Electronic Supplementary Information

Room-Temperature Synthesis of Ce/Tb/Na-codoped CaF_2 and SrF_2 Luminescent Nanocrystals with a Photoluminescence Quantum Yield of 60%

Shuning Li[a], Kangle Sun[a], Mengfei Zhao[a], Mengxin Liu[*b], Xinan Shi[*a] and Daocheng Pan[*a, b]

[a]State Key Laboratory of Featured Metal Materials and Life-cycle Safety for Composite Structures; Guangxi Key Laboratory of Processing for Non-ferrous Metals and Featured Materials; MOE Key Laboratory of New Processing Technology for Nonferrous Metals and Materials; School of Resources, Environment and Materials, Guangxi University, Nanning 530004, China

[b]School of Chemistry and Chemical Engineering, Guangxi University, Nanning 530004, China

*To whom correspondence should be addressed. E-mail: mxliu@st.gxu.edu.cn, xashi@gxu.edu.cn and dcpan@gxu.edu.cn

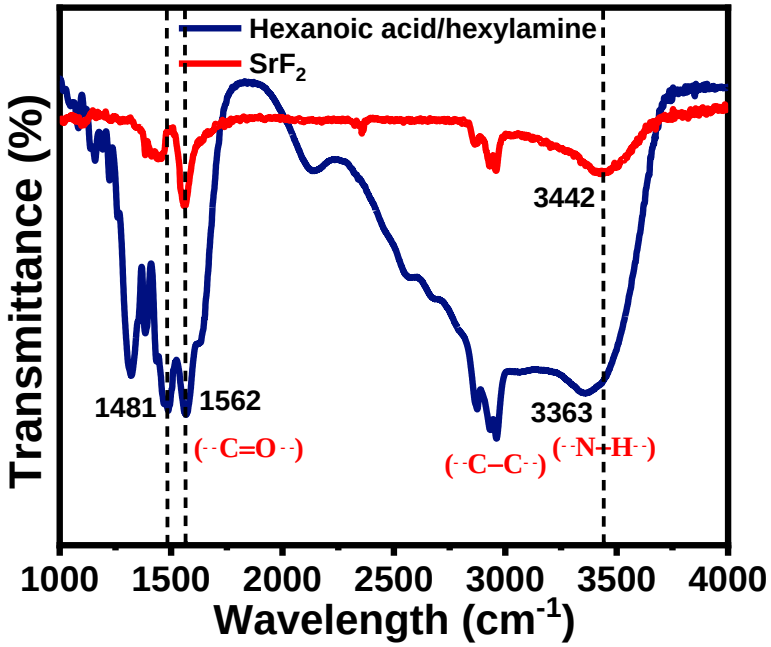

Fig. S1 FT-IR spectra of hexanoic acid/hexylamine-capped $Sr_{0.4}F_2:Ce^{3+}_{0.1}$, $Tb^{3+}_{0.2}$, $Na^{1+}_{0.3}$ nanocrystals and free hexanoic acid/hexylamine ligands.

