Supporting Information for

Color-tunable emissions realized by Tb^{3+} to Eu^{3+} energy transfer in $ZnGdB_5O_{10}$ under near-UV excitation

Yan Gao,[a] *Rihong Cong,*[ab*] *Tao Yang*[*ab]

[a] College of Chemistry and Chemical Engineering, Chongqing University, Chongqing 401331, People's Republic of China

[b] Chongqing Key Laboratory of Theoretical and Computational Chemistry, Chongqing University, Chongqing 401331, People's Republic of China

[*]Corresponding authors: congrihong@cqu.edu.cn; taoyang@cqu.edu.cn.

Table S1. Refined cell lattice parameters from Le Bail fitting on powder XRD data in the space group $P2_1/n$

x in $ZnGd_{1-x}Tb_xB_5O_{10}$	a (Å)	b (Å)	c (Å)	β (º)	V (Å ^{3})
0	8.5986(2)	7.6033(2)	9.3989(2)	93.385(2)	613.40(3)
0.1	8.5956(3)	7.6031(3)	9.3964(3)	93.397(3)	613.05(4)
0.2	8.5933(2)	7.6024(2)	9.3948(3)	93.413(4)	612.68(3)
0.4	8.5869(3)	7.6014(2)	9.3907(3)	93.434(3)	611.85(3)
0.6	8.5827(4)	7.6016(4)	9.3882(4)	93.461(3)	611.39(5)
0.8	8.5758(2)	7.6008(2)	9.3854(2)	93.481(2)	610.66(2)
1.0	8.5723(2)	7.6019(2)	9.3843(3)	93.503(5)	610.43(3)

y in $ZnGd_{1-y}Eu_yB_5O_{10}$	a (Å)	b (Å)	c (Å)	β(º)	V (Å ^{3})
0.05	8.5995(2)	7.6013(2)	9.3978(3)	93.379(2)	613.25(0)
0.10	8.5991(2)	7.6029(2)	9.3994(2)	93.373(1)	613.46(2)
0.20	8.6015(2)	7.6031(2)	9.3997(3)	93.368(3)	613.66(3)
0.40	8.6051(2)	7.6022(2)	9.4000(2)	93.348(2)	613.88(2)
0.60	8.6089(2)	7.6027(2)	9.4029(3)	93.322(1)	614.39(3)
0.80	8.6138(2)	7.6040(2)	9.4069(2)	93.302(2)	615.12(2)
1.00	8.6182(2)	7.6047(1)	9.4093(2)	93.282(2)	615.66(2)

z in $ZnGd_{0.2-z}Tb_{0.8}Eu_zB_5O_{10}$	a (Å)	b (Å)	c (Å)	β (º)	V (Å ^{3})

0.01	8.5774(2)	7.6027(2)	9.3871(2)	93.482(2)	611.02(2)
0.03	8.5775(3)	7.6028(2)	9.3876(3)	93.479(1)	611.07(3)
0.05	8.5776(2)	7.6029(2)	9.3878(4)	93.474(2)	611.10(3)
0.07	8.5777(3)	7.6029(2)	9.3882(2)	93.477(3)	611.13(2)
0.10	8.5788(4)	7.6031(3)	9.3880(5)	93.473(1)	611.20(3)

Table S2. Inter quantum yields for $ZnGd_{1-x}Tb_xB_5O_{10}$ ($0.1 \leq x \leq 1$)

Sample	IQY (%)
x in $ZnGd_{1-x}Tb_xB_5O_{10}$	EX = 364 nm
0.1	36.97
0.2	53.89
0.4	52.32
0.6	51.83
0.8	65.61
1.0	55.80

Table S3. Inter quantum yields for $ZnGd_{1-y}Eu_yB_5O_{10}$ ($0.05 \leq y \leq 1$)

y in $ZnGd_{1-y}Eu_yB_5O_{10}$	EX = 393 nm
0.05	62.26
0.1	63.78
0.2	65.76
0.4	88.69

0.6	81.87
0.8	69.70
1.0	38.63

Table S4. Inter quantum yields for $ZnGd_{0.2-z}Tb_{0.8}Eu_zB_5O_{10}$ ($0.01 \leq z \leq 0.1$)

z in $ZnGd_{0.2-z}Tb_{0.8}Eu_zB_5O_{10}$	EX = 346 nm
0.01	66.70
0.03	98.03
0.05	85.13
0.07	78.37
0.10	71.29

Table S5. Calculated average lifetime (τ) for $ZnGd_{0.2-z}Tb_{0.8}Eu_zB_5O_{10}$ ($0 \leq z \leq 0.1$) and energy transfer efficiency from Tb^{3+} to Eu^{3+} against z

z	A_1	τ_1 (ms)	A_2	τ_2 (ms)	τ (ms)	$\eta_{ET}=1-\tau/\tau_0$ (%)
0	143	0.150	991	2.345	2.325	
0.01	590	0.277	690	1.106	0.960	58.71
0.03	861	0.213	583	0.709	0.557	76.04
0.05	1360	0.158	342	0.835	0.544	76.60
0.07	2745	0.085	410	0.341	0.181	92.22
0.10	5081	0.060	307	0.318	0.123	94.71

