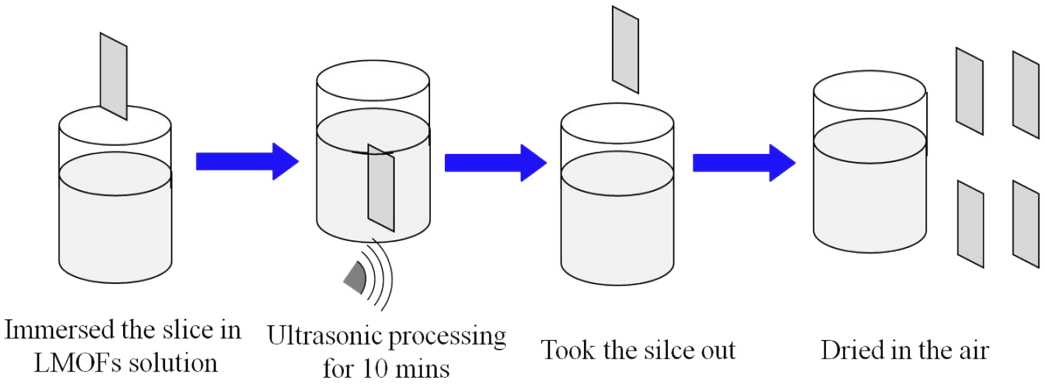


Fig. S15. The processes of LMOFs-based functionalized films prepared in the solution of LMOFs and PVA.

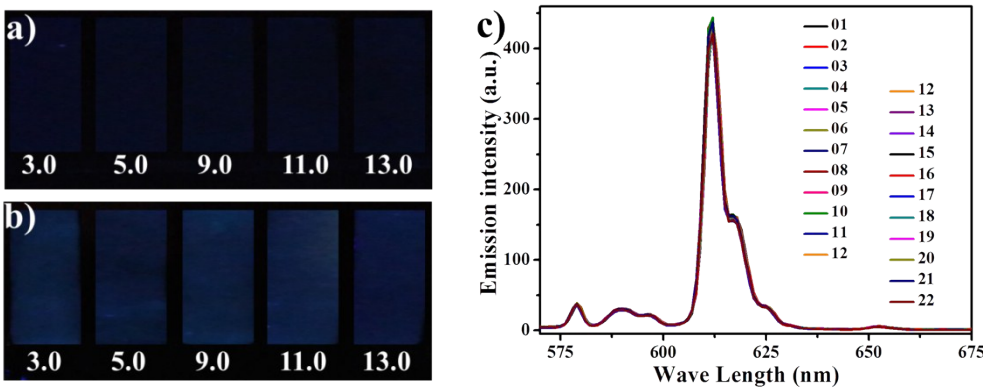


Fig. S16. The digital photos of silica plates **a)** and filter paper **b)** without LMOFs treated with different pH solutions under UV light (365 nm). **c)** The luminescence intensity of LMOFs-based functionalized films (22 groups contrastive experiment) were relatively uniform.

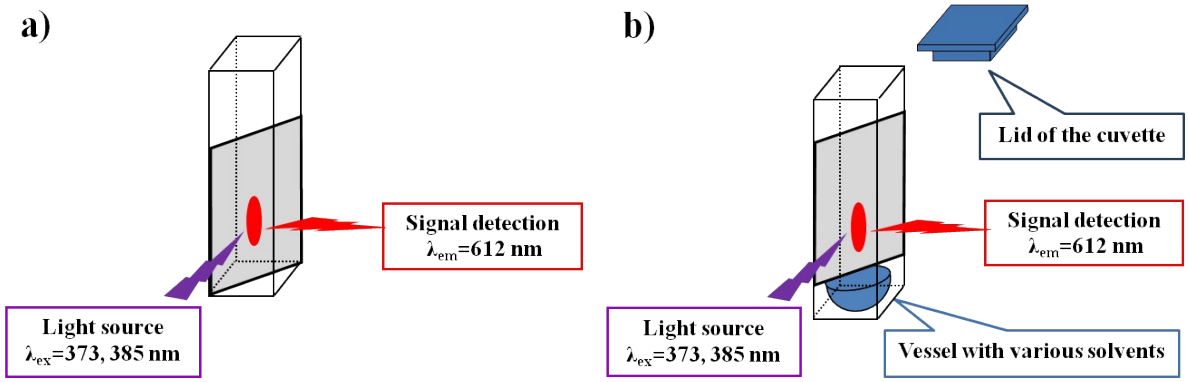


Fig. S17. The sensor setup used for measurement the photoluminescence of films after processing different pH solutions **a)** and vapors **b)**.

