Supplementary Information

Phase-sensitive radioluminescent and photoluminescent features in Tm^{3+}-doped yttrium tantalate for cyan and white light generation

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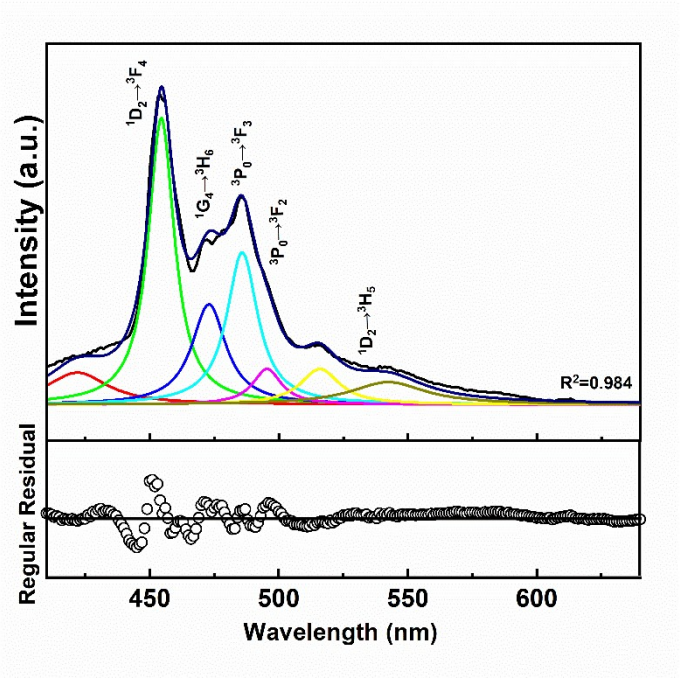

Figure S1. Deconvolution by Lorentzian fitting for the photoluminescence emission spectra in the visible range upon excitation at 243 nm (M'-$YTaO_4$ host absorption) for the Tm^{3+}-doped yttrium tantalate annealed at 1100 °C for 2 h.

Table S1. Full-width at half-maximum for the sample T05 annealed at 900 and 1100 °C under distinct UV excitation.

Excitation Wavelength (nm)	FWHM (nm) Sample T05	
	900 °C	**1100 °C**
243	51	43
253	53	52
261	54	56
275	60	78
282	64	69
290	74	40
300	69	44

Table S2. CIE *x,y* color coordinates calculated for sample T05 annealed at 900 or 1100 °C under different excitation wavelengths.

Excitation Wavelength (nm)	**T05**			
	900 °C		**1100 °C**	
	x	***y***	***x***	***y***
243	0.187	0.211	0.181	0.188
253	0.188	0.220	0.192	0.231
261	0.188	0.223	0.193	0.232
275	0.188	0.228	0.197	0.236
282	0.189	0.233	0.196	0.227
290	0.191	0.237	0.194	0.215
295	0.194	0.241	0.205	0.232
300	0.198	0.244	0.211	0.241
358	0.158	0.077	0.160	0.074

Table S3. CIE *x,y* color coordinates calculated for sample T05 annealed at 900 or 1100 °C under excitation at 275 nm with different delay times.

Delay (ms)	T05			
	900 °C		1100 °C	
	x	***y***	***x***	***y***
0.02	0.226	0.166	0.196	0.199
0.04	0.251	0.173	0.267	0.223
0.1	0.260	0.270	0.222	0.251
0.25	0.305	0.299	0.248	0.279
0.5	0.368	0.339	0.291	0.316
1.0	0.436	0.377	0.364	0.369
2.0	0.471	0.388	0.440	0.396