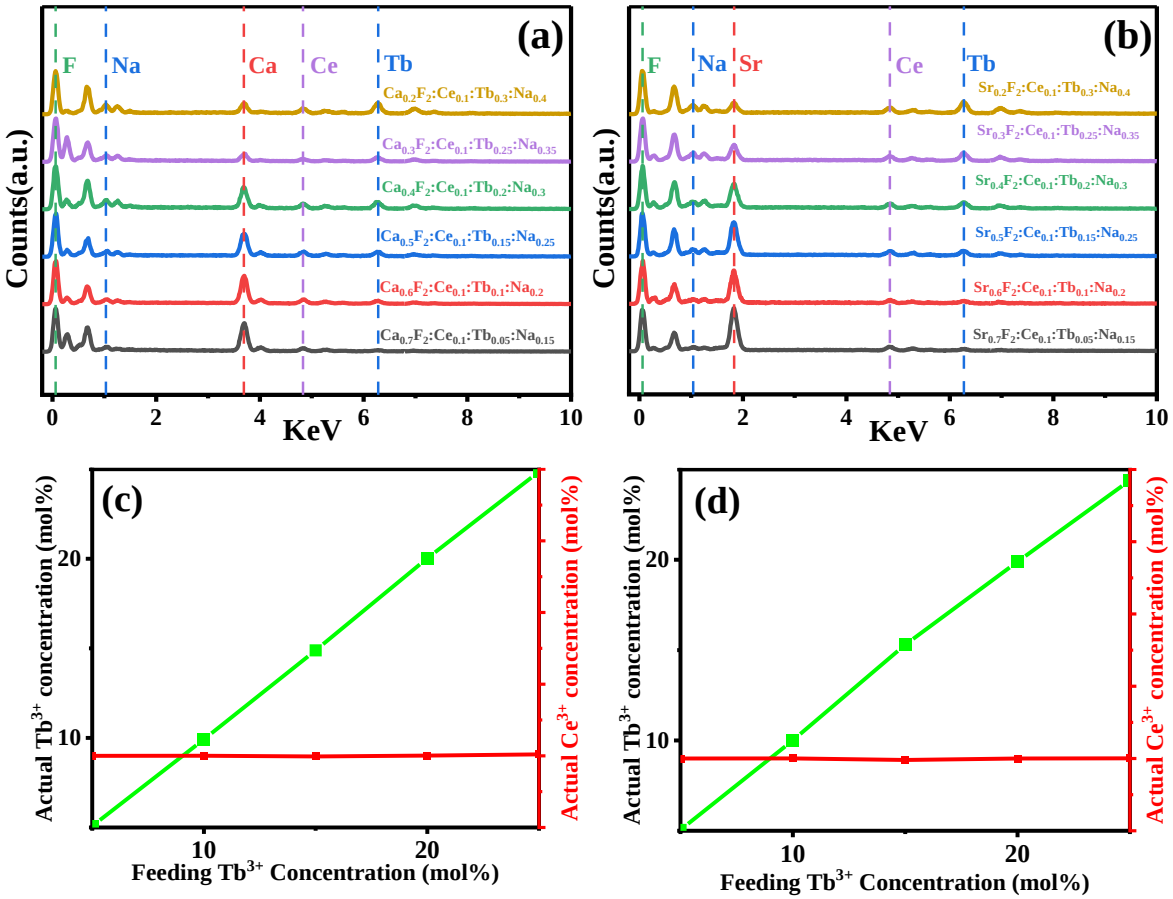

Fig. S2 EDS spectra of (a) $Ca_{0.8-2x}F_2:Ce^{3+}_{0.1}$, Tb^{3+}_x, $Na^{1+}_{0.1+x}$ and (b) $Sr_{0.8-2x}F_2:Ce^{3+}_{0.1}$, Tb^{3+}_x, $Na^{1+}_{0.1+x}$ nanocrystals. Curves of the actual doping concentrations of Tb^{3+} ions in (c) $Ca_{0.8-2x}F_2:Ce^{3+}_{0.1}$, Tb^{3+}_x, $Na^{1+}_{0.1+x}$ and (d) $Sr_{0.8-2x}F_2:Ce^{3+}_{0.1}$, Tb^{3+}_x, $Na^{1+}_{0.1+x}$ nanocrystals versus the feeding concentrations of Tb^{3+} ions.

