

Supporting Information

Realization of multiple luminescence manipulation in tungsten bronze oxides based on photochromism toward real-time, reversible, and fast processes

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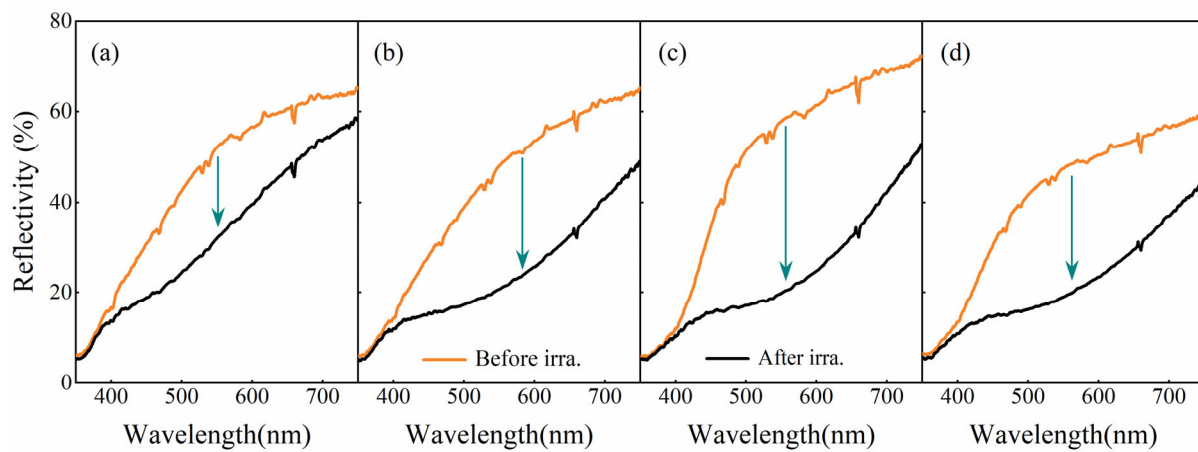


Fig. S1 Reflectance spectra of BGTN:0.5Eu/xMo ($x=0$ (a), 0.005 (b), 0.02 (c), and 0.06 (d)) samples before and after 365 nm irradiation for 120 s.

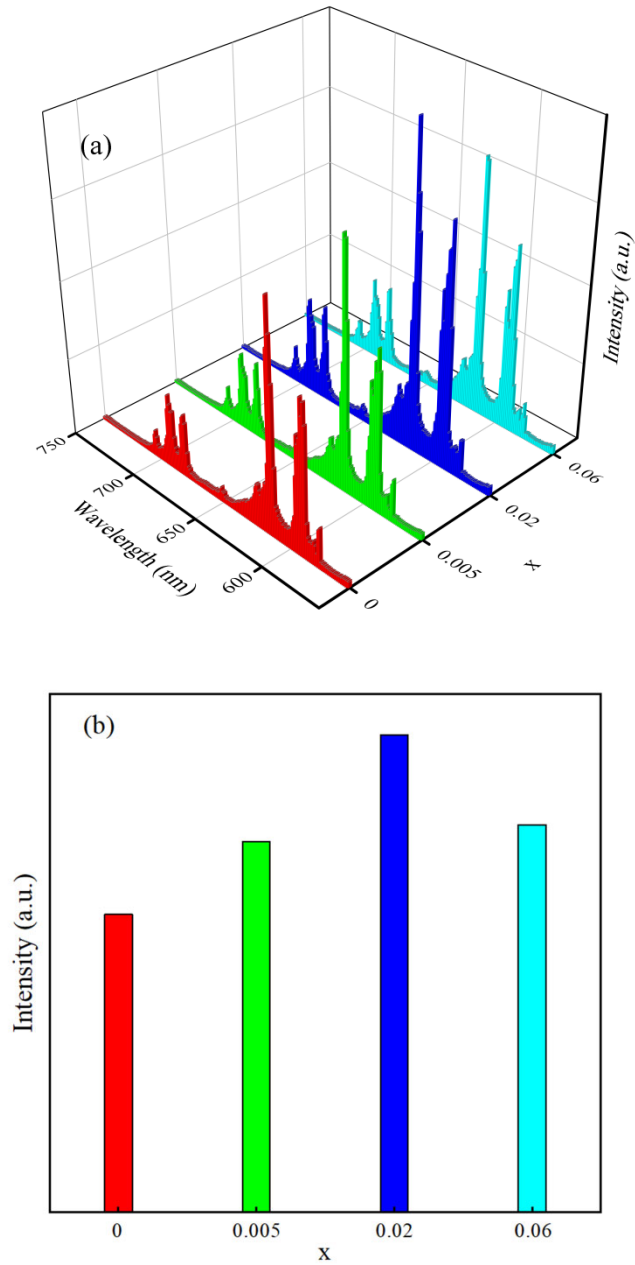


Fig. S2 PL emission spectra of BGTN:0.5Eu/xMo ($x=0$ (a), 0.005 (b), 0.02 (c), and 0.06 (d)) samples under 466 nm excitation (a). Variation of PL emission intensity with x (b).

