# Supplementary Information

## Room temperature tunable multicolor phosphorescent polymers for humidity detection and information encryption

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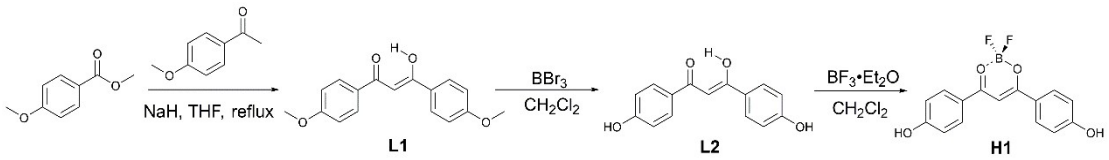


**Scheme S1.** Synthetic route of H1.

Compound 1,3-bis(4-methoxyphenyl)propane-1,3-dione (L1) was synthesized according to the method which has been reported in the earlier literature with same structure.[1]

**Synthesis of 1,3-bis(4-hydroxyphenyl)propane-1,3-dione (L2):** To a solution of L1 (3.46 g, 12.2 mmol) in $CH_2Cl_2$ (50 mL) cooled with an ice-salt bath was added dropwise a 1 M $CH_2Cl_2$ solution of $BBr_3$ (36.5 mL, 36.5 mmol). This solution was stirred for 30 min at ice-salt bath, 30 min at 0 °C, 5 h at room-temperature and afterward quenched by dropwise addition of $H_2O$ (50 mL). Addition of 2 M NaOH (50 mL). The aqueous was adjusted to pH = 6 with conc HCl (aq) caused formation of a yellow precipitate which was then extracted with ethyl acetate 3 times, and the combined organic phase was washed with brine (20 mL), dried ($MgSO_4$), filtrated and concentrated under vacuum to afford L2 as a yellow solid (2.77 g, 88.8% yield). $^1$H NMR (400 MHz, in

Acetone-$d_6$): $\delta$ 17.58 (s, 0.9H), 9.12 (s, 2H), 8.04 (d, 4H), 7.04 (s, 1H), 6.97 (d, 4H), 4.60 (s, 0.1H).

**Synthesis of difluoroboron-1,3-bis(4-hydroxyphenyl)propane**-1**,3-dione (H1):** To a solution of L2 (2.56 g, 10.0 mmol) in $CH_2Cl_2$ (50 mL) added dropwise $BF_3{\cdot}Et_2O$ (2.5 mL, 20.0 mmol) by a syringe. The mixture was heated slowly to 60 °C for 5.5 h under nitrogen atmosphere. After cooled to room temperature, the mixture was concentrated under reduced pressure. The desire pure product was obtained by recrystallization from ethyl acetate as a yellow solid (2.18 g, 71.7% yield). $^1$H NMR (400 MHz, in Acetone-$d_6$): $\delta$ 9.69 (s, 1.5H), 8.25 (d, 4H), 7.51 (s, 1H), 7.06 (d, 4H).