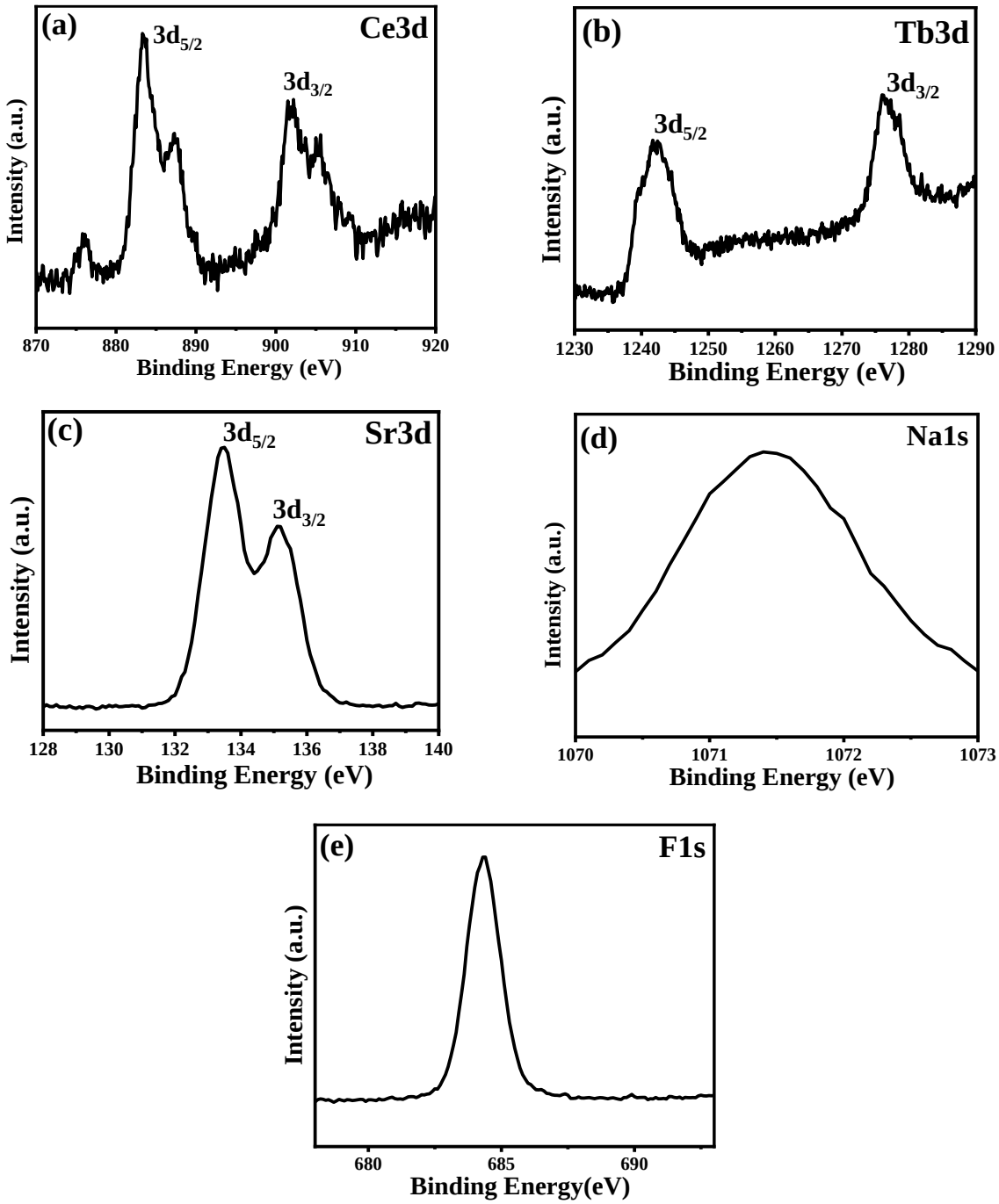

Fig. S3 XPS spectra of $Sr_{0.4}F_2$:$Ce^{3+}_{0.1}$, $Tb^{3+}_{0.2}$, $Na^{1+}_{0.3}$; (a) Ce3d, (b) Tb3d, (c) Sr3d, (d) Na1s, (e) F1s.

