Supporting Information

Color-Tunable of Persistent Luminescent Hybrid Materials by Radiative Energy Transfer

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1. Additional Figures and Tables

The afterglow decay process of composite film consists of a fast decay process and a slow decay part, which well-fitted into a third-order exponential function[1]:

$$I(t) = A_1 exp^{\left\{-\frac{t}{\tau_1}\right\}} + A_2 exp^{\left\{-\frac{t}{\tau_2}\right\}} + A_3 exp^{\left\{-\frac{t}{\tau_3}\right\}} + I_0$$

Here, I(t) and I_0 are the phosphorescence intensities at time t and 0, A_1, A_2 and A_3 are constants, t is time, and τ_1, τ_2, and τ_3 are the decay times.

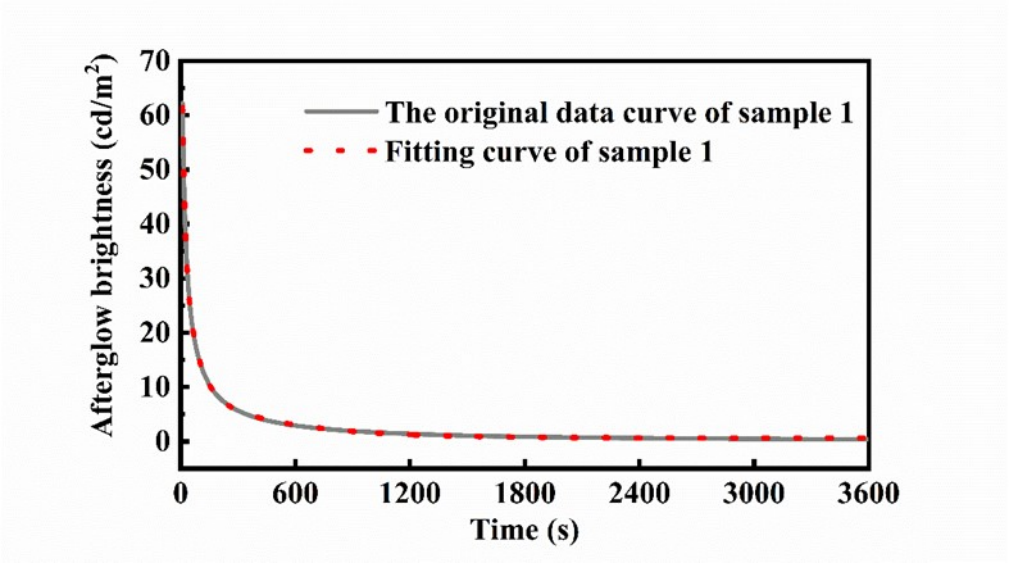

Figure S1. Afterglow decay curve of SA_2O_4/PFD sample 1 after being irradiated for 15 min under 365 nm UV light and the fitting curve of sample 1.

After fitting the curves for all samples, we calculate the corresponding average lifetime of the entire fluorescence decay process, the formula is as follows:

$$\langle\tau\rangle = \frac{B_1{\tau_1}^2 + B_2{\tau_2}^2 + B_3{\tau_3}^2}{B_1\tau_1 + B_2\tau_2 + B_3\tau_3}$$

The energy transfer efficiency η_{ET} can be estimated as follows[2]:

$$\eta_{ET} = 1 - \tau_f/\tau_o$$

where the τ_f is the average lifetime of composite film with different PFD added, and τ_0 is the average lifetime of corresponding composite film with only phosphors added. The energy transfer efficiency η_{ET} of the composite film are summarized in Table S1, and the specific date are shown in Figure S2.

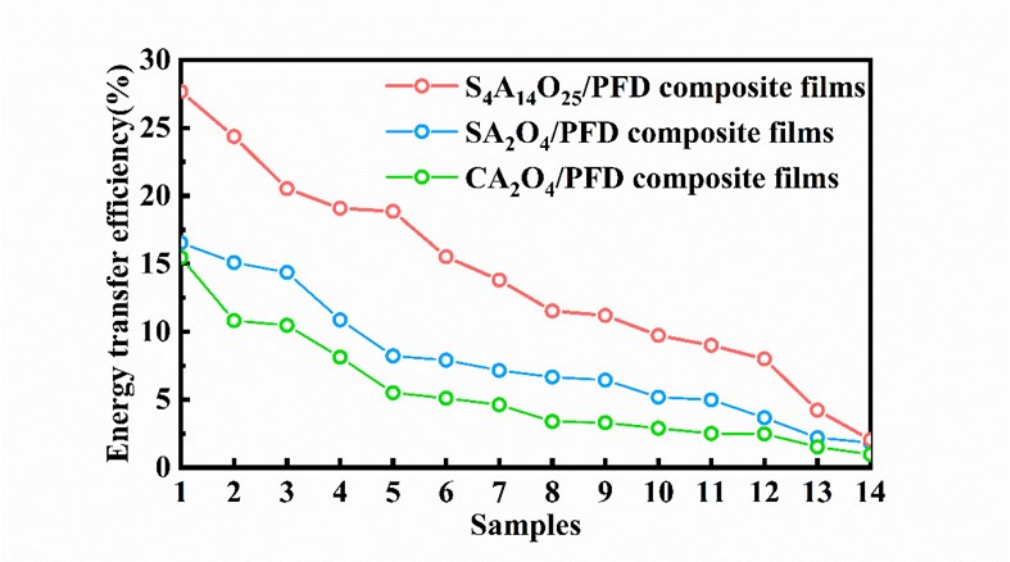

Figure S2. The energy transfer efficiency η_{ET} curve of the composite film (1#-14#).

Table S1. The energy transfer efficiency η_{ET} of the composite film (1#-14#).

Energy transfer efficiency	1#	2#	3#	4#	5#	6#	7#	8#	9#	10#	11#	12#	13#	14#
η_{ET} (SA_2O_4/PFD)	16.5	15.1	14.4	10.8	8.2	7.9	7.1	6.7	6.4	5.2	5.0	3.7	2.2	1.8
η_{ET} ($S_4A_{14}O_{25}$/PFD)	27.7	24.4	20.5	19.1	18.9	15.5	13.8	11.5	11.2	9.7	9.0	8.0	4.2	2.1
η_{ET} (CA_2O_4/PFD)	15.5	10.8	10.5	8.1	5.5	5.1	4.6	3.4	3.1	2.9	2.5	2.4	1.5	1.0

2. References

(1) Chen Z, Luo L, Li Y, et al. Warm-toned SiO_2/red-emitting color converter@$SrAl_2O_4$:Eu^{2+}, Dy^{3+} luminous fibers with variable and color-tuned luminescence on the basis of radiative energy transfer and color conversion[J]. Journal of Luminescence, 2019, 216: 116756.

(2) Yi, Luo, Zhi guo, et al. Effect of Al/Ga Substitution on Photoluminescence and Phosphorescence Properties of Garnet-Type $Y_3Sc_2Ga_{3-x}Al_xO_{12}:Ce^{3+}$ Phosphor[J]. The Journal of Physical Chemistry C, 2014, 118(40):23297-23305.