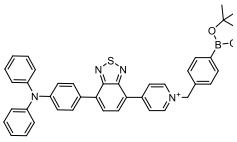
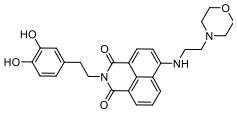
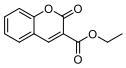
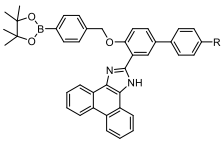
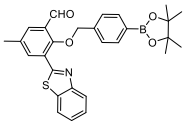
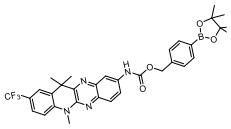
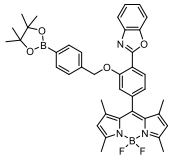
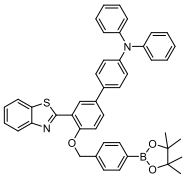
Supporting information

1. Probe performance comparison

Table S1. Probe performance comparison

Probe	Synthesis procedure	Storkes Shift	Response Time	pH adaptability	Selectivity	Cell survivals (%)	Ref.
	relatively complicated	130 nm	16 min	7.0-10.0	good	-	[1]
	simple	98 nm	60 min	4.9-7.4	good	≥ 95%	[2]
	very simple	196 nm	20 min	-	good	≥ 90%	[3]
	complicated	70 nm	10 min	-	good	≥ 90%	[4]
	complicated	162 nm	45 min	7.0-9.0	not good	≥ 90%	[5]
	relatively simple	120 nm	40 min	7.0-10.0	good	≥ 90%	[6]
	complicated	12 nm	20 min	-	good	-	[7]
	simple	225 nm	40 min	7.0-11.0	good	≥ 95%	Our work

Reference

[1] Gao C, Hossain M K, Li L, Wahab M A, Xiong J Y, Li W. A colorimetric and fluorescence

turn-on probe for the highly selective detection of hydrogen peroxide in aqueous solution[J]. Journal of Photochemistry and Photobiology A: Chemistry, 2019, 368: 97-103.

[2] Reja S I, Gupta M, Gupta N, Bhalla V, Ohr P, Kaur C, Kumar M. A lysosome targetable fluorescent probe for endogenous imaging of hydrogen peroxide in living cells[J]. Chemical Communications, 2017, 53(26): 3701-3704.

[3] Zeng X D, Jiang C, Zhang Q, Chai D K, Ma M S, Chen J, Liu Z G. A novel simple fluorescent probe for the detection of hydrogen peroxide in vivo with high selectivity[J]. Journal of Luminescence, 2021, 240: 118422.

[4] Chen Y Z, Shi X M, Lu Z L, Wang X F, Wang Z. A fluorescent probe for hydrogen peroxide in vivo based on the modulation of intramolecular charge transfer[J]. Analytical chemistry, 2017, 89(10): 5278-5284.

[5] Zhang H C, Tian D H, Zheng Y L, Dai F, Zhou B. Designing an ESIPT-based fluorescent probe for imaging of hydrogen peroxide during the ferroptosis process[J]. Spectrochimica Acta Part A: Molecular and Biomolecular Spectroscopy, 2021, 248: 119264-119272.

[6] Zhang Y, Yang M, Wang Y S, Huang W Y, Ji M. Lighting up hydrogen peroxide in living cells by a novel quinoxalinamine based fluorescent probe[J]. Spectrochimica Acta Part A: Molecular and Biomolecular Spectroscopy, 2022, 267: 120528-120537.

[7] Li X H, Li J M, Tao Y H, Peng Z X, Lu P, Wang Y G. Oxazole-based high resolution ratiometric fluorescent probes for hydrogen peroxide detection[J]. Sensors and Actuators B: Chemical, 2017, 247: 609-616.

