Electronic Supplementary Material (ESI) for Materials Chemistry Frontiers.

Supporting Information

Orange super-long persistent luminescent materials: $(Sr_{1-x}Ba_x)_3SiO_5$:Eu^{2+}, Nb^{5+}

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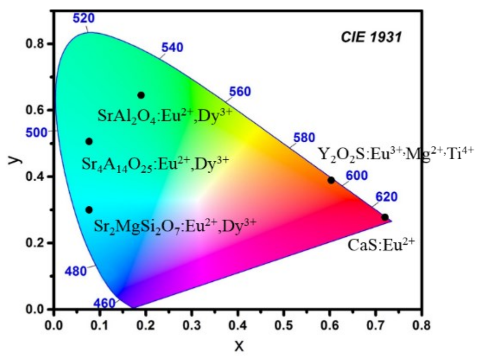

Figure S1. Several known commercial persistent luminescent phosphors. Y_2O_2S:Eu^{3+},Mg^{2+},Ti^{4+} and CaS:Eu^{2+},Tm^{3+} are the only two commercial warm-color persistent phosphors.

The emission intensity of the steady state luminescence I_{PL} (which does not involve trapping and de-trapping) and the afterglow related emission intensity I_{AG} (Low temperature PL emission spectra under 254 nm excitation see in **Figure S2**):

$$I_{PL}(RT) = 0.77I_{tot}(RT) = 0.67I_{tot}(80\ K) \quad \text{....(1)}$$

$$I_{AG}(RT) = 0.23I_{tot}(RT) = 0.20I_{tot}(80\ K) \quad \text{....(2)}$$

So, the efficiency of the persistent luminescence η_{AG} at RT can be calculated as following:

$$\eta_{AG}(RT) = \frac{I_{AG}(RT)}{I_{tot}(80K) - I_{PL}(RT)} \quad \text{....(3)}$$

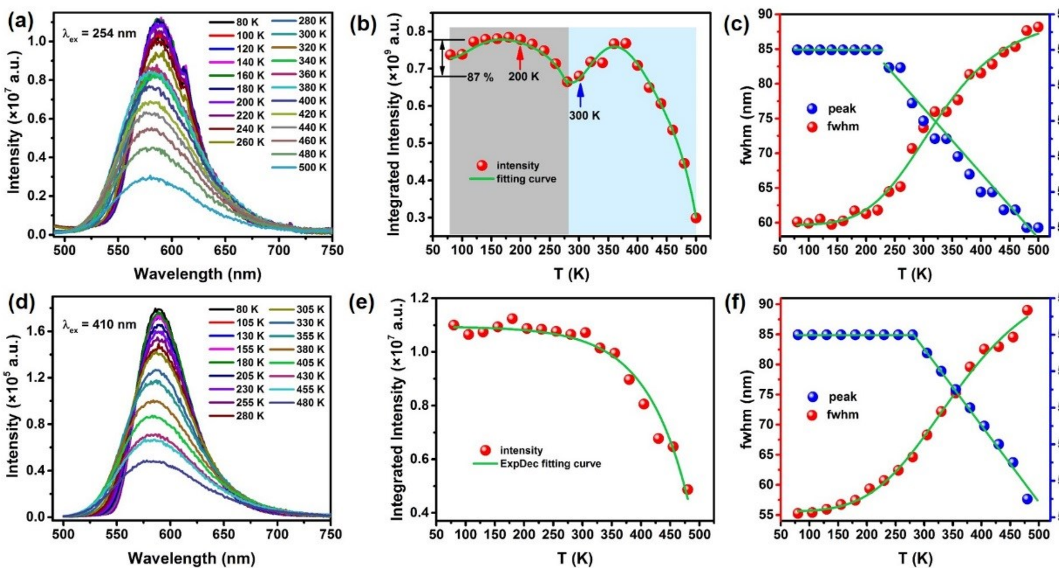

Figure S2. Temperature dependence photoluminescence (PL) emission spectra of Sr_3SiO_5:Eu^{2+},Nb under (a) 254 nm and (d) 410 nm excitation. Integrated intensity of PL emission spectra as a function of various temperature from 80 K to 500 K of Sr_3SiO_5:Eu^{2+},Nb under (b) 254 nm and (e) 410 nm. FWHM and emission peak wavelength of PL emission spectra as a function of various temperature of Sr_3SiO_5:Eu^{2+},Nb under (c) 254 nm and (f) 410 nm.