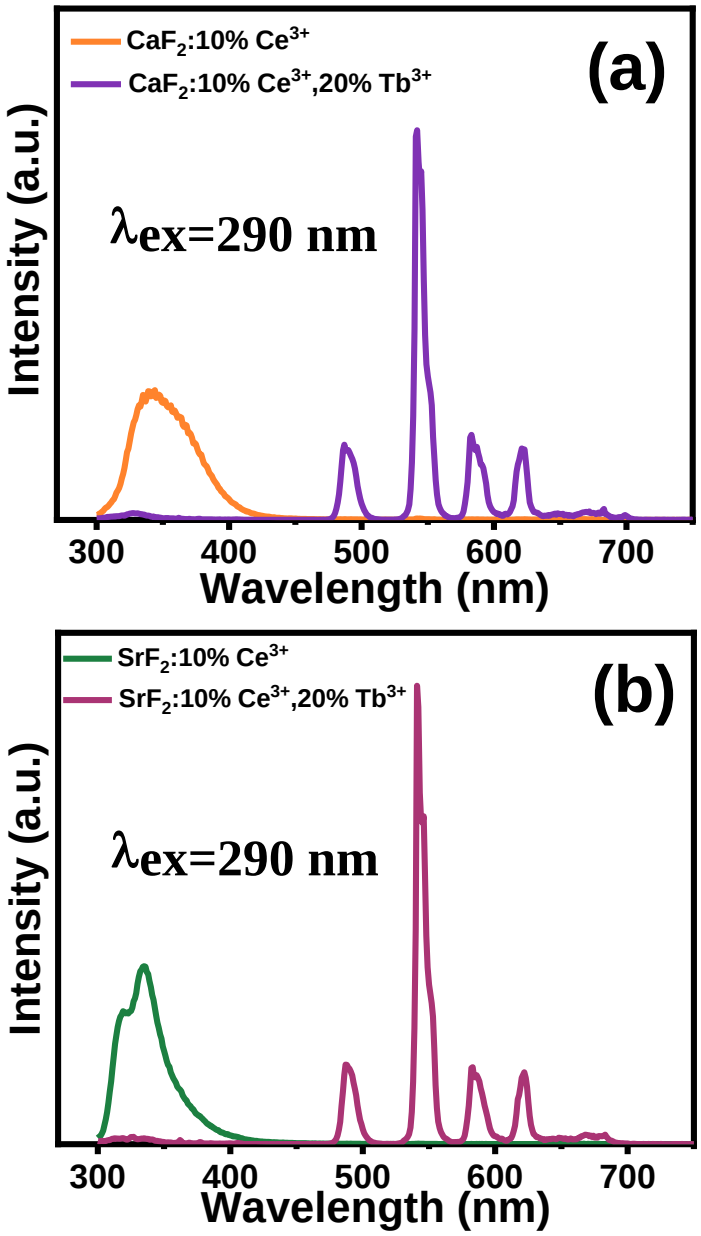

Fig. S4 PL spectra of (a) Tb-free samples (CaF_2:10%Ce^{3+} and SrF_2:10%Ce^{3+}) and (b) Ce/Tb co-doped samples (CaF_2:10%Ce^{3+}, 20%Tb^{3+} and SrF_2:10%Ce^{3+}, 20%Tb^{3+}).

