

## **Supporting Information**

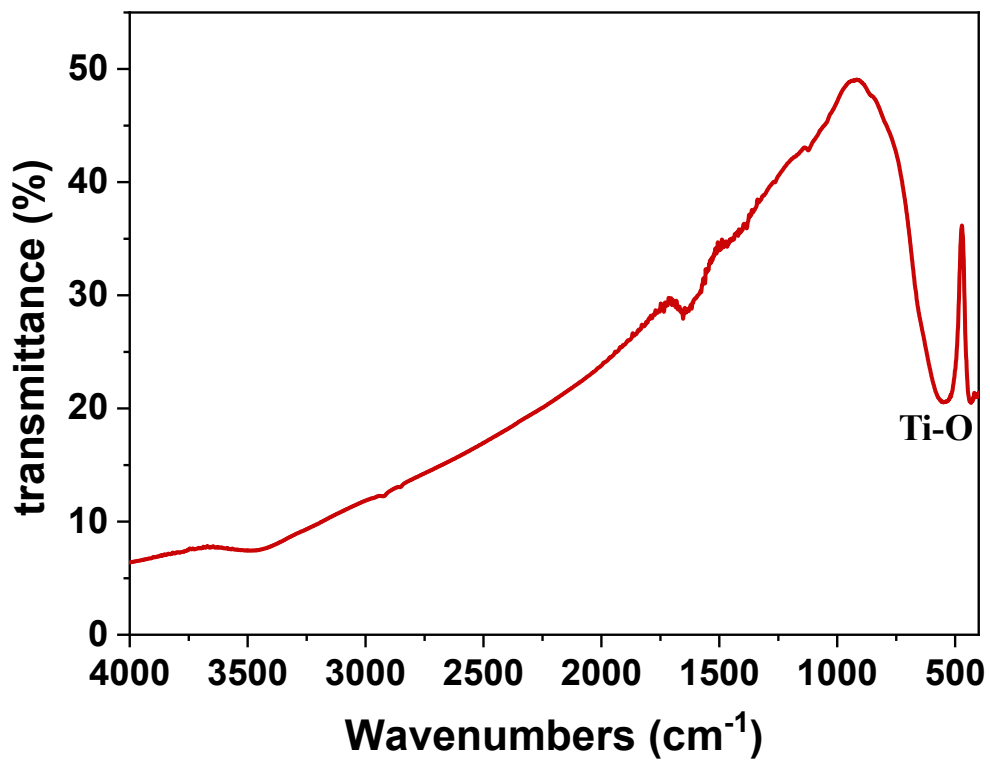
### **Effect of Tetragonal to Cubic Phase Transition on the Upconversion Luminescence Properties of A/B site Erbium-doped Perovskite BaTiO<sub>3</sub>**

