Supporting Information

Achieving Multimodal Emission in $Zn_4B_6O_{13}:Tb^{3+},Yb^{3+}$ for Information Encryption and Anti-counterfeiting

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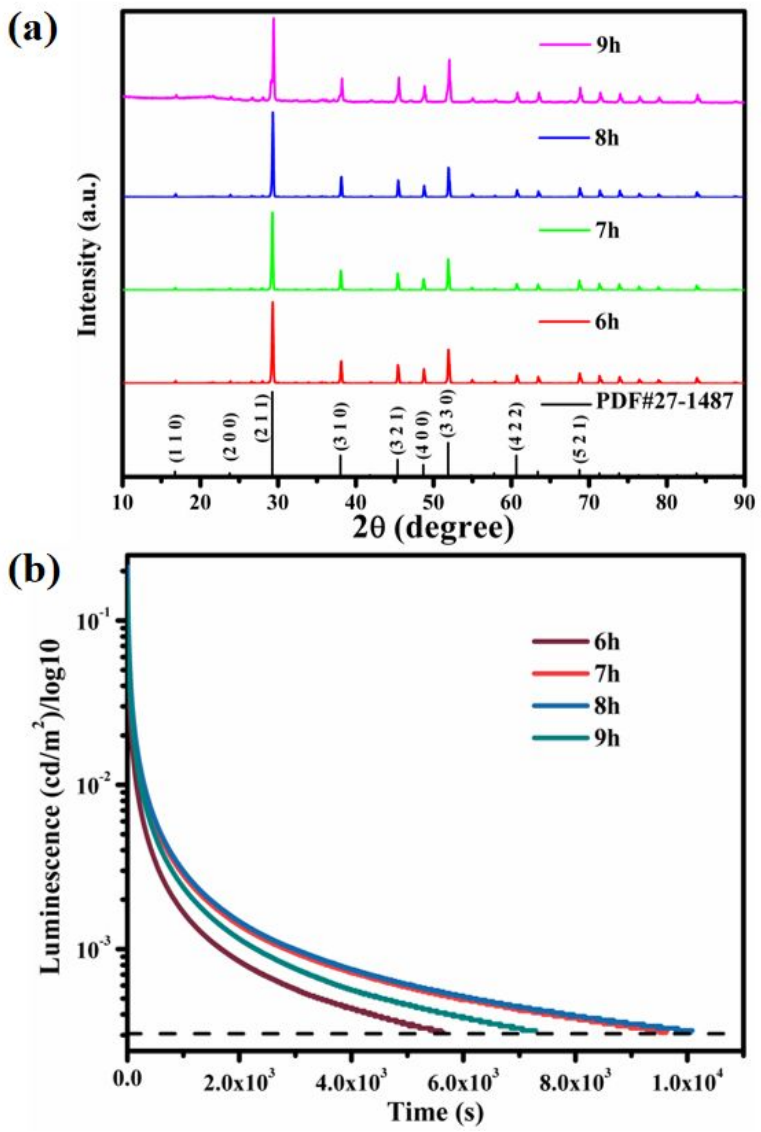

Figure S1. (a) XRD patterns of the $Zn_{3.990}B_6O_{13}$: $0.010Tb^{3+}$ particles sintered for different time, indicating the formation of pure phase $Zn_4B_6O_{13}$ with high crystallinity. (b) PersL decay curves of the $Zn_{3.990}B_6O_{13}$: $0.010Tb^{3+}$ sintered for different time, showing the optimized time of 8h.