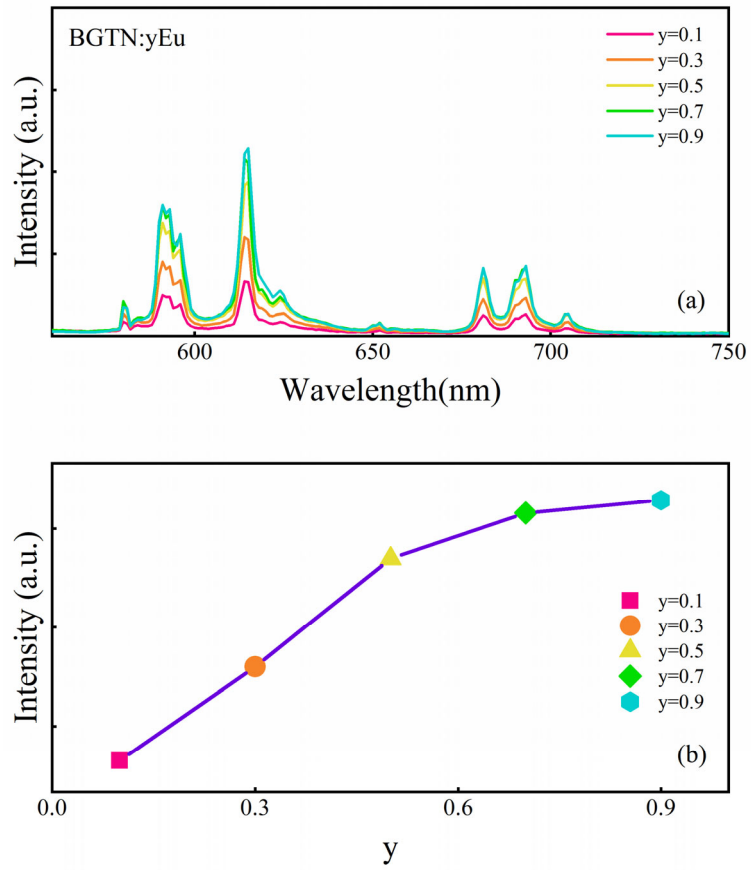


Fig. S3 PL emission spectra of $\text{Ba}_4\text{Gd}_{2-y}\text{Eu}_y\text{Ti}_4\text{Nb}_6\text{O}_{30}$ (BGTN:yEu, $y=0.1, 0.3, 0.5,$ and 0.9) samples under 466 nm excitation (a). Variation of PL emission intensity with y (b).