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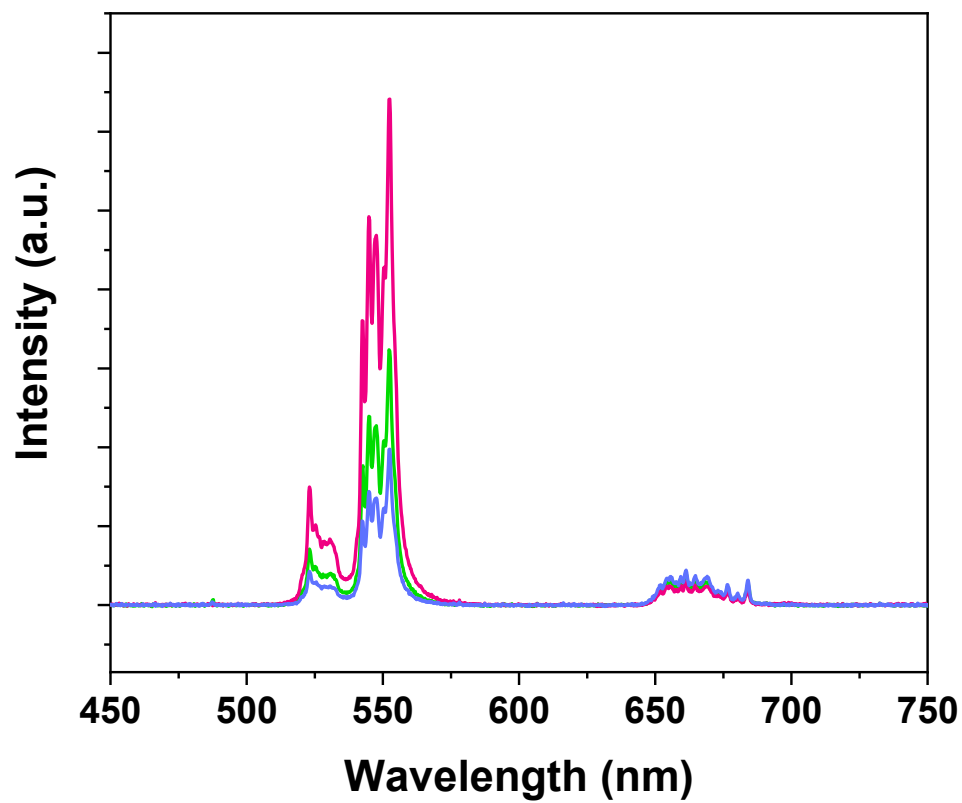
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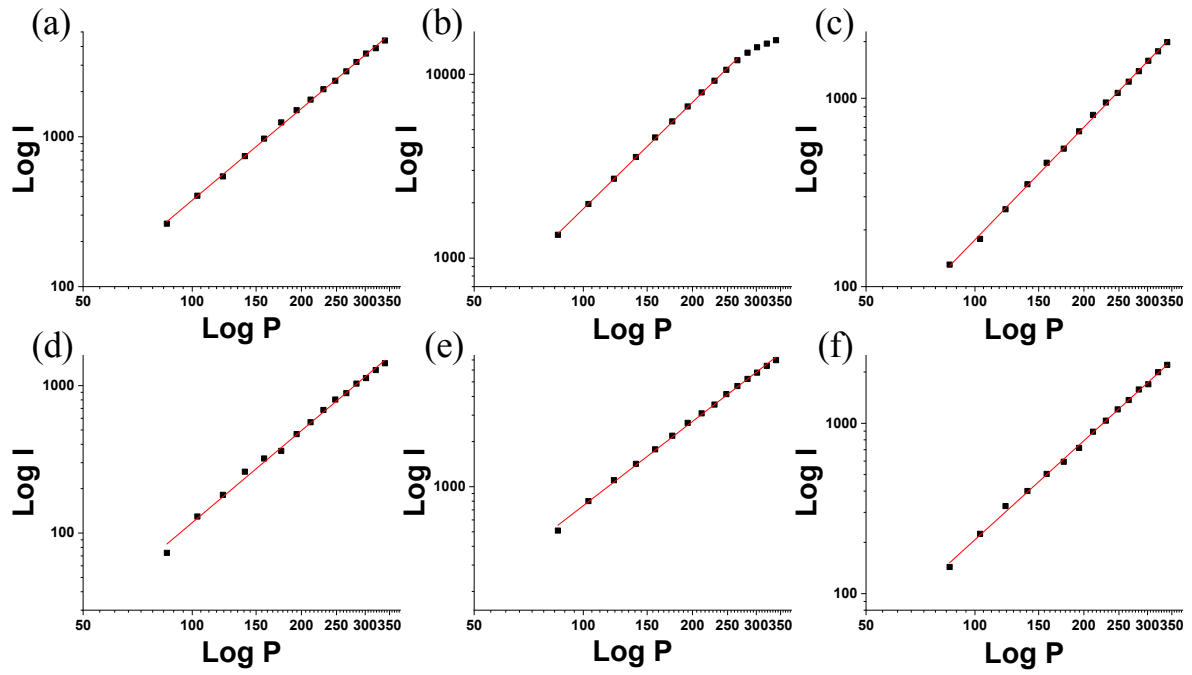
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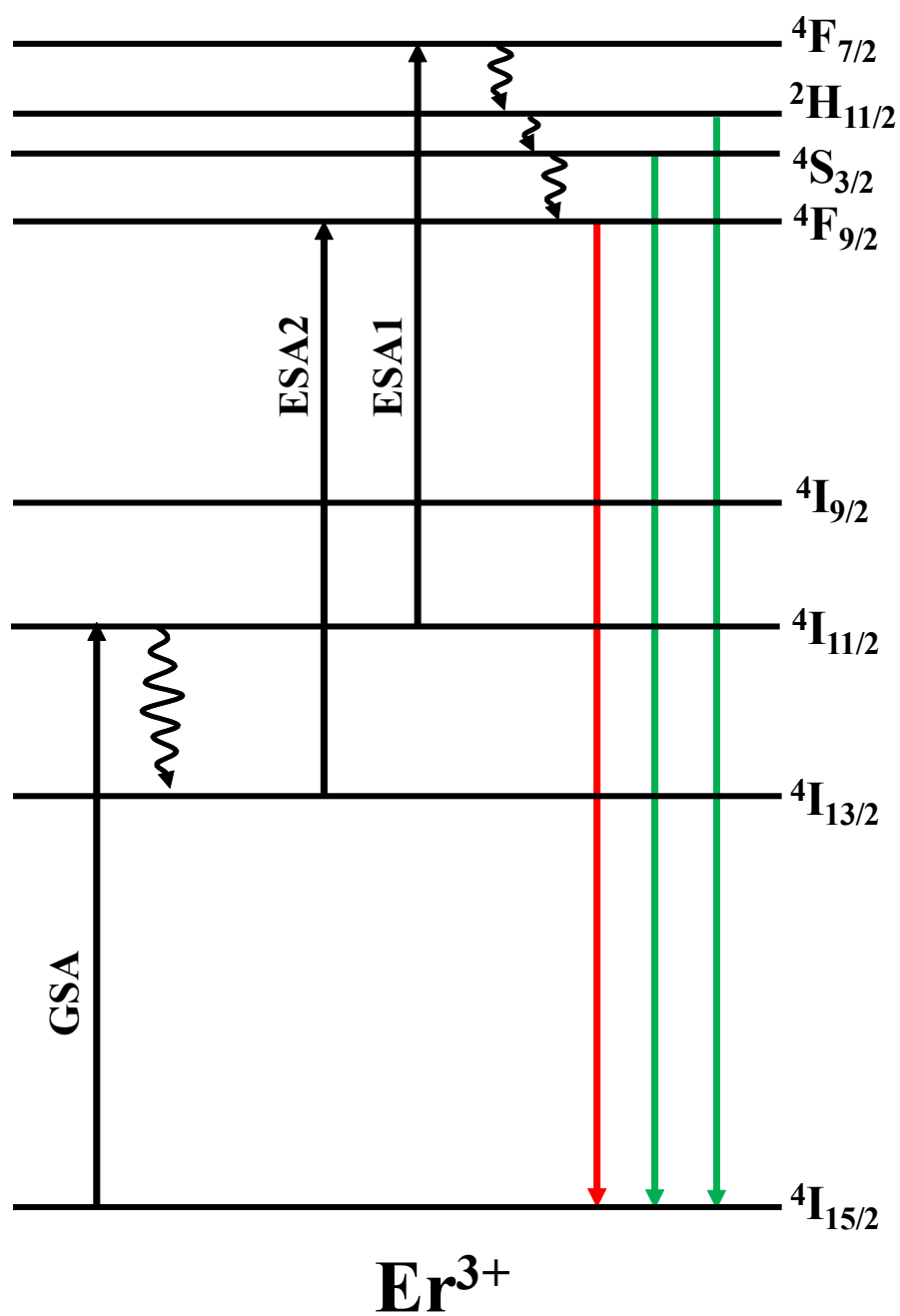
**Figure S1.** IR spectrum of B-BT (Ti-O vibration is the maximum phonon energy of BT).