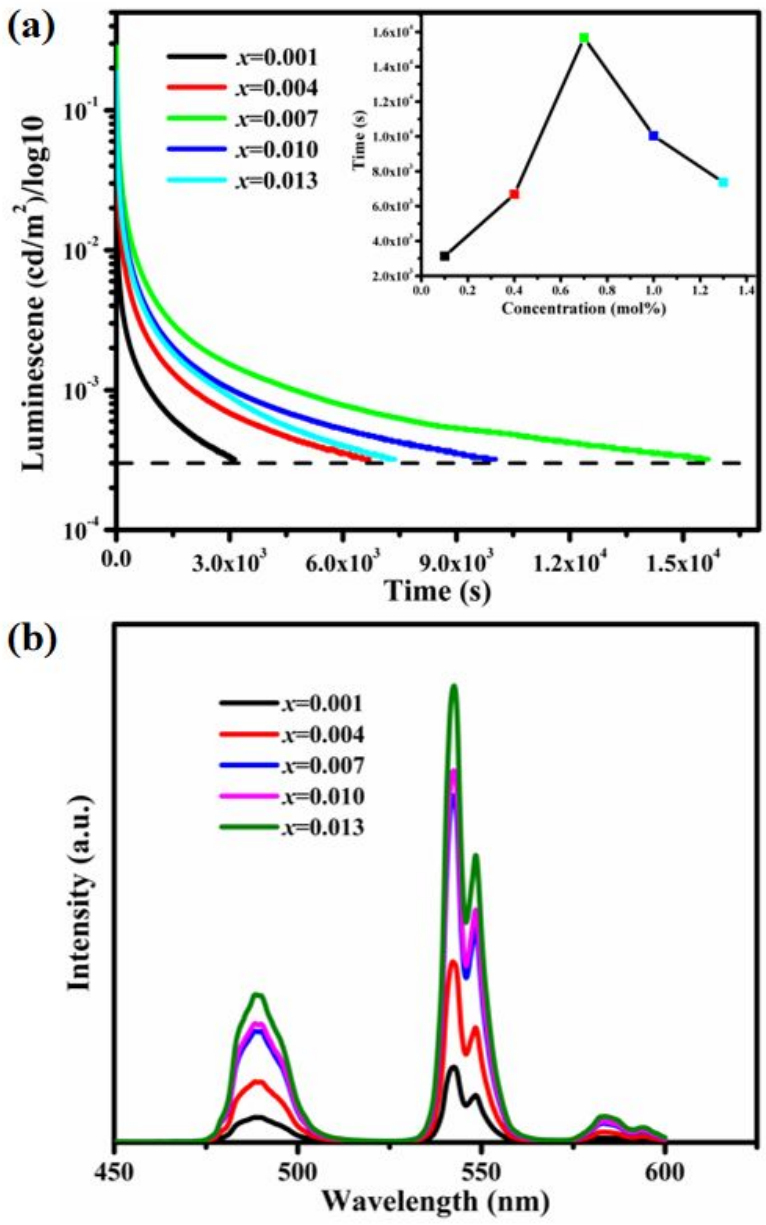

Figure S2. (a) PersL decay curves of the $Zn_{4-x}B_6O_{13}$:$x$$Tb^{3+}$ particles (10min irradiation of 254nm light). The inset shows the dependence of afterglow intensity on the concentration of the Tb^{3+} dopants, showing the optimal concentration of x=0.007. (b) Emission spectra of $Zn_{4-x}B_6O_{13}$:$x$$Tb^{3+}$ (λ_{ex}=262nm), showing an increased emission of Tb^{3+} as increasing Tb^{3+} concentration.

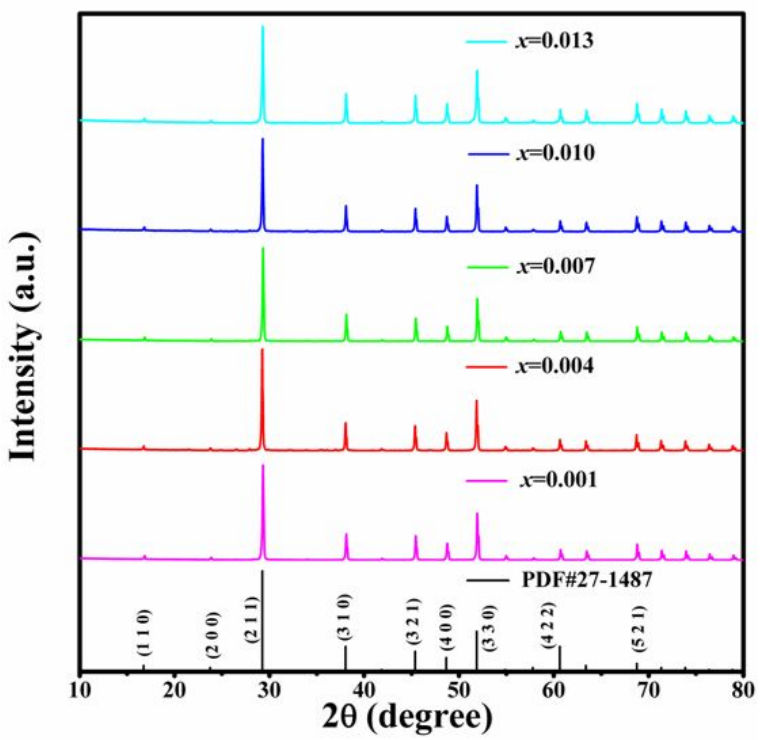

Figure S3. XRD patterns of $Zn_{4-x}B_6O_{13}$:$x$$Tb^{3+}$ with different doping contents 0.001, 0.004, 0.007, 0.010 and 0.013.