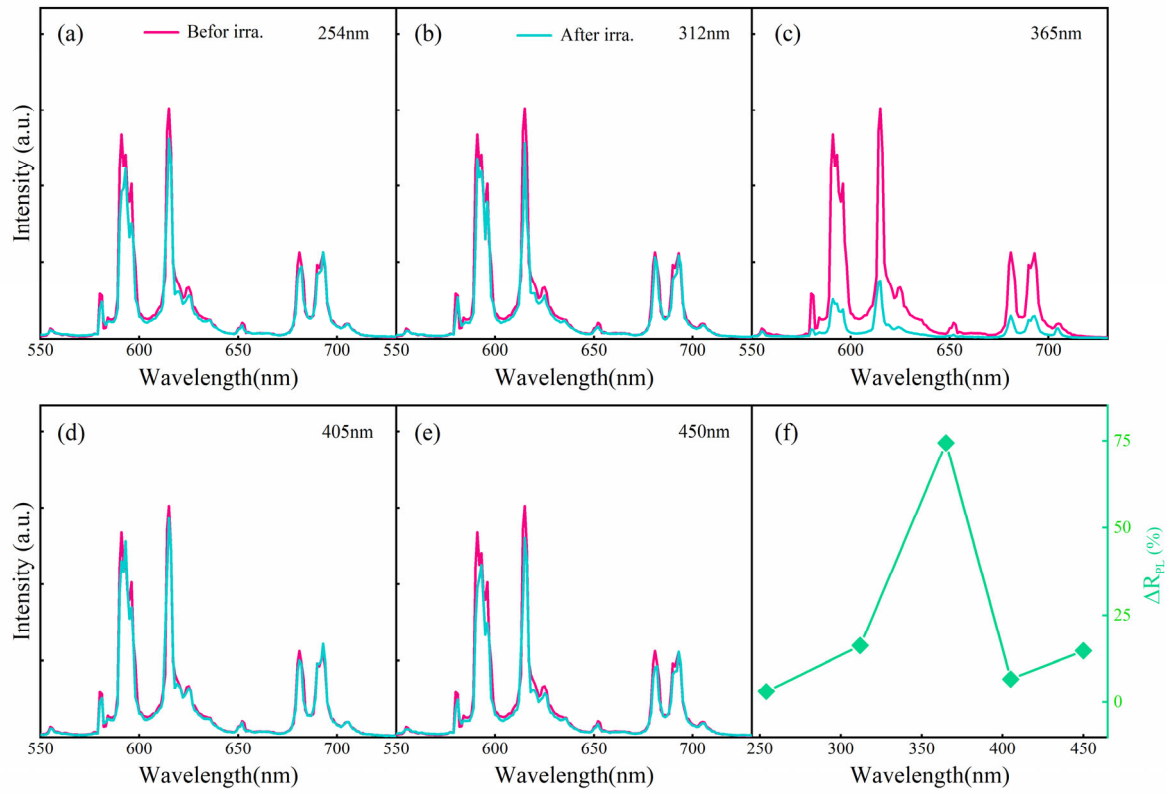


Fig. S4 PL emission spectra of BGTN:0.5Eu/xMo ($x=0.005$) before and after 120 s irradiation with different wavelength of light (254 nm (a), 312 nm (b), 365 nm (c), 405 nm (d), and 450 nm (e)). Variation of ΔR_{PL} with different light irradiation (f).