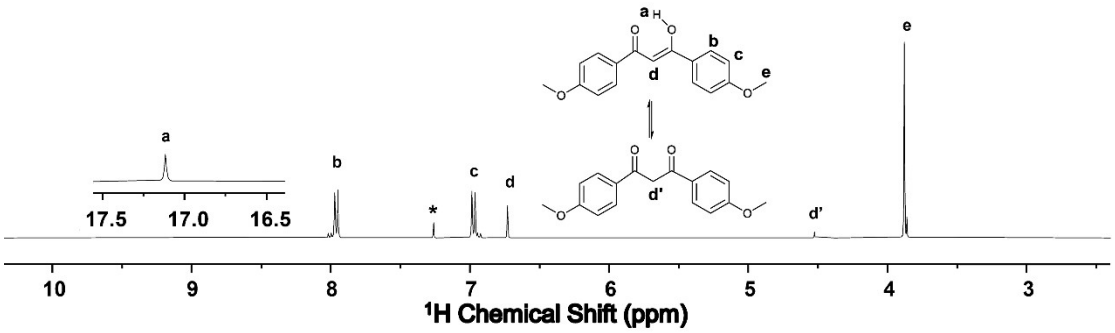


**Figure S1.** The $^1$H NMR spectrum of L1 in $CDCl_3$.

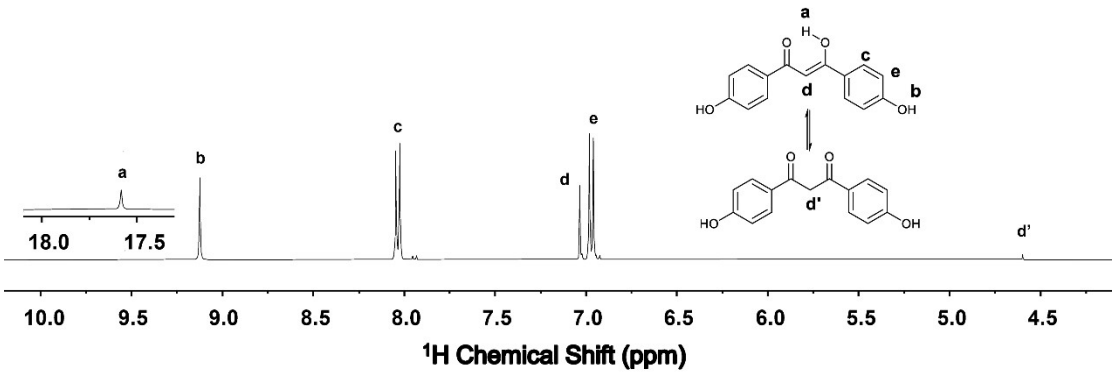


**Figure S2.** The $^1$H NMR spectrum of L2 in Acetone-$d_6$.

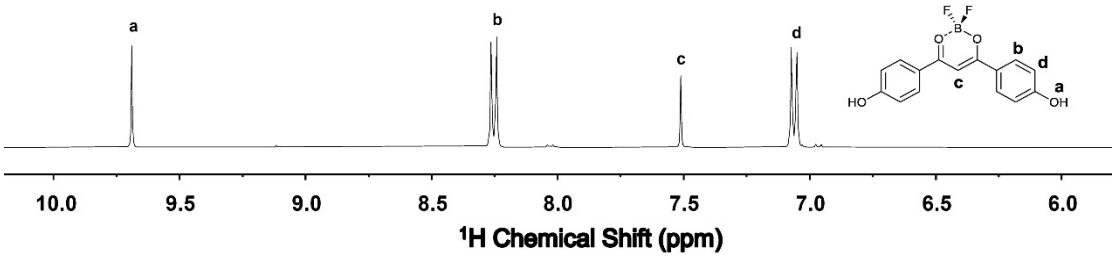


**Figure S3.** The $^{1}H$ NMR spectrum of H1 in Acetone-$d_6$.

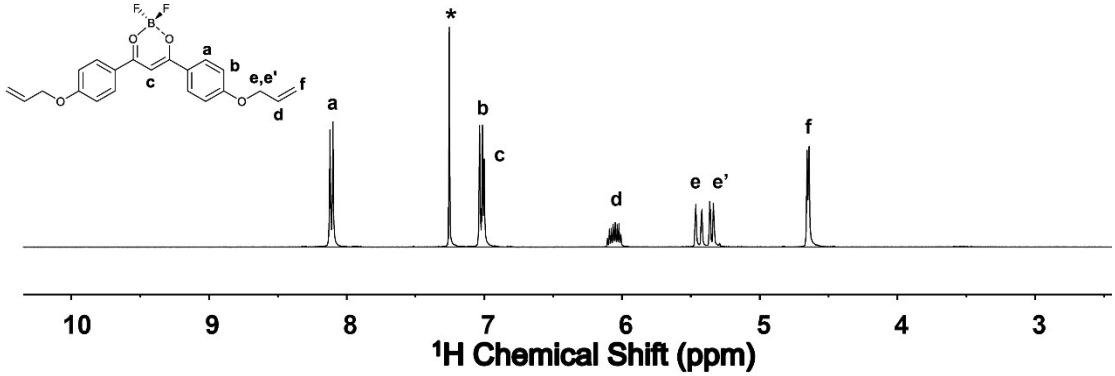


**Figure S4.** The $^{1}H$ NMR spectrum of $BF_2$bad in $CDCl_3$.

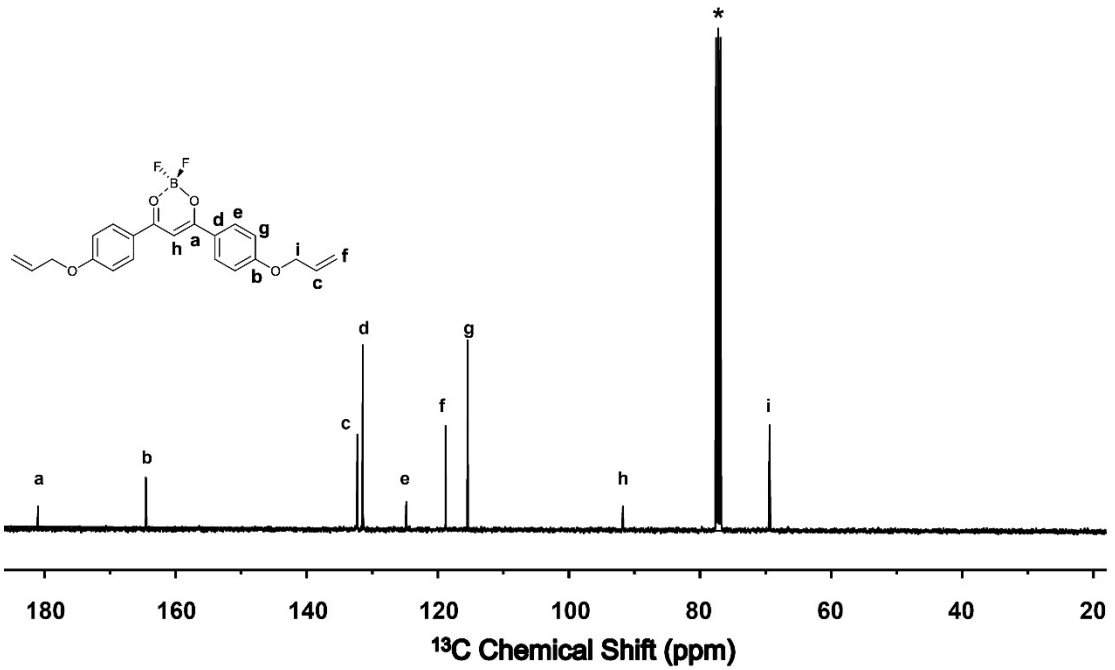


**Figure S5.** The $^{13}C$ NMR spectrum of $BF_2$bad in $CDCl_3$.

**Table S1.** Monomer proportions and yields of SPAP.

| Sample | $BF_2$bad [mg] | AM [mg] | AIBN [mg] | DMSO [mL] | SPAP [mg] |
|---|---|---|---|---|---|
| SPAP(1/10) | 250 | 463 | 6.4 | 4.5 | 300 |
| SPAP(1/25) | 100 | 463 | 6.4 | 4.5 | 350 |
| SPAP(1/50) | 50 | 463 | 6.4 | 4.5 | 450 |
| SPAP(1/75) | 33 | 463 | 6.4 | 4.5 | 410 |
| SPAP(1/100) | 25 | 463 | 6.4 | 4.5 | 470 |

