

Supporting Information

Dual-mode upconversion and downshifting white-light emitting $\text{Ln}^{3+}:\text{Gd}_2\text{W}_2\text{O}_9$ materials

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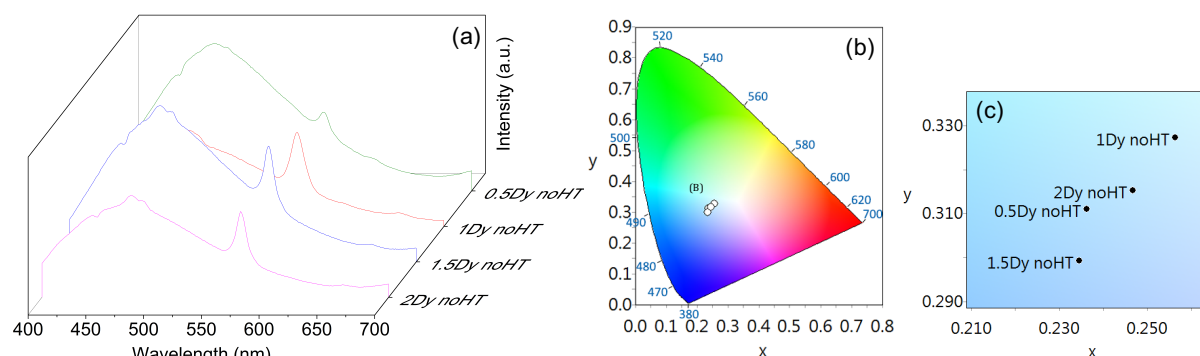


Figure S1. (a) Emission spectra of 0.5%, 1%, 1.5% and 2% $\text{Dy}^{3+}:\text{Gd}_2\text{W}_2\text{O}_9$ noHT excited at 298 nm; (b) CIE diagram of 0.5%, 1%, 1.5% and 2% $\text{Dy}^{3+}:\text{Gd}_2\text{W}_2\text{O}_9$ noHT; (c) Zoom in of the same CIE diagram.

Table S1. CIE coordinates for the noHT downshifting samples (0.5%, 1%, 1.5% and 2% $\text{Dy}^{3+}:\text{Gd}_2\text{W}_2\text{O}_9$).

Sample	CIE x	CIE y
0.5%Dy noHT	0.2363	0.3111
1%Dy noHT	0.2564	0.3274
1.5%Dy noHT	0.2345	0.2993
2%Dy noHT	0.2467	0.3153

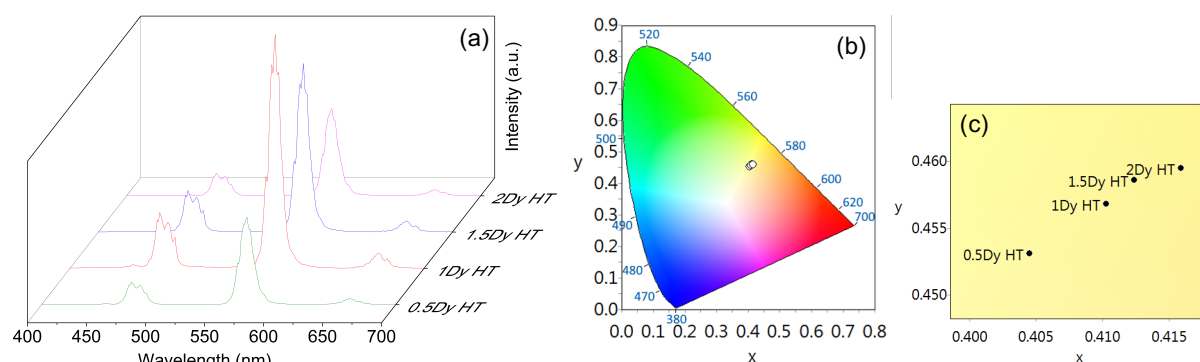


Figure S2. (a) Emission spectra of 0.5%, 1%, 1.5% and 2% $\text{Dy}^{3+}:\text{Gd}_2\text{W}_2\text{O}_9$ HT excited at 298 nm; (b) CIE diagram of 0.5%, 1%, 1.5% and 2% $\text{Dy}^{3+}:\text{Gd}_2\text{W}_2\text{O}_9$ HT; (c) Zoom in of the same CIE diagram.