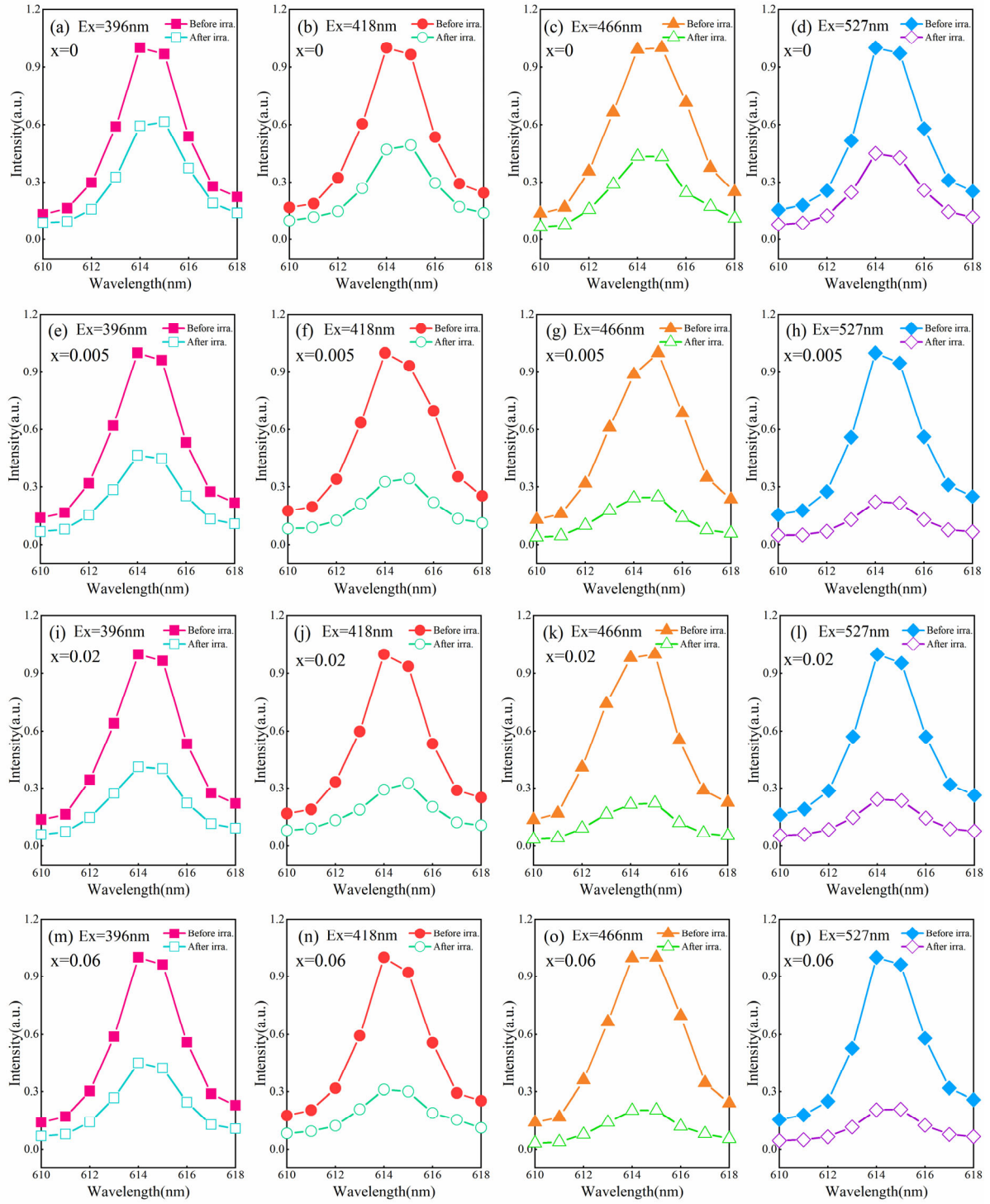


Fig. S5 The 615nm emission peak excited by 396 nm, 418 nm, 466 nm, and 527 nm for BGTN:0.5Eu/xMo ($x=0, 0.005, 0.02, \text{ and } 0.06$) samples before and after 365 nm irradiation for 120 s.

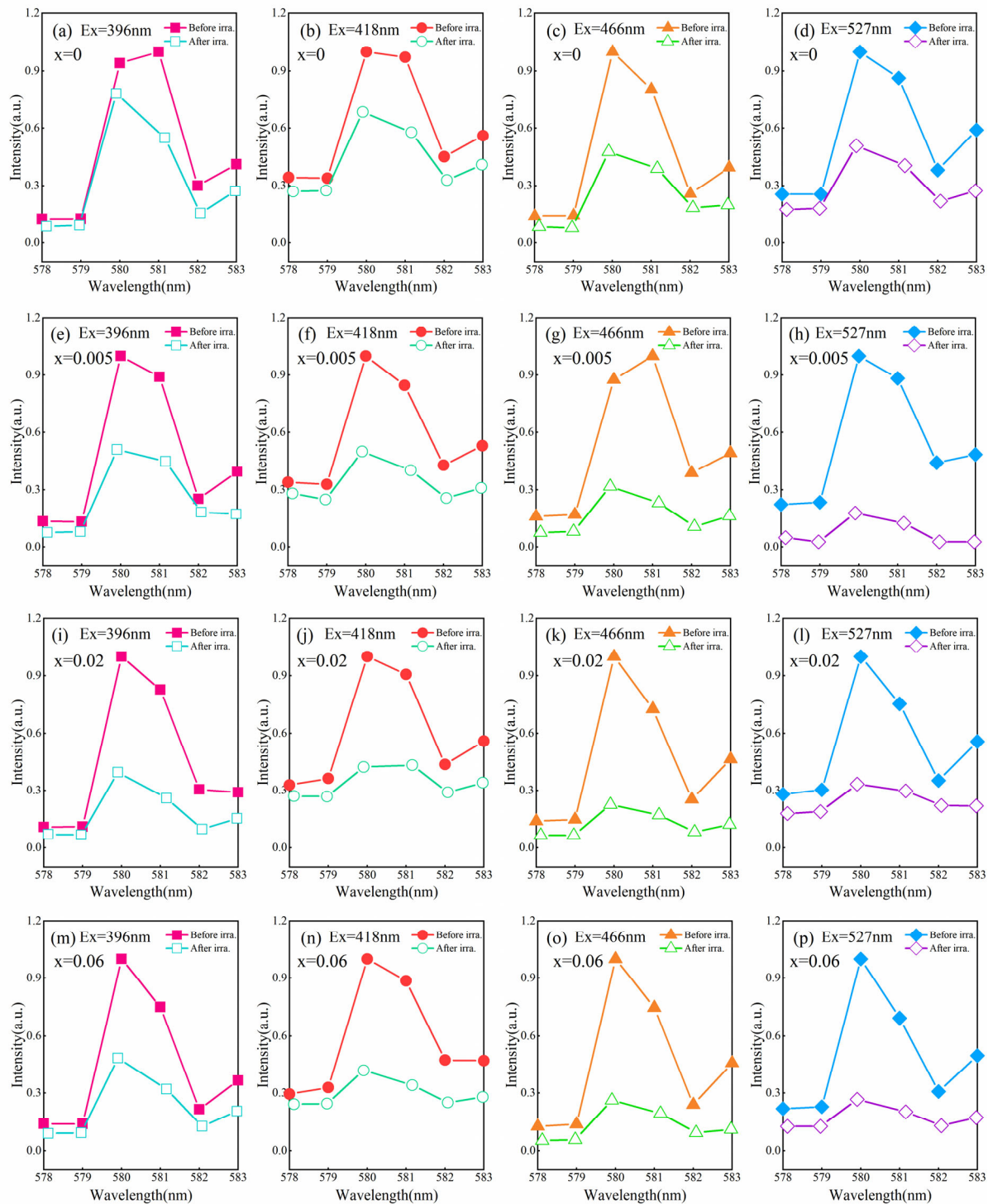


Fig. S6 The 580 nm emission peak excited by 396 nm, 418 nm, 466 nm, and 527 nm for BG:TN:0.5Eu/xMo ($x=0, 0.005, 0.02,$ and 0.06) samples before and after 365 nm irradiation for 120 s.