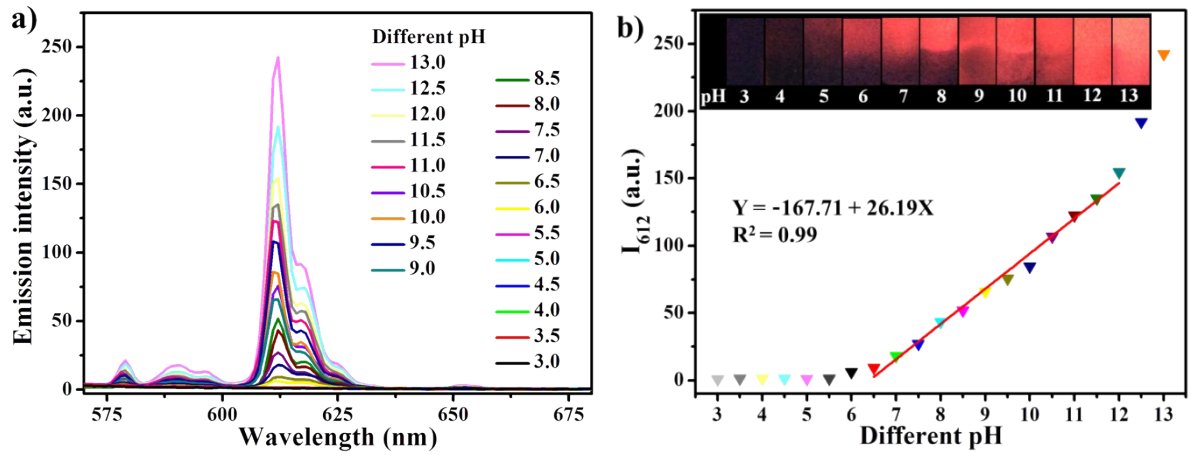


Fig. S18. a) The emission spectra of LMOF-**1** loaded papers immersed in different pH aqueous solution (λ_{ex}=373 nm, slits: 3/3 nm). **b)** The relationship between luminescent intensity at 612 nm and pH. Inset: Photos of the papers under UV light (365 nm) after soaked with different pH solution.