Table S2. CIE coordinates for the HT downshifting samples (0.5%, 1%, 1.5% and 2% Dy³⁺: Gd₂W₂O₉).

Sample	CIE x	CIE y
0.5%Dy HT	0.4045	0.4531
1%Dy HT	0.4103	0.4568
1.5%Dy HT	0.4124	0.4586
2%Dy HT	0.4159	0.4595

Table S3. Change in CIE coordinates when exciting sample of sample 1 at different wavelengths in the range 250-330 nm.

Excitation wavelength	CIE x	CIE y
250 nm	0.2226	0.2940
260 nm	0.2246	0.2973
270 nm	0.2281	0.3030
280 nm	0.2349	0.3117
290 nm	0.2488	0.3273
300 nm	0.2487	0.3374
310 nm	0.2722	0.3509
320 nm	0.2883	0.3882
330 nm	0.2647	0.3415

Table S4. Change in CIE coordinates when exciting sample of sample 2 at different wavelengths in the range 230-310 nm.

Excitation wavelength	CIE x	CIE y
230 nm	0.3005	0.2940
240 nm	0.4076	0.4546
250 nm	0.4083	0.4557
260 nm	0.4095	0.4568
270 nm	0.4104	0.4576
280 nm	0.4117	0.4584
290 nm	0.4128	0.4595
300 nm	0.4135	0.4606
310 nm	0.4147	0.4624

Table S5. CIE coordinates of Er³⁺, Tm³⁺, Yb³⁺, Ho³⁺: Gd₂W₂O₉ HT upconversion materials.

Sample	CIE x	CIE y
3	0.2110	0.6067
4	0.2060	0.5903
5	0.1862	0.4481
6	0.1854	0.4861
7	0.1778	0.4015
8	0.1594	0.2552
9	0.2967	0.3910
10	0.3770	0.3937

11	0.2489	0.2970
12	0.2875	0.3288

Table S6. CIE coordinates of downshifting luminescence of sample 1, 2, 13, 14, 15 and 16.

Sample	CIE x	CIE y
1	0.2589	0.3312
2	0.3035	0.2940
13	0.2469	0.3151
14	0.2526	0.3239
15	0.2845	0.2922
16	0.3363	0.3630

Table S7. CIE coordinates of upconversion luminescence of sample 9, 12, 13, 14, 15 and 16.

Sample	CIE x	CIE y
9	0.2967	0.3910
12	0.2875	0.3288
13	0.2768	0.3778
14	0.2827	0.3270
15	0.2868	0.3936
16	0.2743	0.3295

Table S8. CIE coordinates of downshifting luminescence of sample 2, 15, 16, 17 and 18.

Sample	CIE x	CIE y
2	0.3035	0.2940
15	0.2845	0.2922
16	0.3363	0.3630
17	0.2764	0.2876
18	0.2572	0.2645

Table S9. CIE coordinates of upconversion luminescence of sample 9, 12, 15, 16, 17 and 18.

Sample	CIE x	CIE y
9	0.2967	0.3910
12	0.2875	0.3288
15	0.2868	0.3936
16	0.2743	0.3295
17	0.3917	0.5173
18	0.4363	0.4809

Table S10. CIE coordinates, CCT, CRI, LER and QYs of downconversion luminescence of sample 2, 16 and 18.

Sample	CIE x	CIE y	CCT	CRI	LER	QYs
2	0.3005	0.2940	7843	30	291	6.1%
16	0.3363	0.3630	5359	14	356	3.8%
18	0.2572	0.2645	17391	47	245	0.2%

Table S11. CIE coordinates, CCT, CRI and LER of upconversion luminescence of sample 12, 14, 16 and 18.

Sample	CIE x	CIE y	CCT	CRI	LER
12	0.2875	0.3288	7996	40	188
14	0.2827	0.3270	8351	42	190
16	0.2743	0.3295	8863	48	195
18	0.4363	0.4809	3541	20	200