2. Analytical parameters

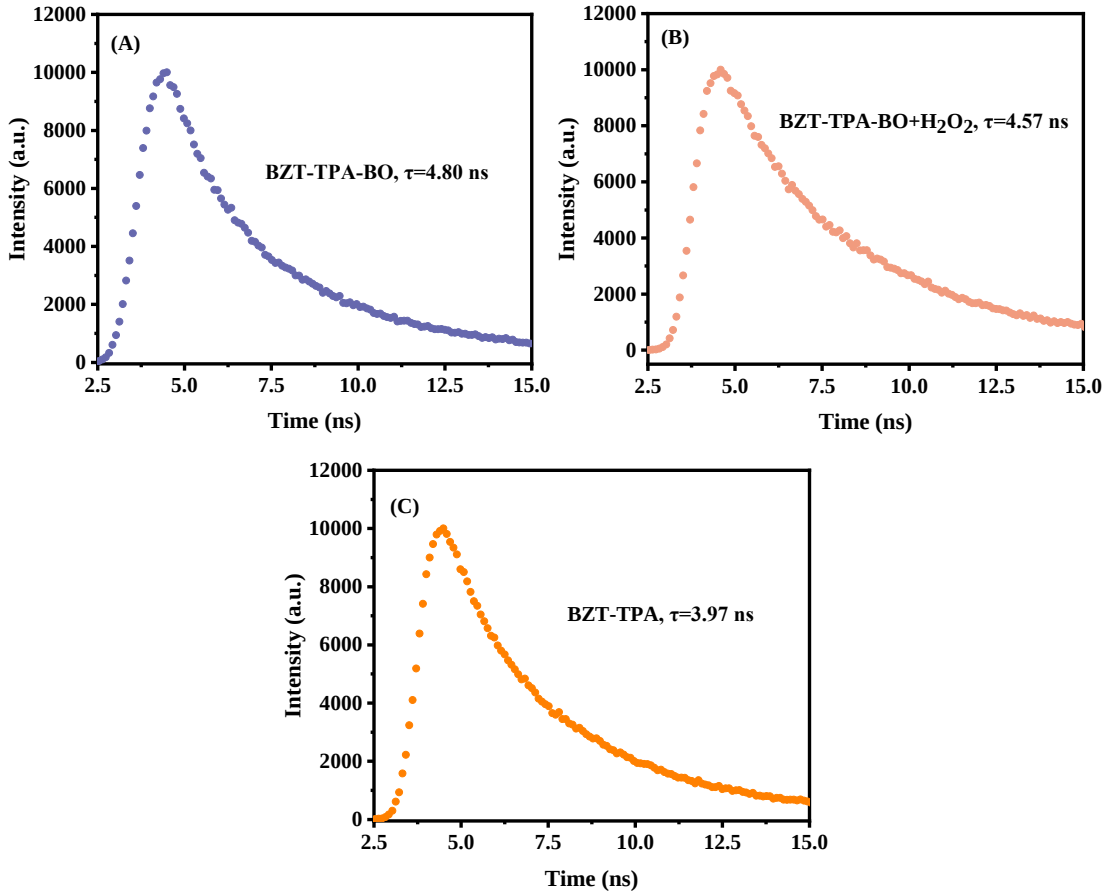


Figure S1. The fluorescence lifetime of **BZT-TPA-BO** (A)、**BZT-TPA-BO**+H_2O_2 (B) and **BZT-TPA** (C).

3. Mechanism study

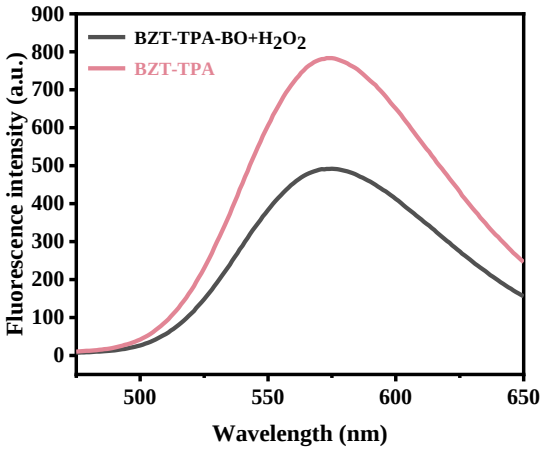


Figure S2. The emission spectrum of **BZT-TPA-BO** (10 μM)+H_2O_2 (200 μM) and **BZT-TPA** (10 μM).