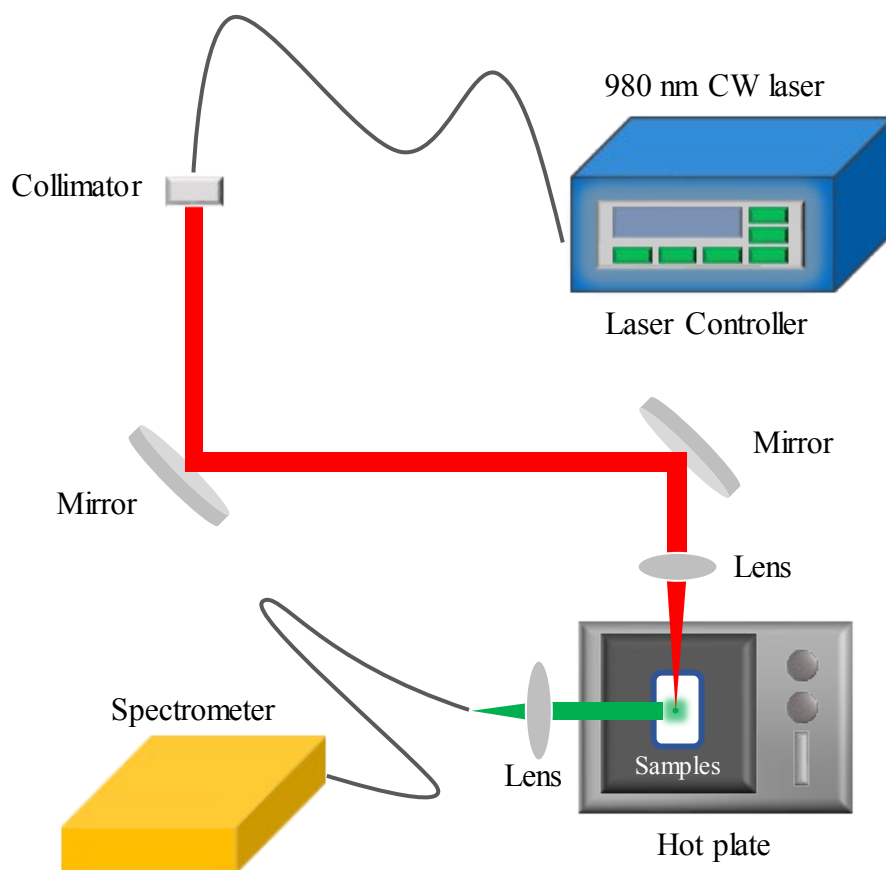
**Figure S2.** Upconversion emission spectrum of A-BT with different concentrations of Er<sup>3+</sup> ions (green: doped with 1% Er<sup>3+</sup> ion, pink: doped with 2% Er<sup>3+</sup> ion, blue: doped with 3% Er<sup>3+</sup> ion).