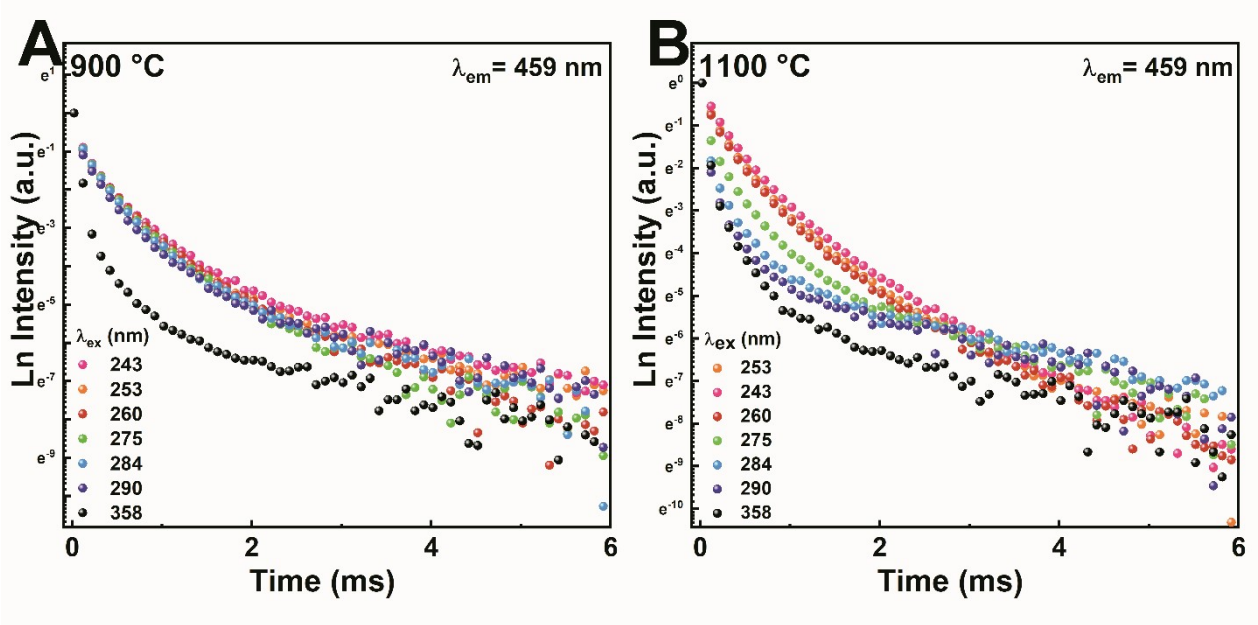

Figure S2. Photoluminescence decay curves for the Tm^{3+} $^1D_2$ (459 nm) emitting level under excitation at distinct excitation wavelengths for Tm^{3+}-doped yttrium tantalate samples annealed at (A) 900 and (B) 1100 °C for 2 h.

Table S4. $^1D_2$ and $^1G_4$ emitting levels lifetimes (ms) for Tm^{3+}-doped yttrium tantalate samples annealed at 900 °C for 2 h at different excitation wavelengths.

λ_{ex} (nm)	T05 900 °C							
	λ_{em}= 459 nm				λ_{em}= 655nm			
	τ_1	τ_2	τ_3	R^2	τ_1	τ_2	τ_3	R^2
243	0.03	0.22	0.66	0.99998	0.06	0.29	1.01	0.99996
253	0.03	0.23	0.65	0.99998	0.05	0.30	1.03	0.99995
260	0.04	0.25	0.71	0.99999	0.1	0.36	1.10	0.99997
275	0.04	0.23	0.75	0.99999	0.13	0.40	1.23	0.99995
284	0.03	0.23	0.69	0.99998	0.07	0.32	1.10	0.99993
290	0.03	0.22	0.76	0.99998	0.06	0.26	0.89	0.99987
358	0.05	0.31	2.82	0.99999	0.03	0.18	0.63	0.99994

Table S5. $^1D_2$ and $^1G_4$ emitting levels lifetimes (ms) for Tm^{3+}-doped yttrium tantalate samples annealed at 1100 °C for 2 h at different excitation wavelengths.

λ_{ex} (nm)	T05 1100 °C							
	λ_{em}= 459 nm				λ_{em}= 655nm			
	τ_1	τ_2	τ_3	R^2	τ_1	τ_2	τ_3	R^2
243	0.06	0.25	0.67	0.99999	0.07	0.30	0.83	0.99999
253	0.01	0.25	0.68	0.99999	0.08	0.31	0.92	0.99998
260	0.04	0.23	0.62	0.99999	0.06	0.28	0.86	0.99996
275	0.03	0.24	0.91	0.99999	0.06	0.30	1.29	0.99987
284	0.03	0.21	1.30	0.99999	0.04	0.25	1.39	0.99973
290	0.03	0.18	1.44	0.99998	0.03	0.40	2.53	0.99939
358	0.04	0.20	1.26	0.99999	0.02	0.18	0.57	0.99996

Table S6. Pr^{3+}: $^1D_2$ and Tm^{3+}: $^1G_4$ emitting levels lifetimes (ms) for sample M1 at different excitation wavelengths.