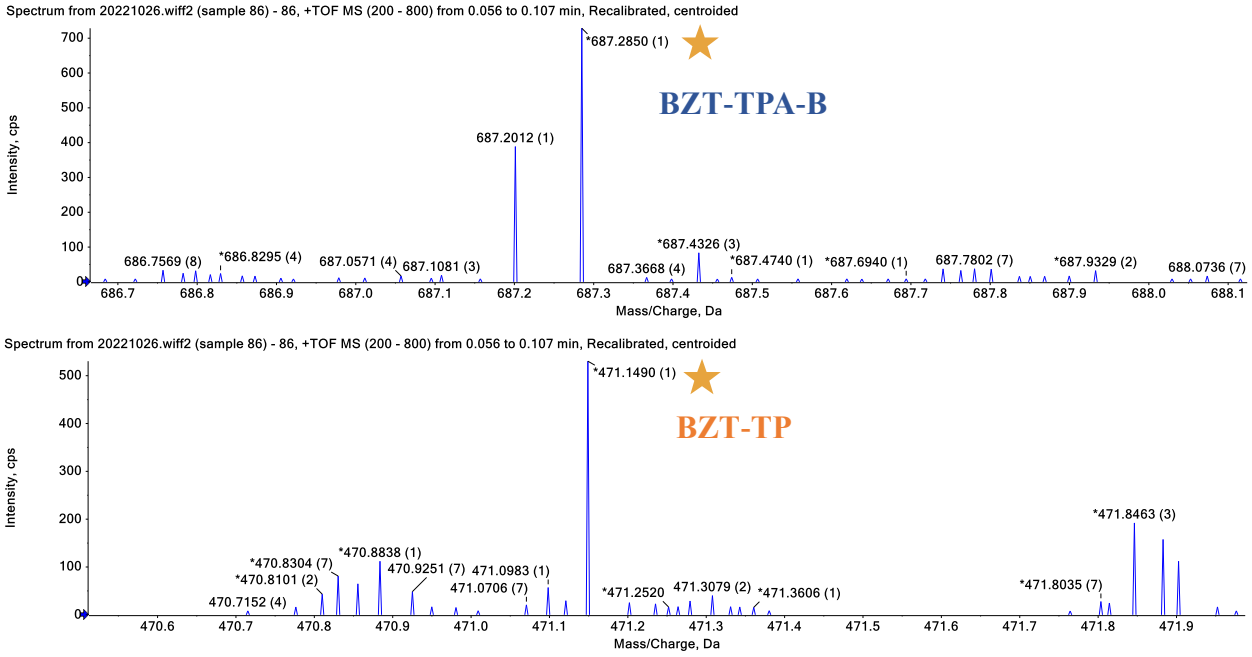
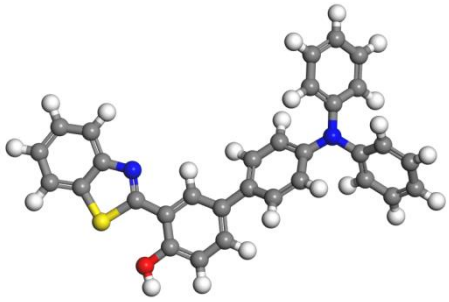
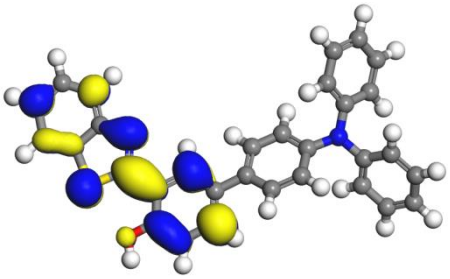


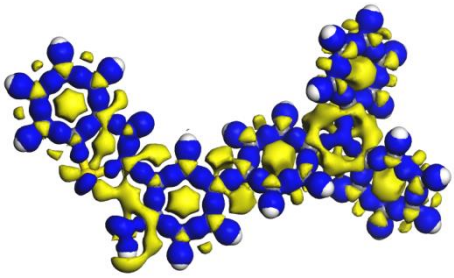
Figure S3. HR-MS of **BZT-TPA-BO** (10 μM)+H_2O_2 (200 μM).