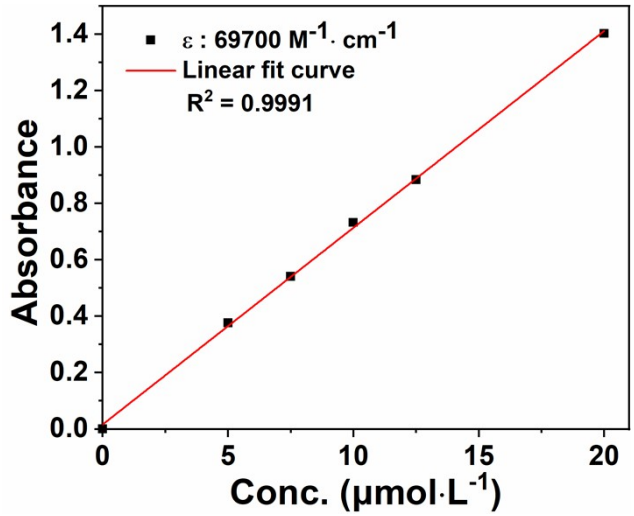


**Figure S6.** Molar extinction coefficient of $BF_2$bad in $CH_2Cl_2$.

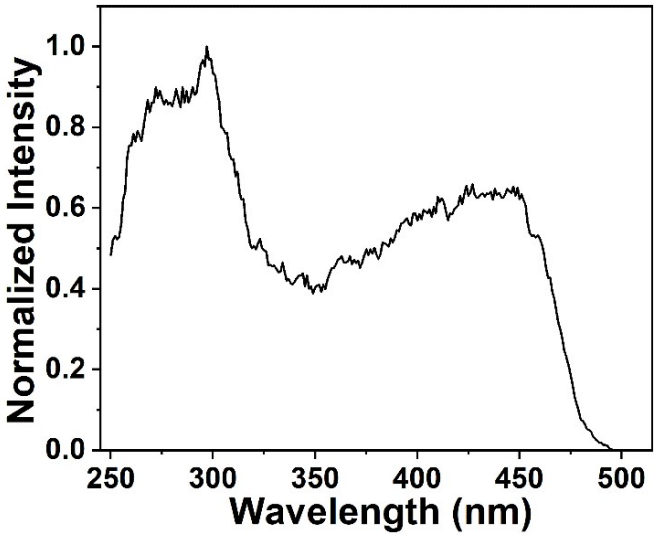


**Figure S7.** Excitation spectra of SPAP(1/50) ($\lambda_{em}$ = 518 nm).

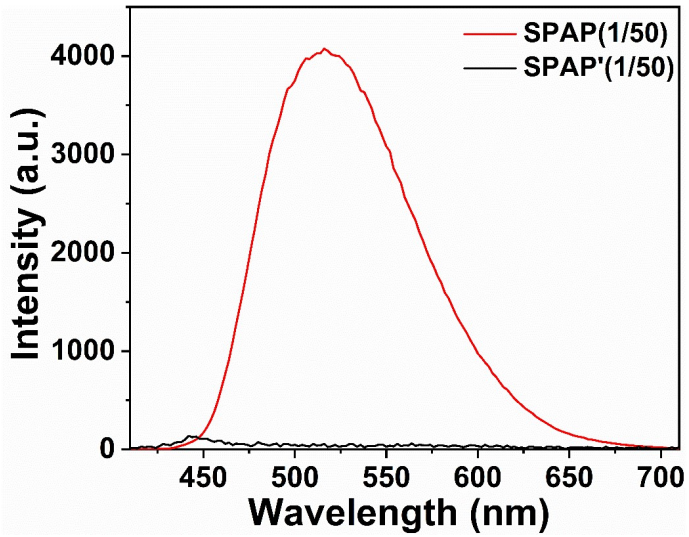