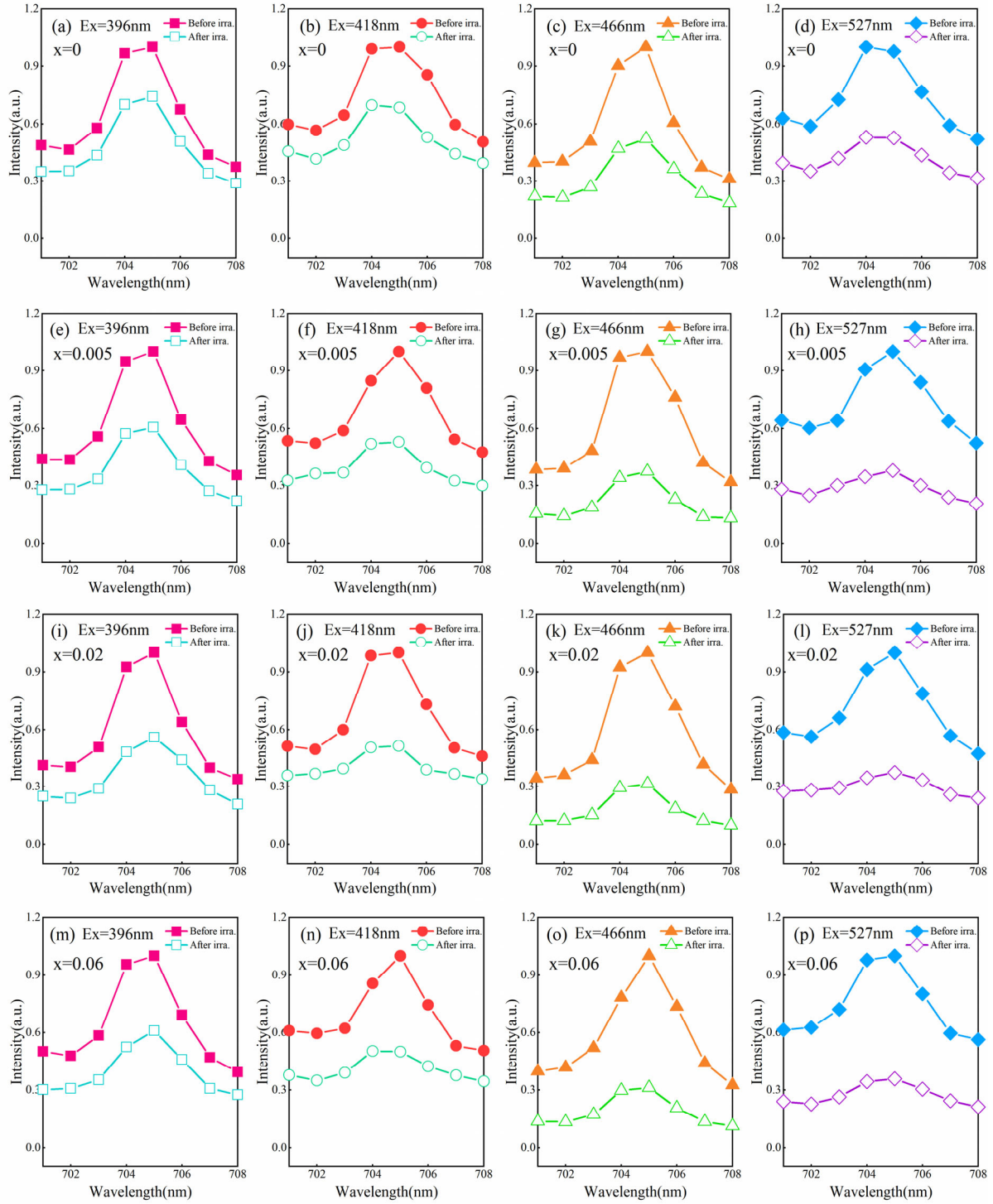


Fig. S7 The 705 nm emission peak excited by 396 nm, 418 nm, 466 nm, and 527 nm for BGTN:0.5Eu/xMo ($x=0, 0.005, 0.02,$ and 0.06) samples before and after 365 nm irradiation for 120 s.