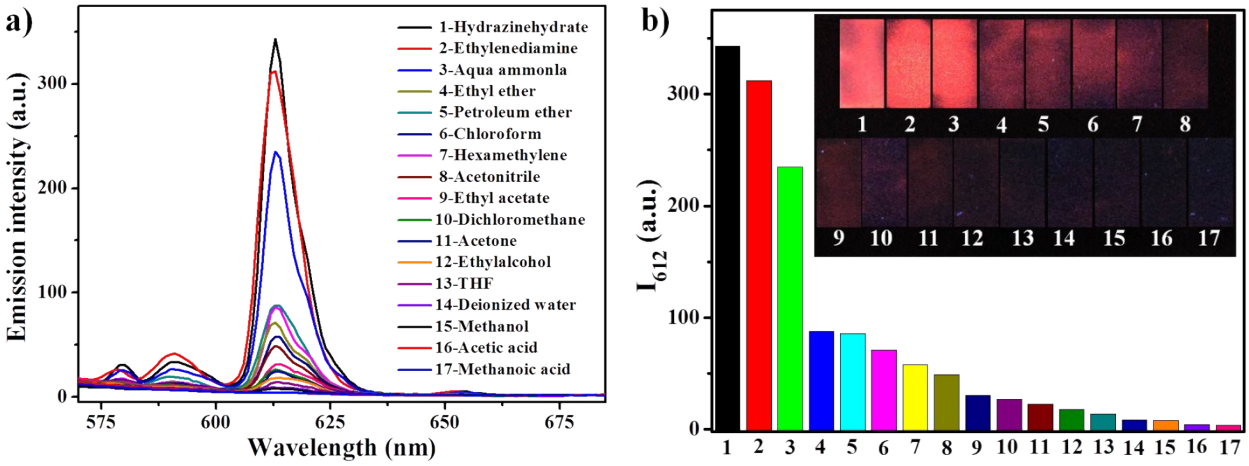


Fig. S19. a) The emission spectra of MOF-**1** loaded papers processed in different vapors (λ_{ex}=373 nm, slits: 3/5 nm). **b)** The emitting intensity at 612 nm (serial number corresponding to different vapors in **a)**). Inset: The digital photos of the tested papers under UV light (365 nm).

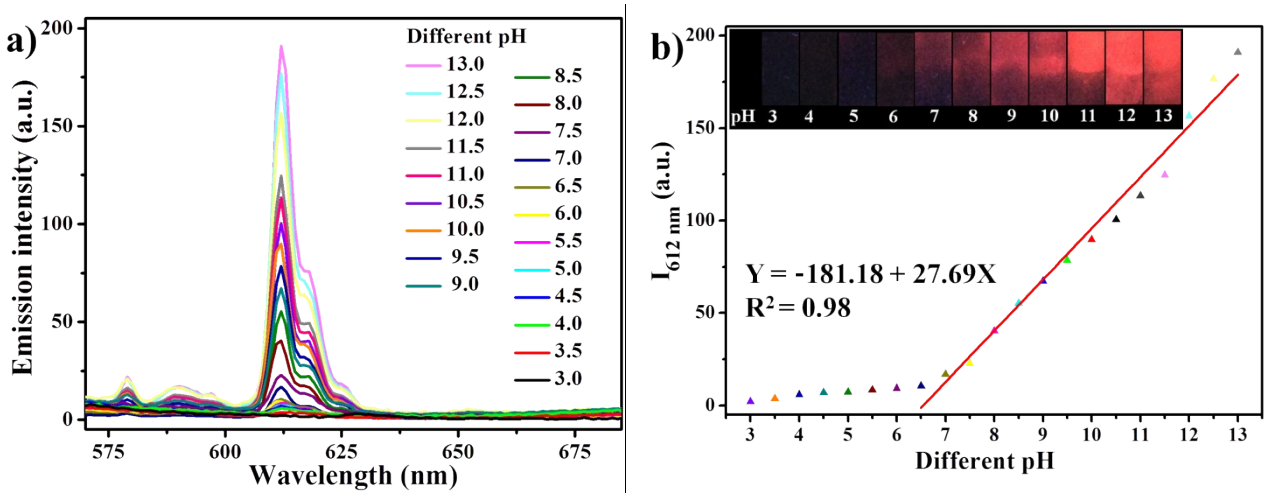


Fig. S20. a) The emission spectra of LMOF-**1** loaded silica plates immersed in different pH aqueous solution (λ_{ex}=373 nm, slits: 3/3 nm). **b)** The relationship between luminescent intensity at 612 nm and pH. Inset: Photos of silica plates under UV light (365 nm) after soaked with different pH solution.