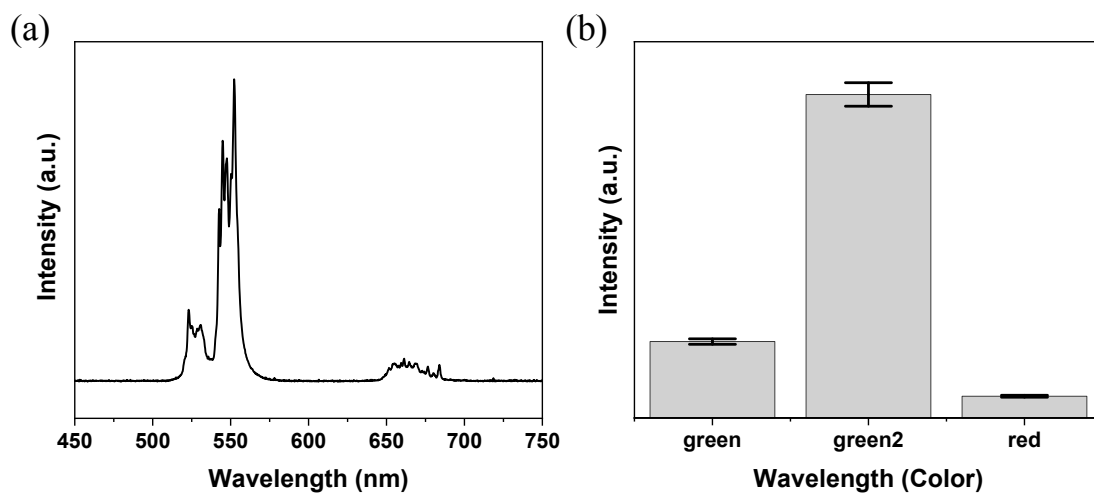
**Figure S3.**  $\text{Log}(I)$  versus  $\text{log}(P)$  diagram of each emission of A-BT: (a)  ${}^2\text{H}_{11/2} \rightarrow {}^4\text{I}_{15/2}$ , (b)  ${}^4\text{S}_{3/2} \rightarrow {}^4\text{I}_{15/2}$ , (c)  ${}^4\text{F}_{9/2} \rightarrow {}^4\text{I}_{15/2}$ ; (a) slope = 2.03225, (b) slope = 1.92454, (c) slope = 1.98517; and  $\text{log}(I)$  versus  $\text{log}(P)$  diagram of each emission of B-BT: (d)  ${}^2\text{H}_{11/2} \rightarrow {}^4\text{I}_{15/2}$ , (e)  ${}^4\text{S}_{3/2} \rightarrow {}^4\text{I}_{15/2}$ , (f)  ${}^4\text{F}_{9/2} \rightarrow {}^4\text{I}_{15/2}$ ; (d) slope = 2.07297, (e) slope = 1.86522, (f) slope = 1.9305.