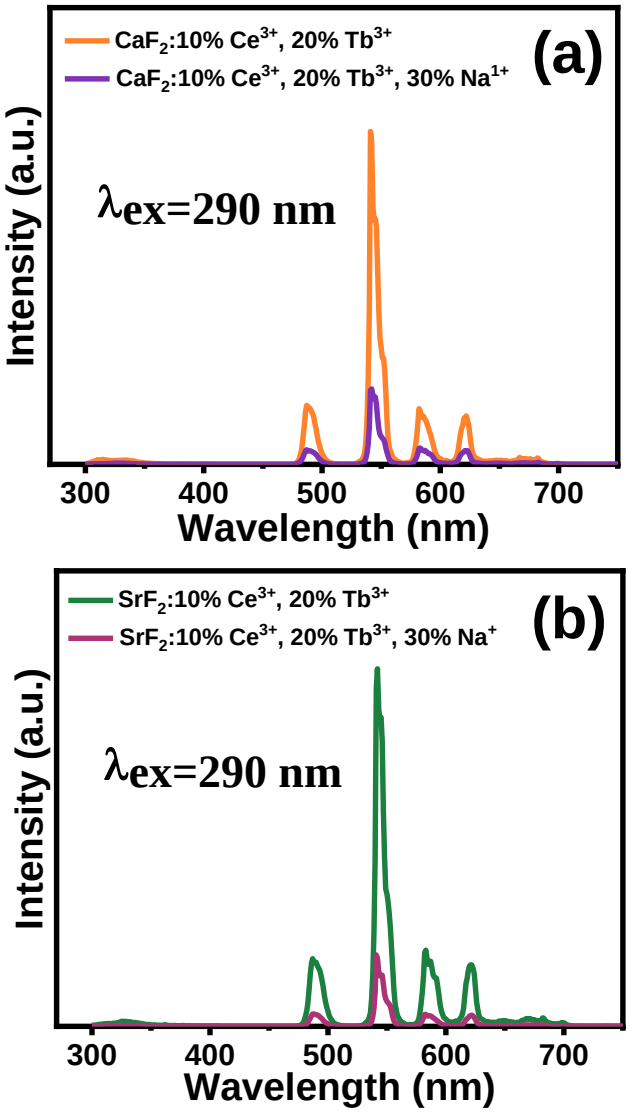

Fig. S5 The effects of Na^+ ion doping on the photoluminescence properties of Ce/Tb codoped (a) CaF_2 and (b) SrF_2 nanoparticles.