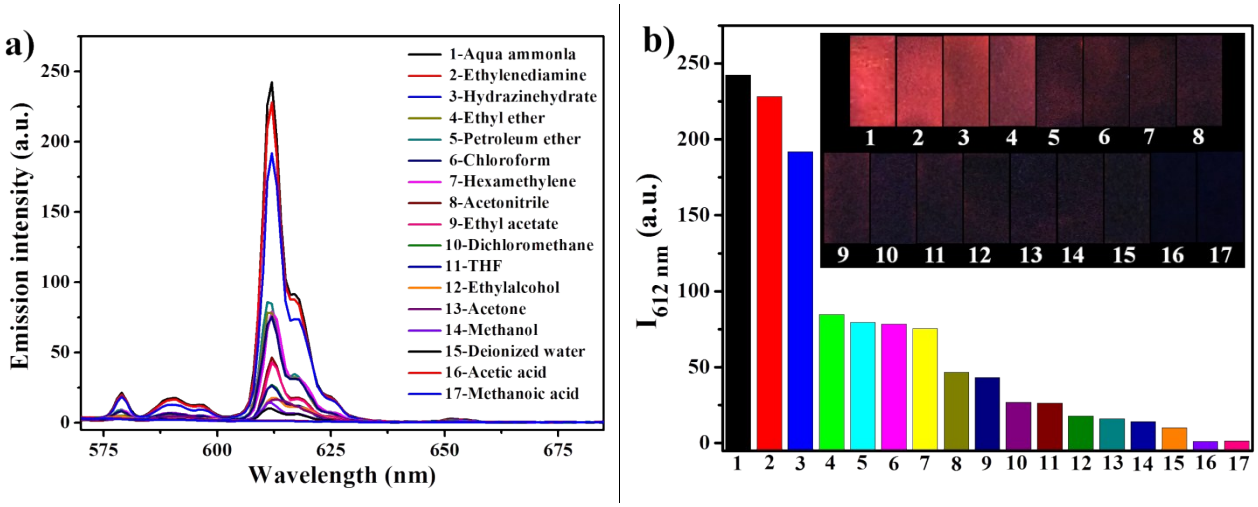


Fig. S21. a) The emission spectra of MOF-**1** loaded silica plates processed in different vapors (λ_{ex}=373 nm, slits: 3/3 nm). **b)** The emitting intensity at 612 nm (serial number corresponding to different vapors in **a)**). Inset: The digital photos of the tested silica plates under UV light (365 nm).

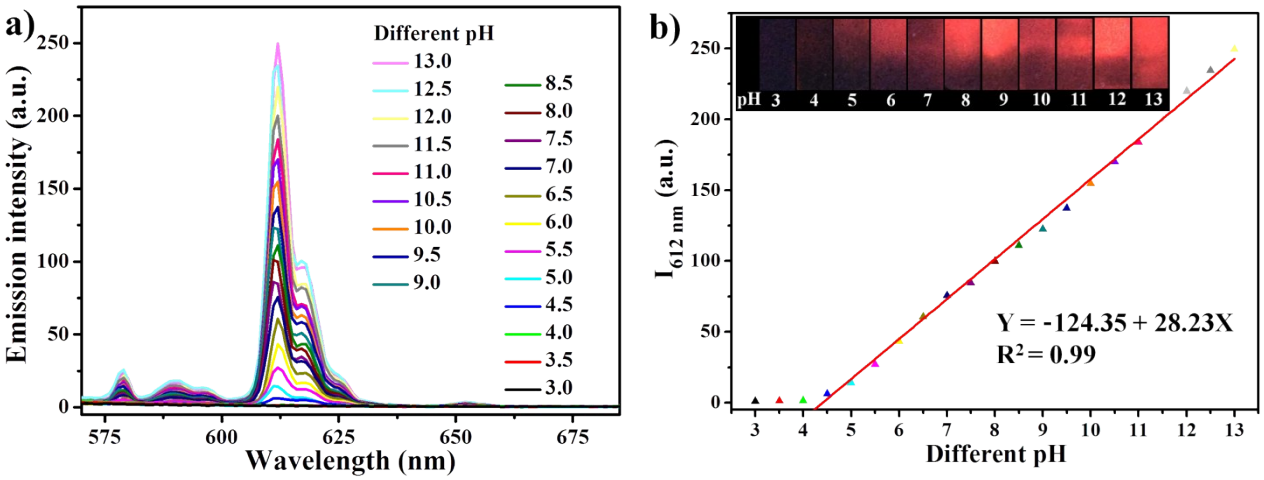


Fig. S22. a) The emission spectra of LMOF-**2** loaded silica plates immersed in different pH aqueous solution (λ_{ex}=385 nm, slits: 3/3 nm). **b)** The relationship between luminescent intensity at 612 nm and pH. Inset: Photos of silica plates under UV light (365 nm) after soaked with different pH solution.