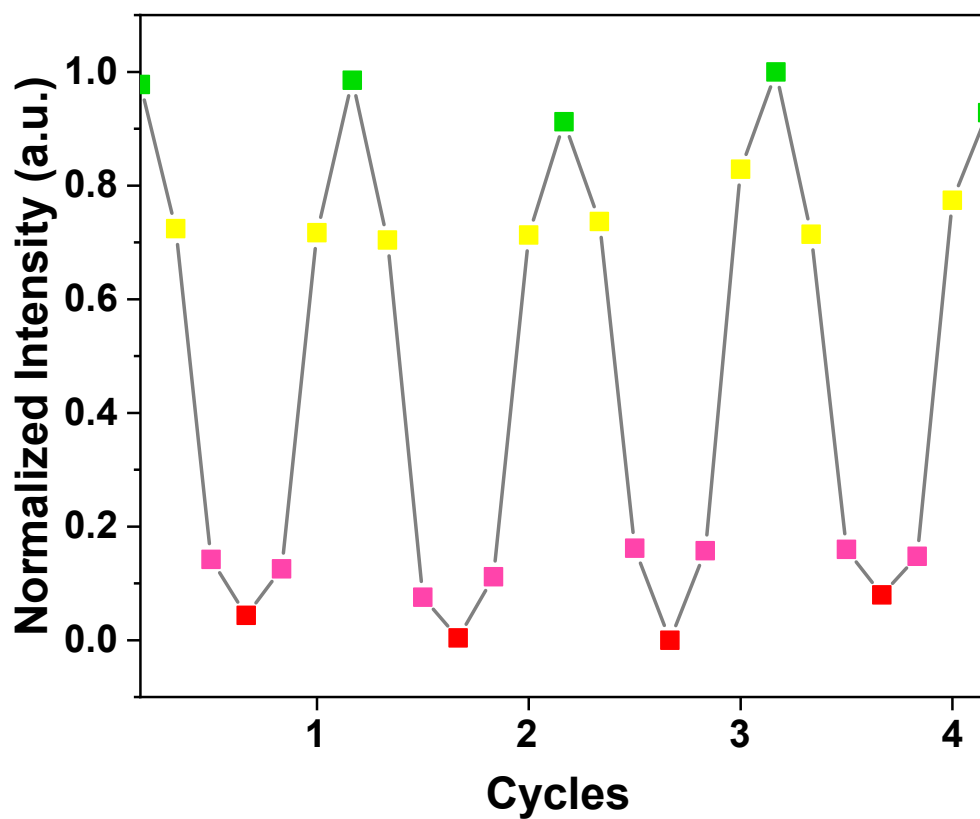
**Figure S4.** Schematic energy level diagram of erbium ions ( $\text{Er}^{3+}$ ) (GSA: ground-state absorption, ESA: excited-state absorption).



**Figure S5.** Optical setup for temperature-dependent upconversion spectrum measurement.



**Figure S6.** Optical setup reliability test. (a) Upconversion luminescence spectrum of A-BT. (b) Mean intensities of the respective luminescent points (green:  ${}^2\text{H}_{11/2} \rightarrow {}^4\text{I}_{15/2}$ , green 2:  ${}^4\text{S}_{3/2} \rightarrow {}^4\text{I}_{15/2}$ , red:  ${}^4\text{F}_{9/2} \rightarrow {}^4\text{I}_{15/2}$ ), where error bars represent standard deviation (N=40).



**Figure S7.** Normalized intensity versus cycles diagrams that show the reversibility of the B-BT intensity temperature from 105 °C to 135 °C (green: 105 °C, yellow: 115 °C, pink: 125 °C, red: 135 °C).