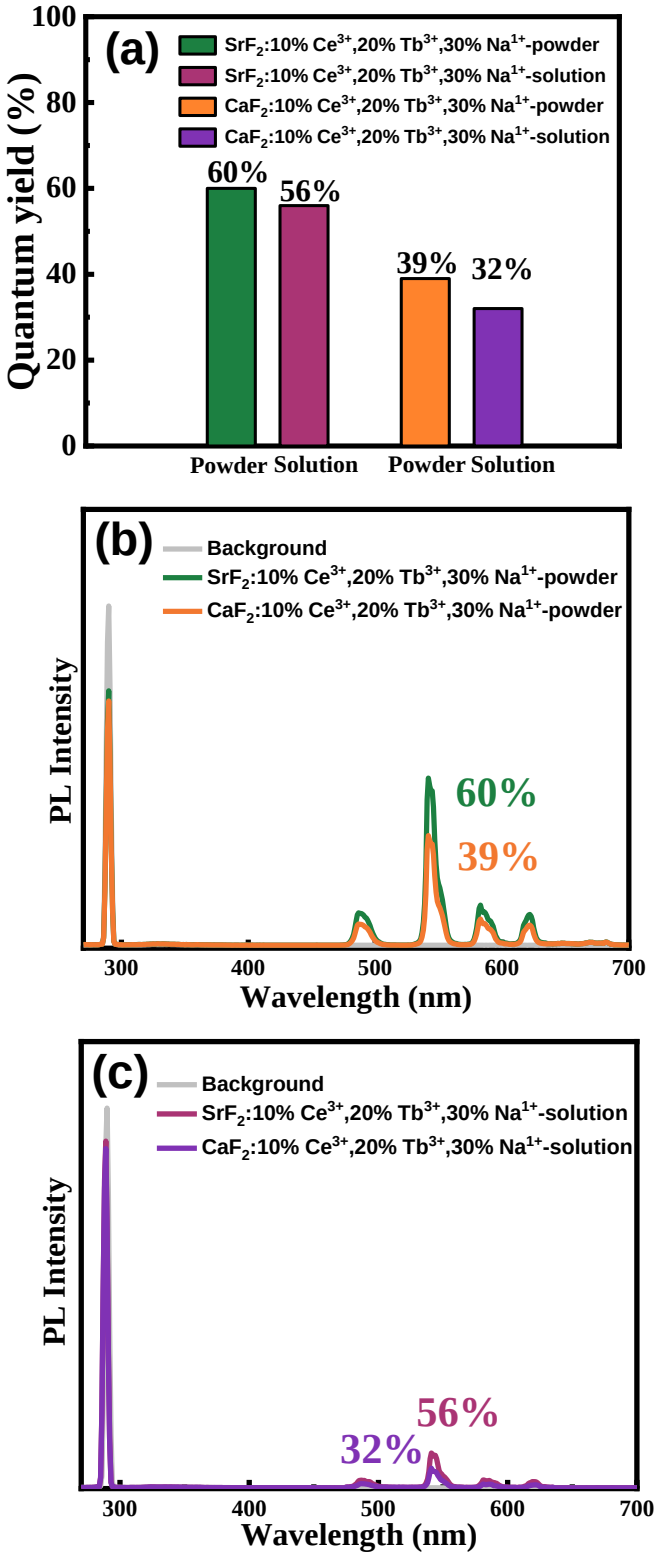

Figure S6. (a) The comparison of PLQYs of nanocrystal powders and nanocrystal chloroform solutions. The raw absorption and emission data for measuring PLQYs of (b) nanocrystal powders and (c) nanocrystal chloroform solutions.