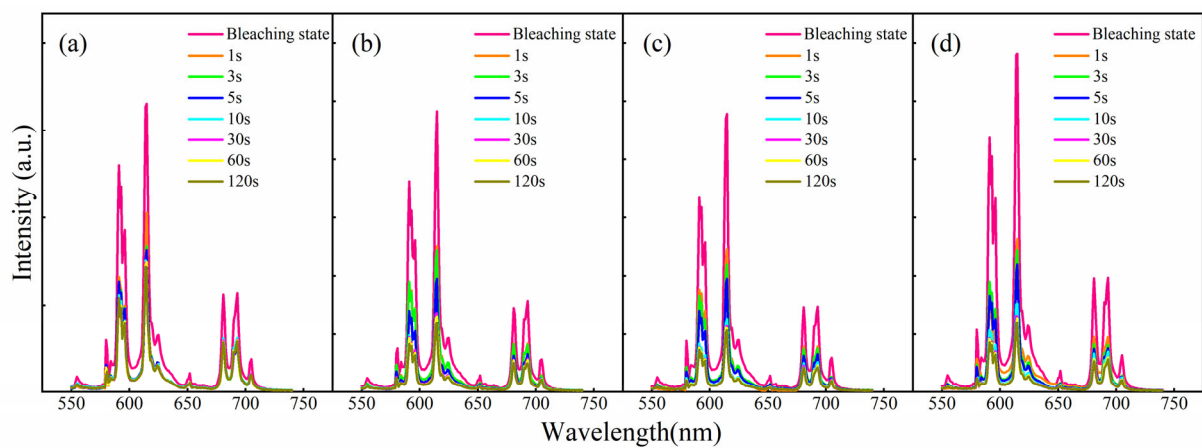


Fig. S8 PL emission spectra of BGTN:0.5Eu/xMo ($x=0$ (a), 0.005 (b), 0.02 (c), and 0.06 (d)) samples under 365 nm irradiation for different time.

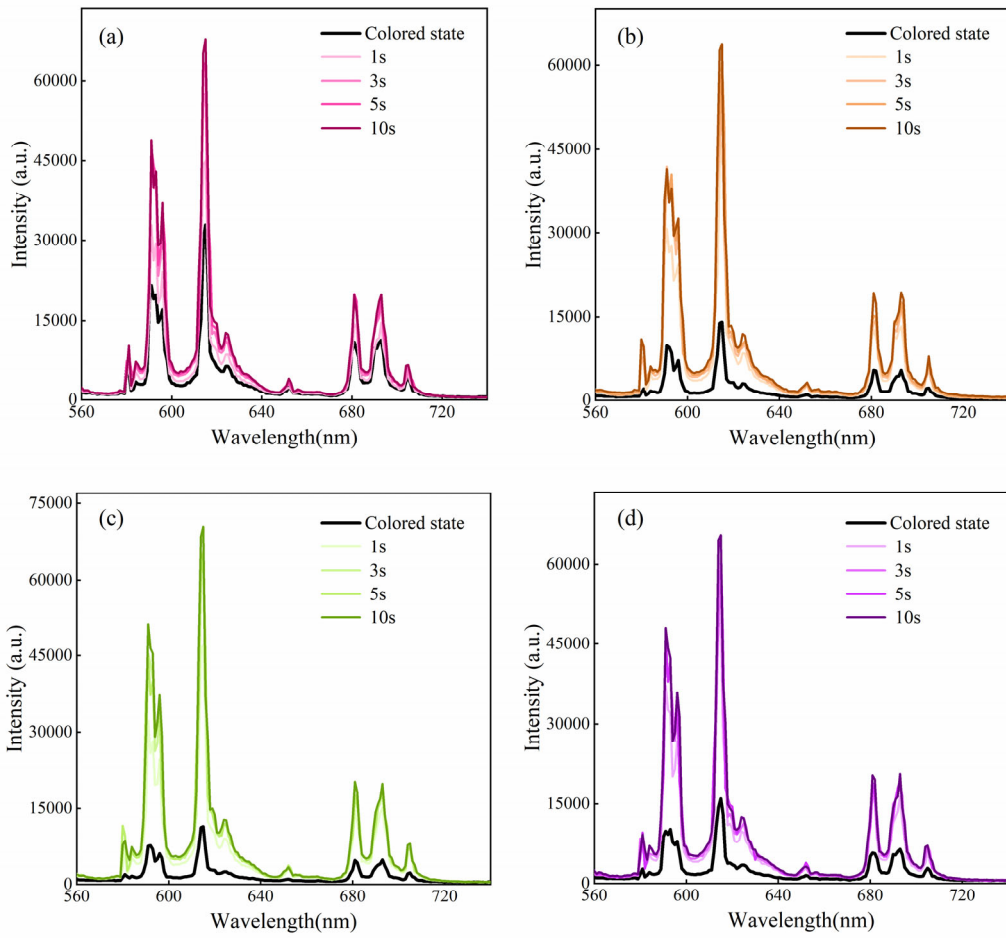


Fig. S9 PL emission spectra of the colored BGTN:0.5Eu/xMo ($x=0$ (a), 0.005 (b), 0.02 (c), and 0.06 (d)) samples under different thermal treatment times at 250 °C.