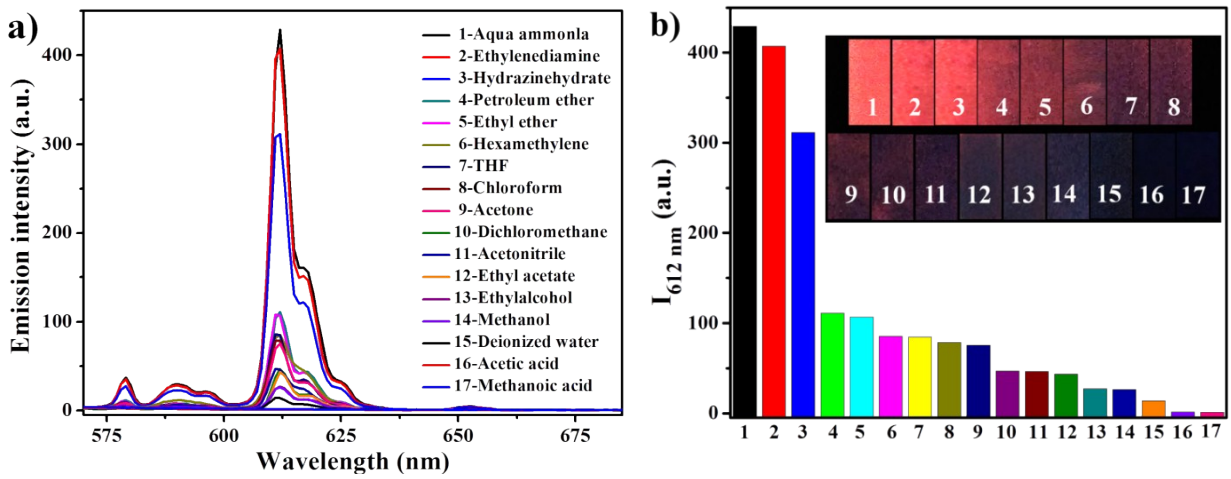


Fig. S23. a) The emission spectra of LMOF-**2** loaded silica plates processed in different vapors (λ_{ex}=385 nm, slits: 3/5 nm). **b)** The emitting intensity at 612 nm (serial number corresponding to different vapors in **a)**). Inset: The digital photos of the tested silica plates under UV light (365 nm).

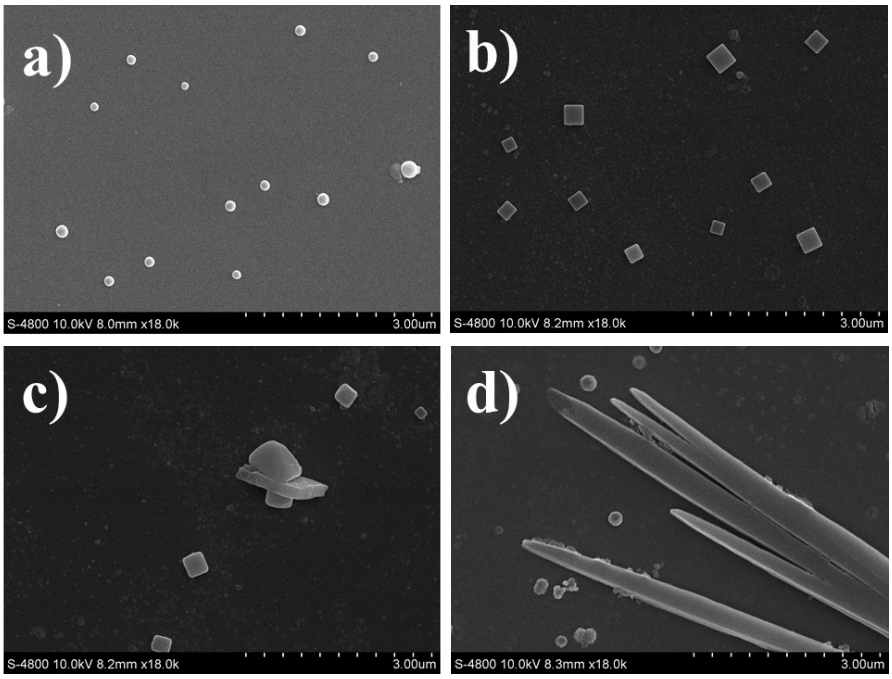


Fig. S24. The SEM of LMOF-**1** in different pH solution. a) pH=3; b) pH=6; c) pH=9; d) pH=12.