λ_{ex} (nm)	M1							
	λ_{em}= 610 nm				λ_{em}= 655 nm			
	τ_1	τ_2	τ_3	R^2	τ_1	τ_2	τ_3	R^2
243	0.08	0.26	1.56	0.99997	0.09	0.31	0.84	0.99998
253	0.07	0.22	1.52	0.99997	0.09	0.34	0.88	0.99998
260	0.07	0.22	1.53	0.99997	0.05	0.23	0.64	0.99996
275	0.09	0.23	1.74	0.99999	0.09	0.29	0.78	0.99998
284	0.01	0.31	2.16	0.99999	0.07	0.24	0.65	0.99997
290	0.12	0.31	2.15	0.99999	0.05	0.18	0.58	0.99998
322	0.05	0.16	0.72	0.99999	0.03	0.28	2.41	0.99996

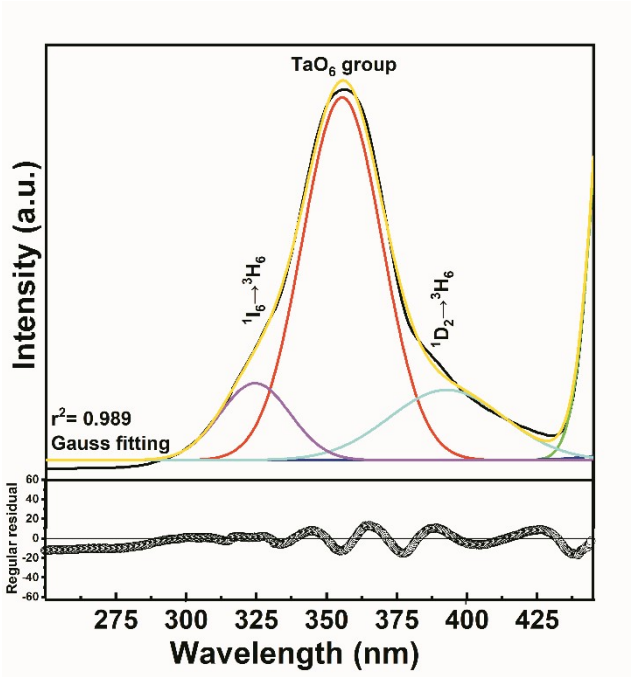

Figure S3. Deconvolution by Gauss fitting for the RL emission spectra in the visible range, upon 5 s irradiation, for the Tm^{3+}-doped yttrium tantalate annealed at 1100 °C for 2 h.

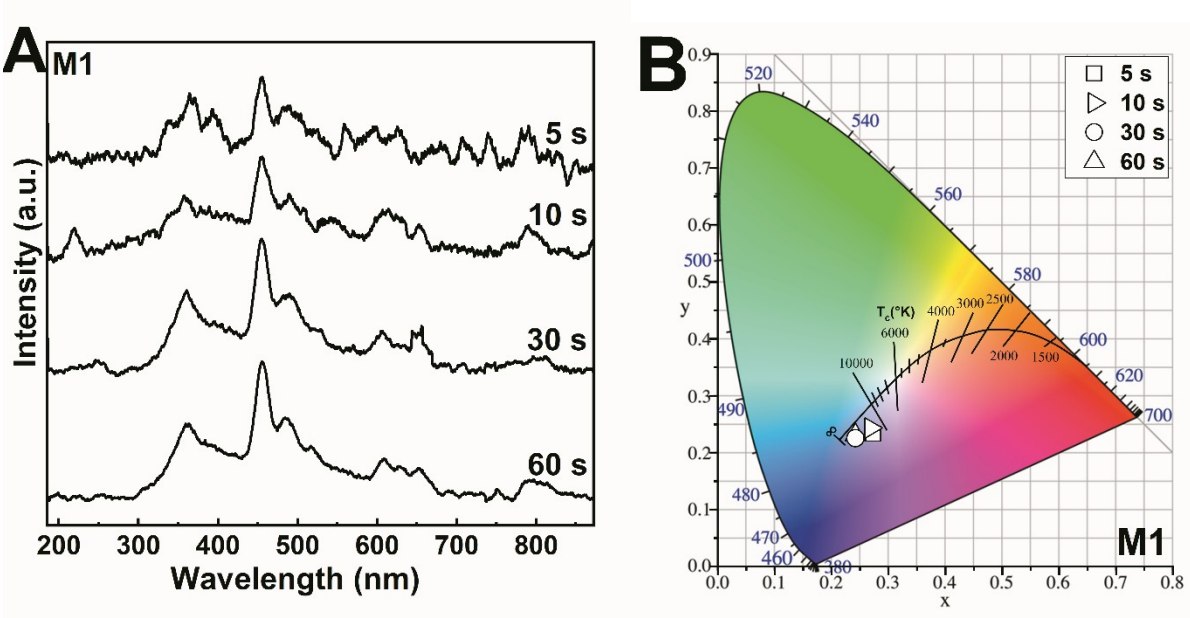

Figure S4. (A) RL emission spectra upon 5, 10, 30 or 60 s of irradiation and (B) CIE 1931 chromaticity diagram for the sample M1 upon X-ray excitation.