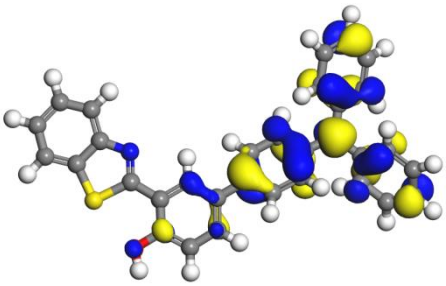
BZT-TPA



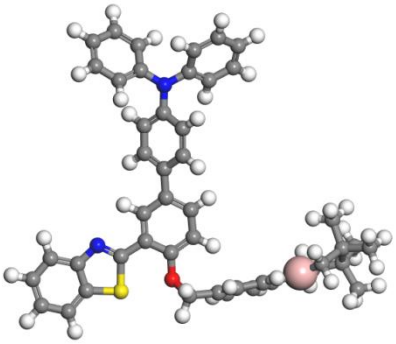
LUMO -2.380eV



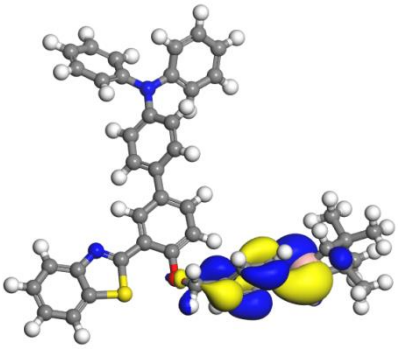
Charge density difference



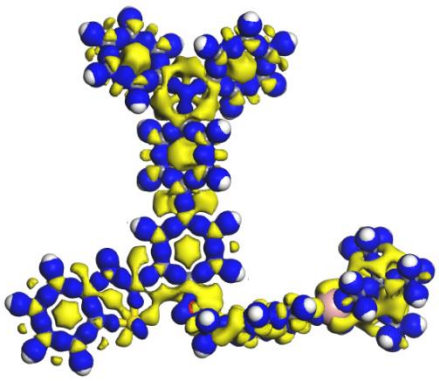
HUMO -4.519eV



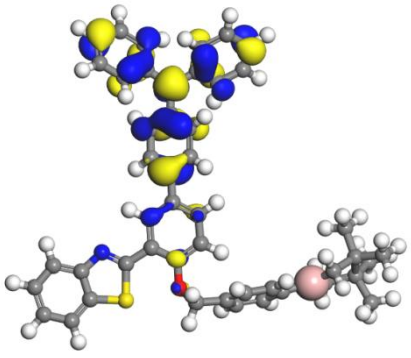
BZT-TPA-BO



LUMO -2.591eV



Charge density difference



HUMO -4.525eV

ΔE = -0.205 eV

Figure S4. The molecular orbitals for the ground states of **BZT-TPA** and **BZT-TPA-BO** based on DFT calculations.

Synthesis of Compound 1, BZT-TPA and BZT-TPA-BO

*Synthesis of Compound **1***: In a two-necked flask, EtOH (30 mL), 5-bromosalicylaldehyde (25 mmol, 5.02 g) and 2-aminobenzenethiol (25 mmol, 2.7 mL) were added in sequence. Then, the temperature of mixed solution was rise to 40~45 ℃, and slowly add $POCl_3$ (25 mmol, 2.3 mL). After the addition, the reaction temperature was raised to 60 ℃ for 4 h. The solids and liquids are separated by filtration. The resulting solid was recrystallized with isopropanol to give a white product (compound **1**, yield 46%). ^{1}H NMR (600 MHz, DMSO-d_6): δ (ppm) 11.71 (s, 1H), 8.39 (d, *J*= 2.6 Hz, 1H), 8.16 (dt, *J*= 7.9, 1.0 Hz, 1H), 8.08 (dt, *J*= 8.2, 0.9 Hz, 1H), 7.60–7.52 (m, 2H), 7.46 (ddd, *J*= 8.2, 7.1, 1.2 Hz, 1H), 7.06 (d, *J*= 8.7 Hz, 1H). ^{13}C NMR (101 MHz, DMSO-d_6): δ(ppm) 162.80, 155.71, 151.78, 135.54, 134.93, 130.63, 126.95, 125.64, 122.88, 122.48, 121.45, 119.62, 111.29. Elemental analysis: found C, 50.73; N, 4.55; O, 5.31; H, 2.57; S, 10.58; calcd. C, 51.00; N, 4.57; O, 5.23; H, 2.63; S, 10.47.

*Synthesis of **BZT-TPA***: Under nitrogen atmosphere, compound **1** (2 mmol, 0.612 g), 4-(diphenylamino)benzeneboronic acid (2 mmol, 0.299 g), K_2CO_3 (4 mmol, 0.553 g, in 2 mL H_2O), THF (10 mL) were added to the two-necked flask successively and stirred at room temperature for 10 min. And then added $Pd(PPh_3)_4$ (0.1 mmol, 0.116 g, in 10 mL THF). Reacted at 80 ℃ for 8 h. After the reaction was completed, 10 mL H_2O was added to quench this reaction. The mixed solution was extracted with DCM (20 mL×3), and the combined organic layer was washed once with saturated brine.