**Figure S8.** RTP emission spectra of SPAP(1/50) and SPAP'(1/50).

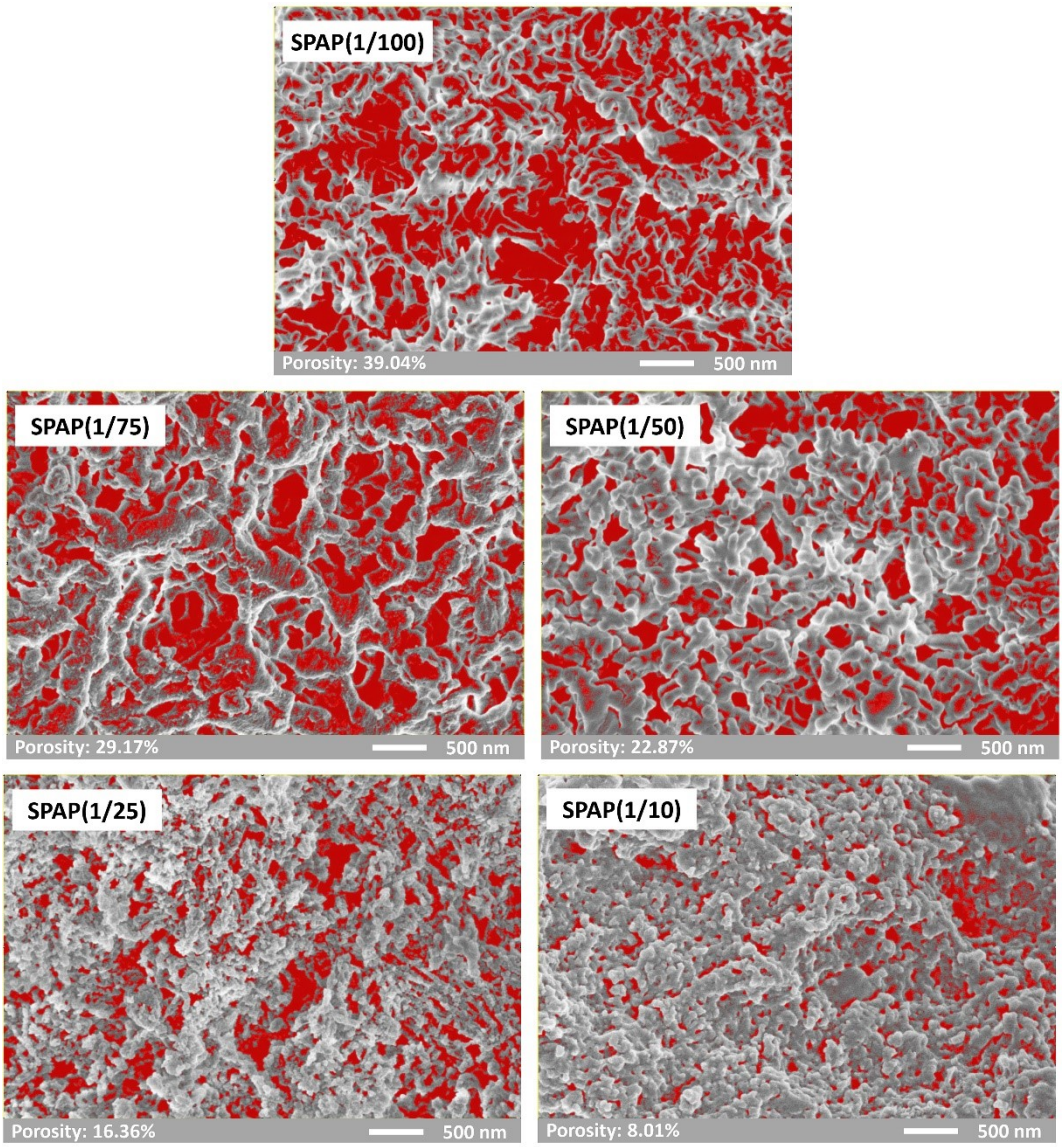


**Figure S9.** The estimated porosity of SPAP using ImageJ. The part as red color marked is the pore.

1. J. L. Howard, Y. Sagatov, L. Repusseau, C. Schotten and D. L. Browne, *Green Chem.*, 2017, **19**, 2798-2802.