Table S6. CIE chromaticity coordinates for $ZnGd_{0.2-z}Tb_{0.8}Eu_zB_5O_{10}$ ($0 \leq z \leq 0.1$) excited by 346 nm irradiation

z in $ZnGd_{0.2-z}Tb_{0.8}Eu_zB_5O_{10}$	CIE (x, y)
0	(0.2915, 0.5915)
0.01	(0.4675, 0.4796)
0.03	(0.5365, 0.4317)
0.05	(0.5887, 0.3952)
0.07	(0.6080, 0.3815)
0.10	(0.6207, 0.3731)

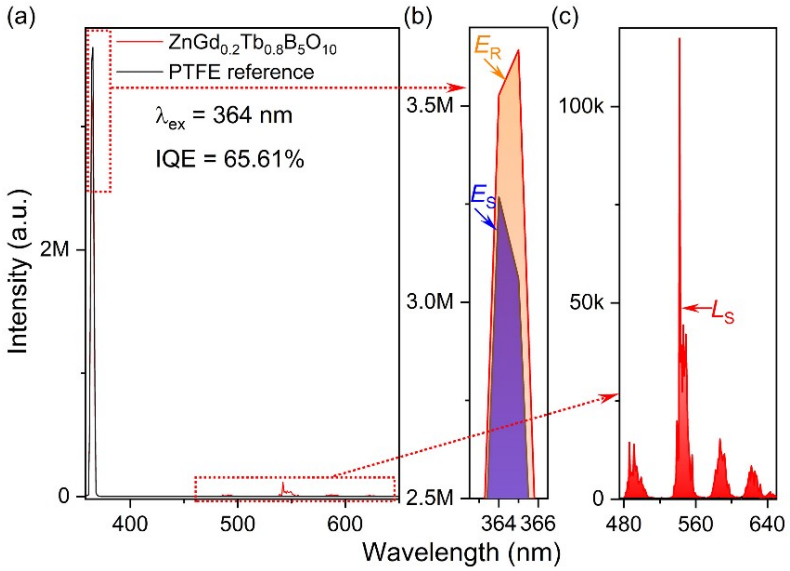

Fig. S1. (a) Representative calculation of the inter quantum efficiency of $ZnGd_{0.2}Tb_{0.8}B_5O_{10}$, where L_S and E_S are the emission and excitation spectra of the sample, respectively, and E_R is the excitation spectra of the reference; (b) and (c) are the enlargement figures.

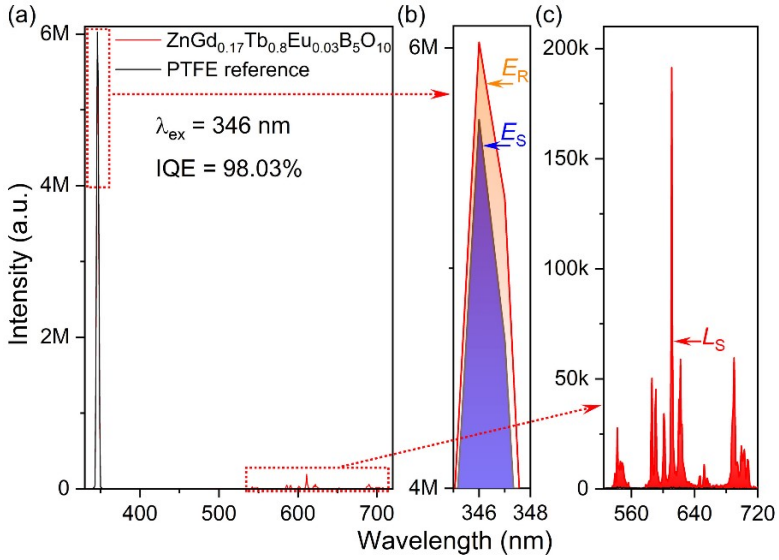

Fig. S2. (a) Representative calculation of the Inter quantum efficiency of $ZnGd_{0.17}Tb_{0.8}Eu_{0.03}B_5O_{10}$; (b) and (c) are the enlargement figures.