Dried with anhydrous Na_2SO_4, and spin-dried. Purified by column chromatography with PE: DCM =1:5, bright yellow solid (**BZT-TPA**, yield 50%) was obtained. ^{1}H NMR (600 MHz, DMSO-d_6) δ 11.63 (s, 1H), 8.44 (d, *J*= 2.4 Hz, 1H), 8.16 (dd, *J*= 8.0, 1.1 Hz, 1H), 8.09 (d, *J*= 8.1 Hz, 1H), 7.70 (dd, *J*= 8.5, 2.4 Hz, 1H), 7.64 – 7.61 (m, 2H), 7.56 (ddd, *J*= 8.3, 7.1, 1.3 Hz, 1H), 7.46 (ddd, *J*= 8.1, 7.1, 1.1 Hz, 1H), 7.36 – 7.31 (m, 4H), 7.17 (d, *J*= 8.5 Hz, 1H), 7.12 – 7.05 (m, 8H). ^{13}C NMR (151 MHz, DMSO-d_6) δ 164.97, 155.92, 151.90, 147.58, 146.78, 135.11, 134.12, 131.89, 130.84, 130.05, 127.78, 126.92, 126.24, 125.52, 124.39, 124.28, 123.56, 122.67, 122.45, 119.35, 118.03. *m/z* (ESI+): found 471.1490 $(M+H)^+$; calcd. 471.1486 $(M+H)^+$. Elemental analysis: found. C, 79.07; N, 5.88; O, 3.99; H, 4.75; S, 6.31; calcd. C, 79.12; N, 5.95; O, 3.40; H, 4.71; S, 6.81.

Synthesis of ***BZT-TPA-BO***: Under nitrogen atmosphere, the compound **BZT-TPA** (1 mmol，0.471 g)、4-bromomethylphenylboronic acid pinacol ester (0.7 mmol，0356 g)、K_2CO_3 (2 mmol，0.276 g) were dissolved in anhydrous DMF(15 mL) and stirred for 6 h at room temperature. After the reaction, the mixed solution was extracted with DCM (20 mL×3), the separated organic layer was washed with saturated brine, dried with anhydrous Na_2SO_4, and concentrated by rotary evaporation. Purification by column chromatography (PE: EA =1:20) yielded the aim probe **BZT-TPA-BO** (white solid, yield 35%). ^{1}H NMR (600 MHz, $CDCl_3$) δ 8.79 (d, *J*= 2.4 Hz, 1H), 8.10 (d, *J*= 8.1 Hz, 1H), 7.89 (dd, *J*= 15.7, 7.8 Hz, 3H), 7.57 (ddd, *J*= 18.8, 11.1, 8.5 Hz, 5H), 7.48 (ddd, *J*= 8.2, 7.2, 1.1 Hz, 1H), 7.39–7.34 (m, 1H), 7.30–7.25 (m, 5H), 7.17–7.11 (m, 7H), 7.03 (td, *J*= 7.3, 1.2 Hz, 2H), 5.38 (s, 2H), 1.36 (s, 12H). ^{13}C NMR (151

MHz, $CDCl_3$) δ 155.41, 147.73, 147.01, 139.13, 135.13, 134.19, 129.80, 129.27, 127.94, 127.71, 127.01, 125.97, 124.66, 124.30, 124.15, 122.83, 122.77, 121.37, 113.40, 83.93, 71.18, 24.92. *m/z* (ESI+): found 687.2850 $(M+H)^+$; calcd. 687.2847 $(M+H)^+$. Elemental analysis: found. C, 76.86; N, 4.02; O, 6.98; H, 5.79; S, 4.57; calcd. C, 76.96; N, 4.08; O, 6.99; H, 5.72; S, 4.67.

Cytotoxicity Test

The cytotoxicity was tested using the in vitro MTT method (3-(4,5-dimethylthiazole-2)-2,5-diphenyltetrazolium bromide, abbr. MTT). L929 cells in the logarithmic growth phase were seeded on 96-well cell culture plate (1×10^4 cells/well), and incubated at 37 ℃ and 5% CO_2 for 24 h. Added the dye and probe (0-50 μM, RPMI1640 dilution) to different wells in turn, set 5 multiple wells for each concentration (to calculate the average value and improve the authenticity), and kept the cells in an air containing 5% CO_2. After incubating for 24 h at 37 ℃, added 10 μL MTT solution (5 μg/mL) to each well, and then incubated it for 4 h at 37 ℃ in air containing 5% CO_2. Then added 100 μL DMSO to each well and let them stand at room temperature for 2 h. In the MTT experiment, set the zero-adjustment hole, the control hole, and the sample hole to be tested. In the zero-hole culture medium, MTT, and dimethyl sulfoxide were added. Cells, culture medium, MTT, and dimethyl sulfoxide must be added to the control wells and the wells for the test sample. The difference is that the control wells add the culture medium to dissolve the test sample, and whereas the test sample group is added with different concentrations of the test sample. Test the absorbance value (OD_{570} or OD_{490} value) of each well in the 96-well plate at 570 nm (or 490 nm) on the Benchmark Plus microplate reader. Use the following formula (eq. 1) to calculate the cell survival rate:

$$VR=A/A_0\times 100\% \quad \text{---------- (eq. 1)}$$

In eq. 1, A represents the absorbance after treatment with the probe; A_0 represents the absorbance of untreated cells.