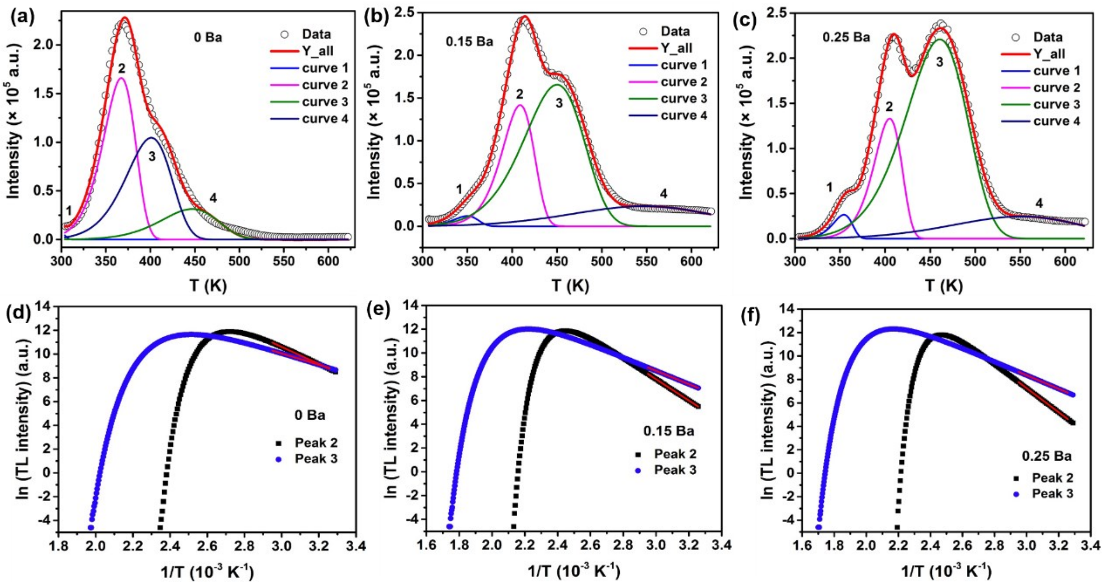

Figure S3. TL glow curves of $(Sr_{1-x}Ba_x)_3SiO_5$:Eu^{2+}, Nb^{5+} samples after UV light excitation from a Hg lamp at temperatures from 300 to 623 K with heating rate of 5 K/s of (a) Sr_3SiO_5:Eu^{2+}, Nb^{5+}; (b) $(Sr_{0.85}Ba_{0.15})_3SiO_5$:$Eu^{2+}$, Nb^{5+} and (c) $(Sr_{0.75}Ba_{0.25})_3SiO_5$:$Eu^{2+}$, Nb^{5+}. All the TL glow curves can be fitted using four first-order kinetic function, noted as 1, 2, 3 and 4. Initial rise analysis of the 2 and 3 glow curves in (d) Sr_3SiO_5:Eu^{2+}, Nb^{5+}; (e) $(Sr_{0.85}Ba_{0.15})_3SiO_5$:$Eu^{2+}$, Nb^{5+} and (f) $(Sr_{0.75}Ba_{0.25})_3SiO_5$:$Eu^{2+}$, Nb^{5+} as a function of excitation temperature.

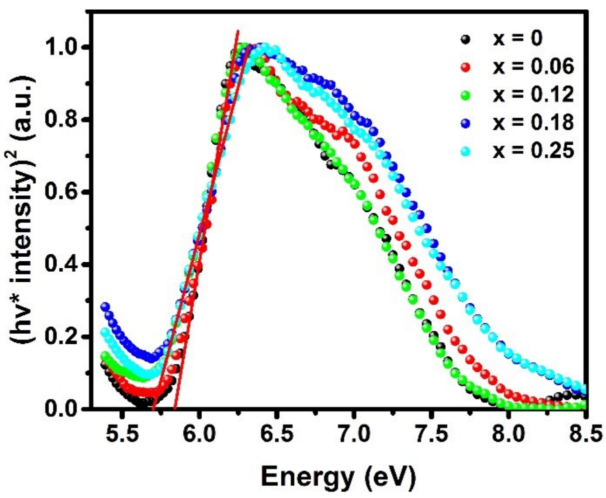

Figure S4. Tauc plot of PLE spectra in the VUV region in $(Sr_{1-x}Ba_x)SiO_5:Eu^{2+}$, Nb^{5+}.