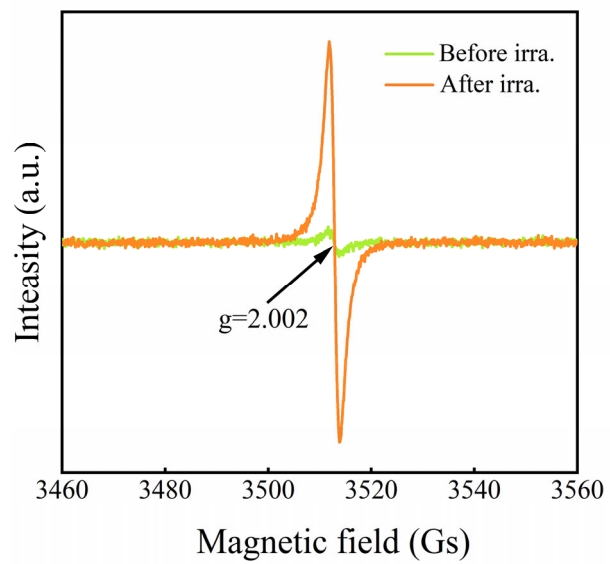


Fig. S10 EPR spectra of BGTN:0.5Eu/xMo ($x=0.02$) corresponding to the decoloration and coloration states (365 nm irradiation for 120 s).

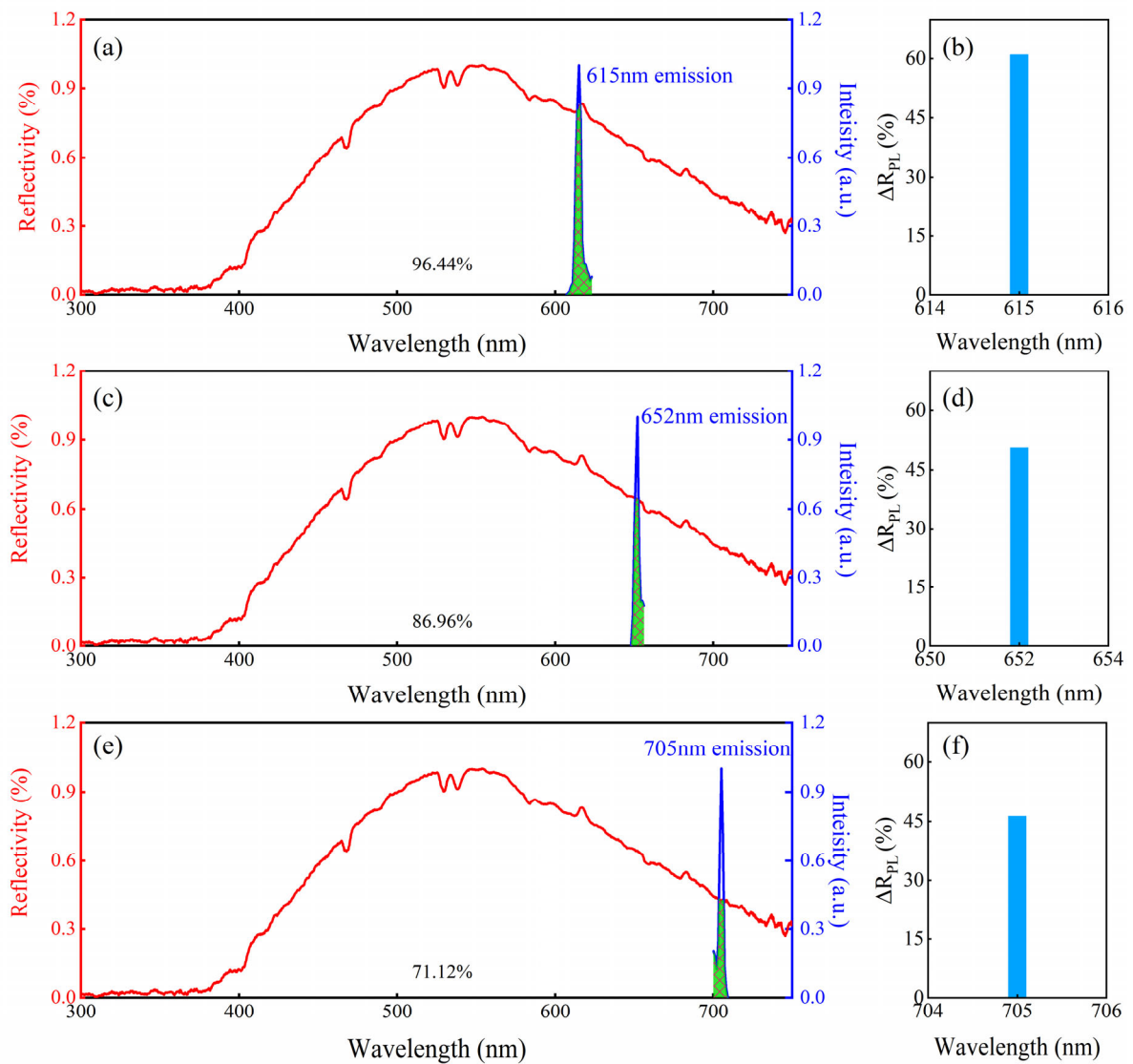


Fig. S11 Normalized absorption peak and PL emission peaks (615 nm (a), 652 nm (c), and 705 nm (e)) for $x=0$ sample. The obtained ΔR_{PL} values of 615 nm (b), 652 nm (d), and 705 nm (f) emissions.