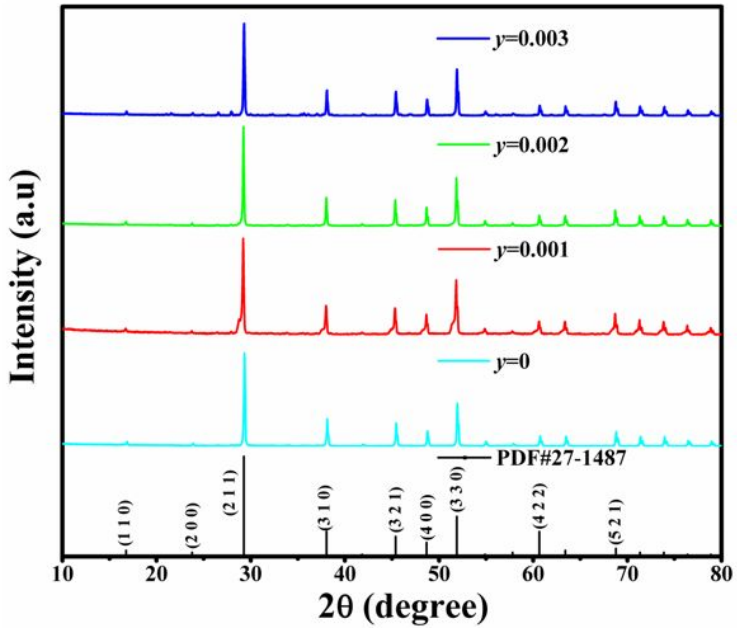

Figure S4. XRD patterns of the $Zn_{3.993-y}B_6O_{13}$:0.007Tb^{3+},$y$$Yb^{3+}$ (y=0, 0.001, 0.002, 0.003).

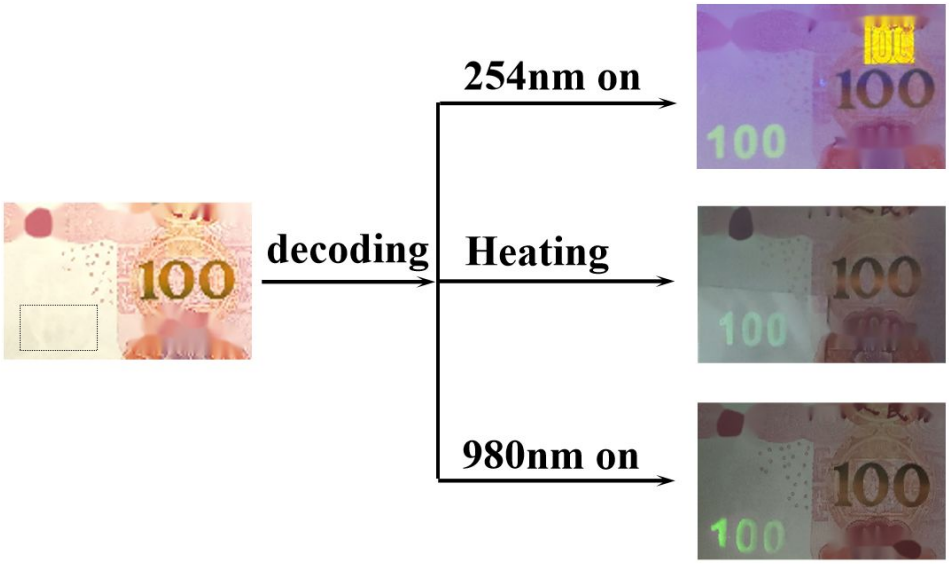

Figure S5. A typical example of anti-counterfeiting design on the banknote in the bright field.

Table S1 The detailed parameters of bond length in the $Zn_4B_6O_{13}$

Atom	Coordination	Type of bond	Bond length (pm)
Zn_1	4	Zn_1-O_1(×1)	1.9586
		Zn_1-O_2(×3)	1.9447
B_1	4	B_1-O_2(×4)	1.4799