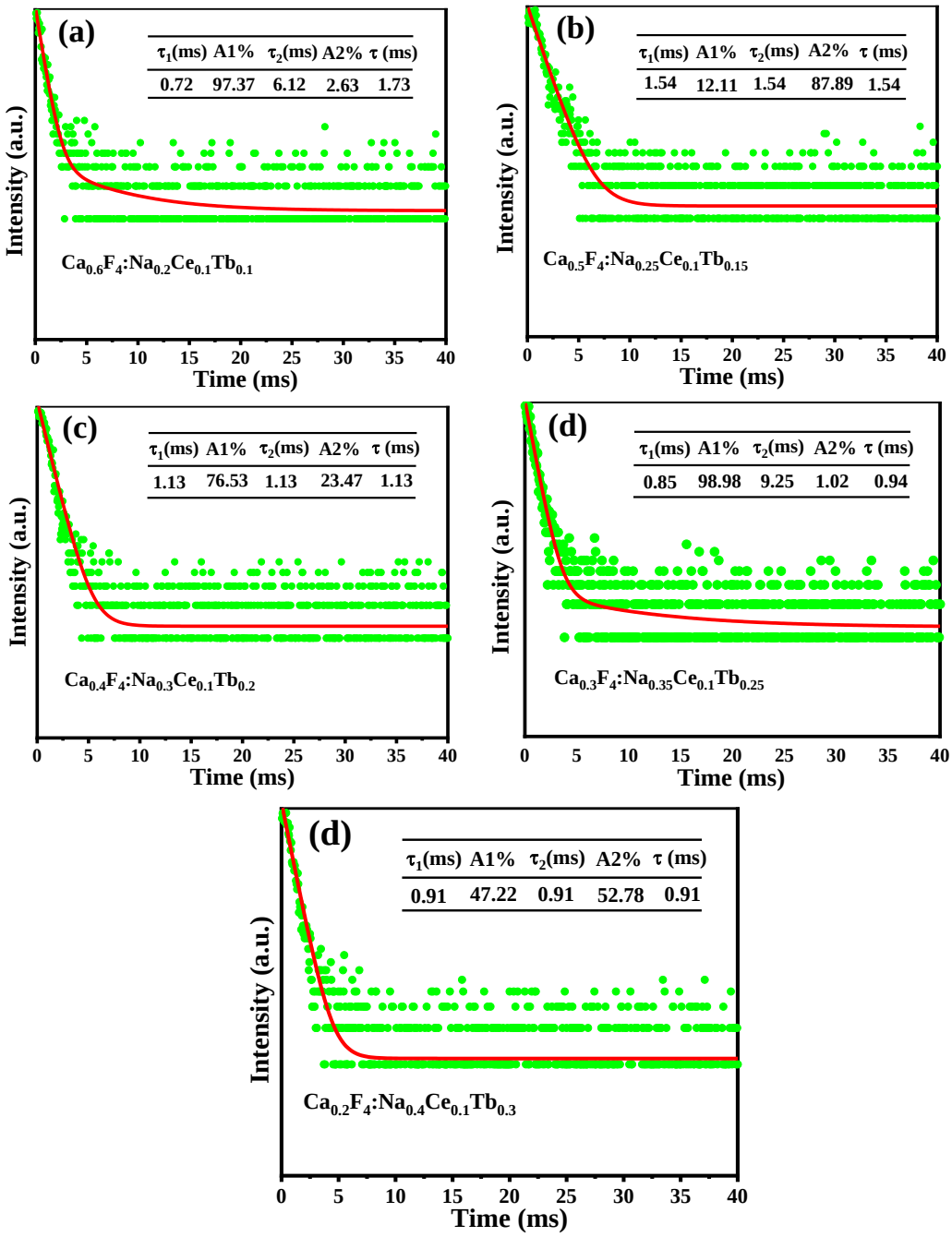

Fig. S7 (a-e) Fluorescence lifetime plots of $Ca_{0.8-2x}F_2:Ce^{3+}_{0.1}$, Tb^{3+}_{x}, $Na^{1+}_{0.1+x}$ (x=0.1, 0.15, 0.2, 0.25, 0.3) nanocrystals with different Tb doping concentrations.