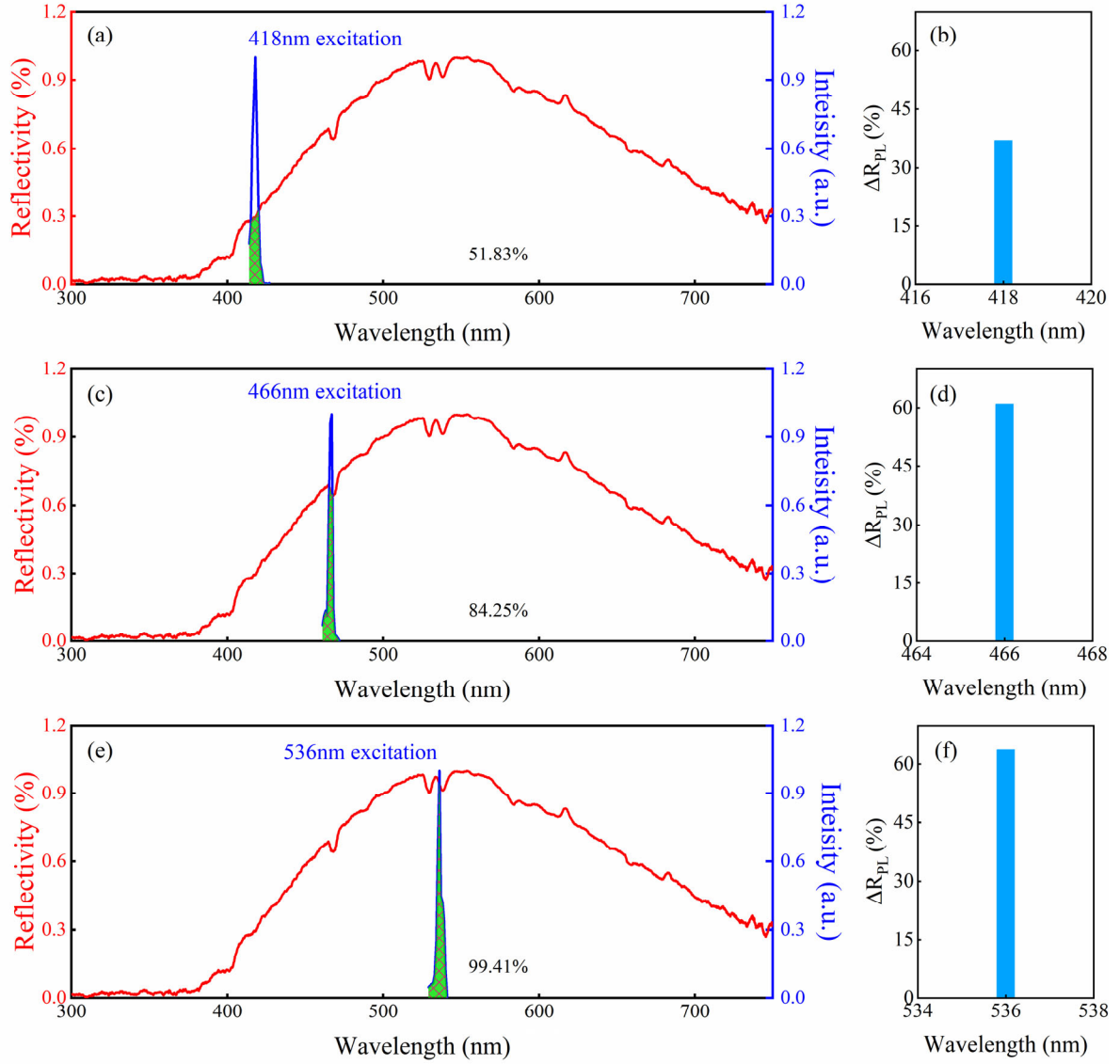


Fig. S12 Normalized absorption peak and PL excitation peaks (615 nm (a), 652 nm (c), and 705 nm (e)) of 615 nm emission for x=0 sample. The obtained ΔR_{PL} values corresponding to 418 nm (b), 466 nm (d), and 536 nm (f) excitation.