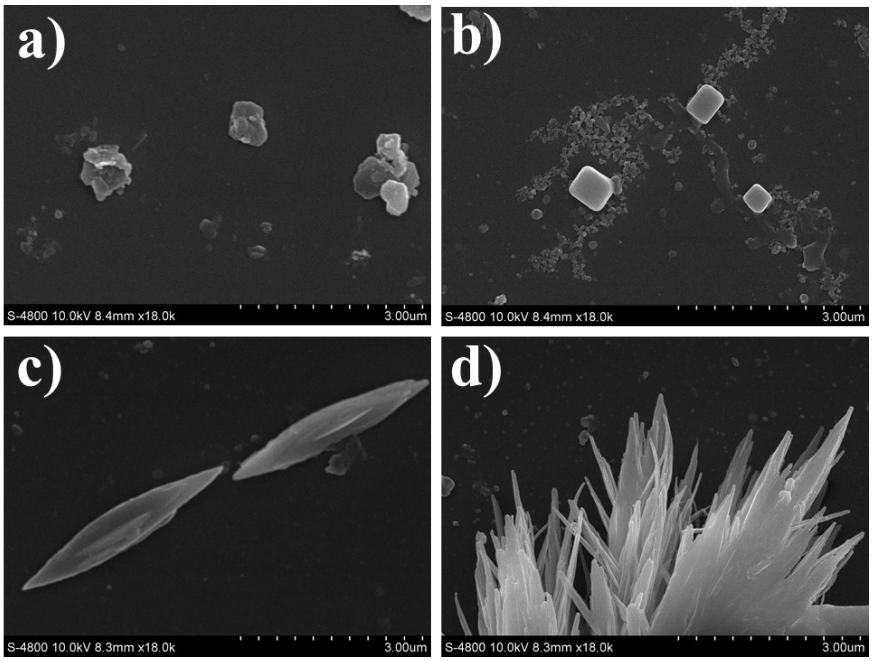


Fig. S25. The SEM of LMOF-**2** in different pH solution. a) pH=3; b) pH=6; c) pH=9; d) pH=12.

As shown in **Fig. S24** and **S25**, different morphologies of LMOF-**1** and LMOF-**2** were observed in the condition of different pH values, which were due to the conformational transformation between enol and keto form in different acid-base environment[1]and Phen's and BPY's protonation and deprotonation under stronger acidic and alkalic circumstance.[2-5] In acidic environment, owing to the protonation of Phen and BPY as well as the ketonic transformation of DBM, LMOFs was damaged. So that crystal cannot generate (**Fig. S24a** and **S25a**). With the increase of pH value, crystal generated gradually, from block to strip (**Fig. S24b-d** and **S25b-d**).

Reference

1. V. Pramod Kumar, K. Federico, S. Andreas, N. Patrick and B. Tobias, *J. Am. Chem. Soc.*, 2014, **136**, 14981-14989.
2. H. Doe, K. Yoshioka and T. Kitagawa, *J. Electroanal. Chem.*, 1992, **324**, 69-78.
3. Z. Yoshida and H. Freiser, *J. Electroanal. Chem.*, 1984, **162**, 307-319.
4. K. Dimitrou, A. D. Brown, K. Folting and G. Christou, *Inorg. Chem.*, 1999, **38**, 1834-1841.
5. A. Samotus, A. Kanas, W. Glug, J. Szklarzewicz and J. Burgess, *Transit. Metal Chem.*, 1991, **16**, 614-617.