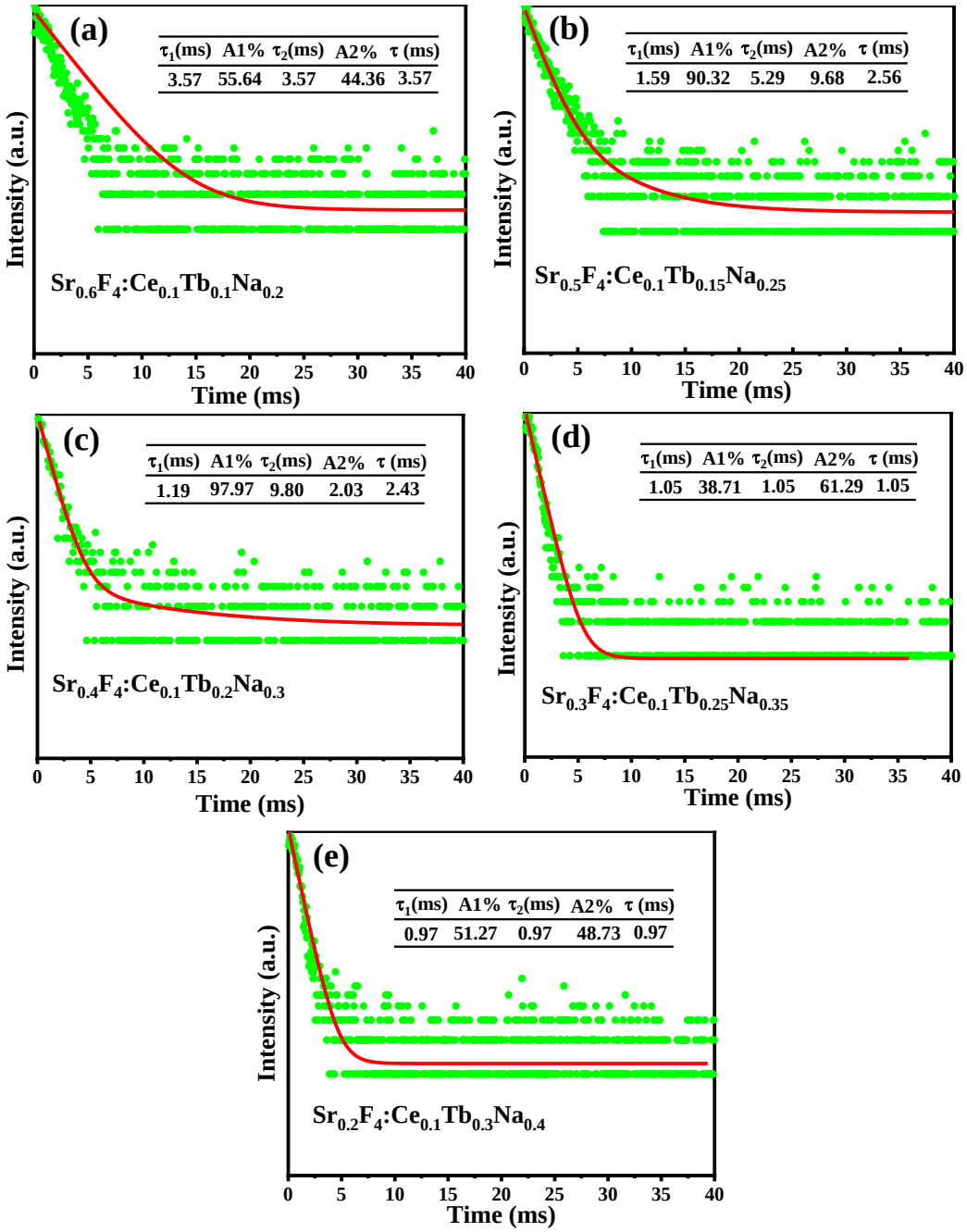

Fig. S8 (a-e) Fluorescence lifetime plots of $Sr_{0.8-2x}F_2:Ce^{3+}_{0.1}$, Tb^{3+}_x , $Na^{1+}_{0.1+x}$ (x=0.1, 0.15, 0.2, 0.25, 0.3) nanocrystals with different Tb doping concentrations.

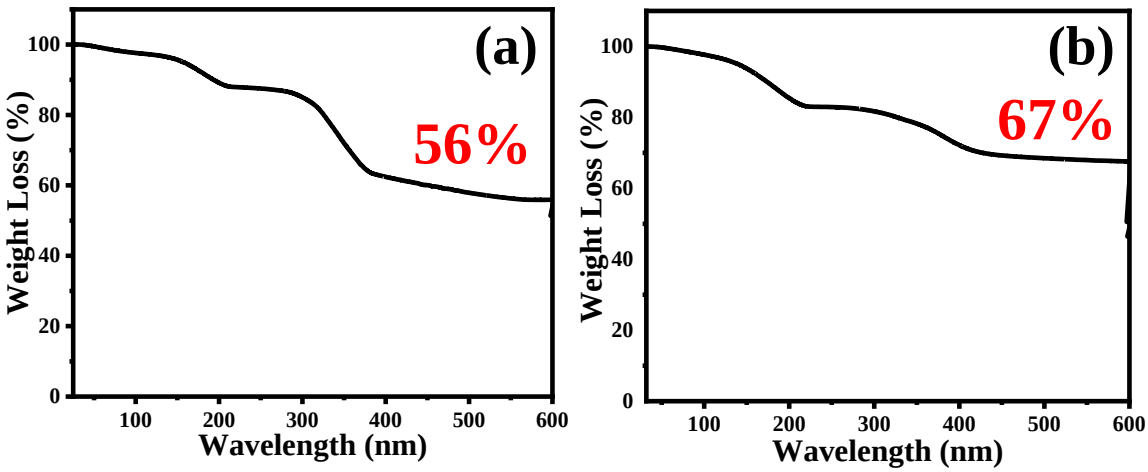

Fig. S9 Thermogravimetric profiles of (a) $Ca_{0.4}F_2:Ce^{3+}_{0.1}$, $Tb^{3+}_{0.2}$, $Na^{1+}_{0.3}$ and (b) $Sr_{0.4}F_2:Ce^{3+}_{0.1}$, $Tb^{3+}_{0.2}$, $Na^{1+}_{0.3}$ nanocrystals.