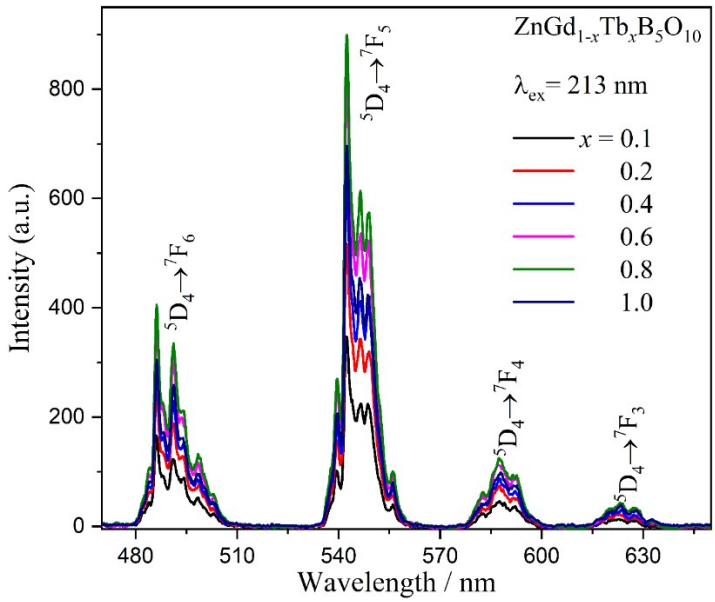

Fig. S3. PL emission spectra under the excitation at 213 nm for $ZnGd_{1-x}Tb_xB_5O_{10}$ ($0.1 \leq x \leq 1$).

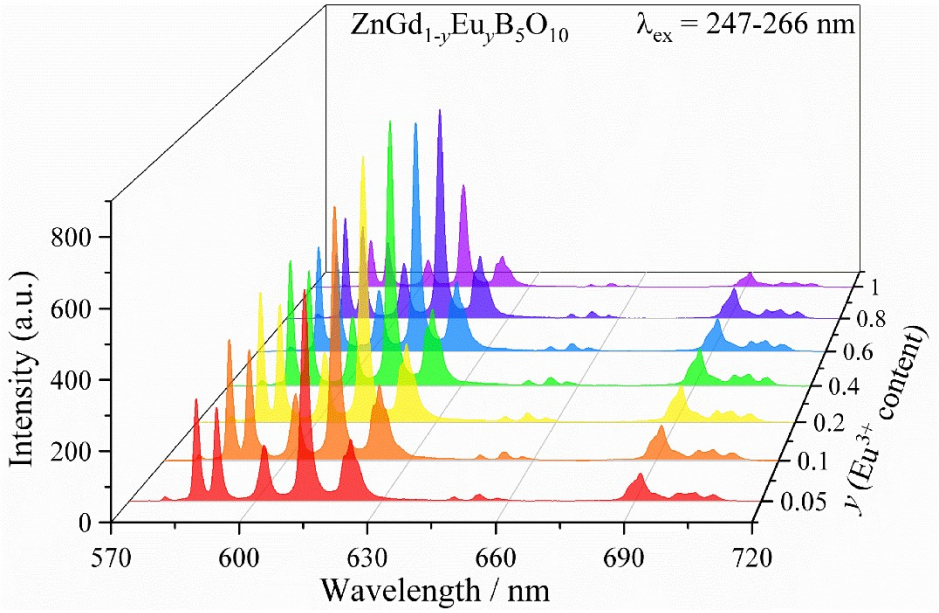

Fig. S4. PL emission spectra under the excitation at 247-266 nm for $ZnGd_{1-y}Eu_yB_5O_{10}$ ($0.05 \leq y \leq 1$).

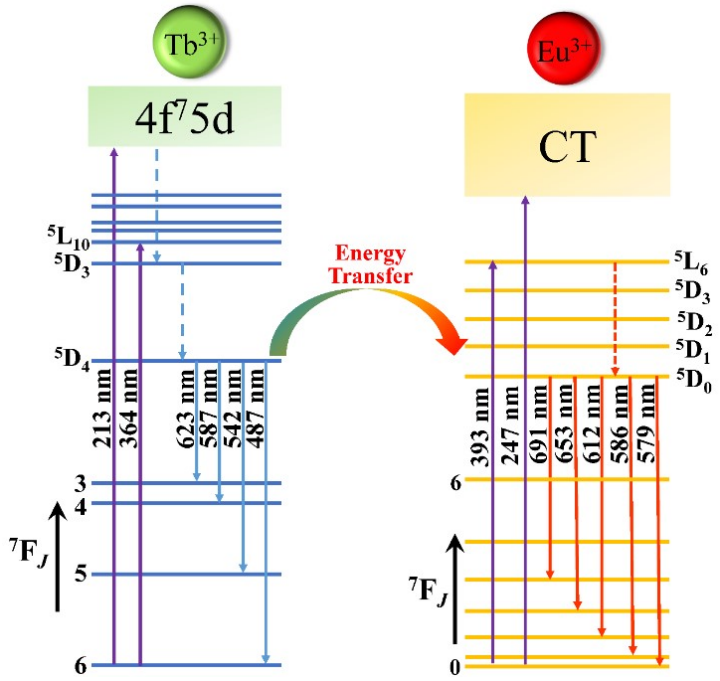

Fig. S5. Schematic energy level diagram and energy-transfer process from Tb^{3+} to Eu^{3+} in $ZnGdB_5O_{10}$.