Electronic Supplementary Information

Synthesis of rare-earth doped ZnO nanorods and their defect-dopant correlated enhanced visible-orange luminescence

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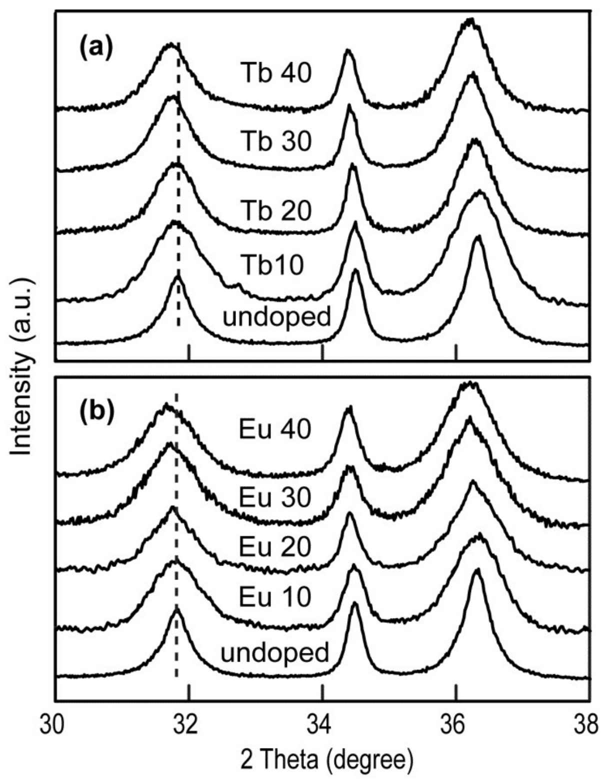

Fig. S1 XRD pattern shows diffraction peaks shift to lower angle with increasing doping concentration indicating expansion of the ZnO lattice.

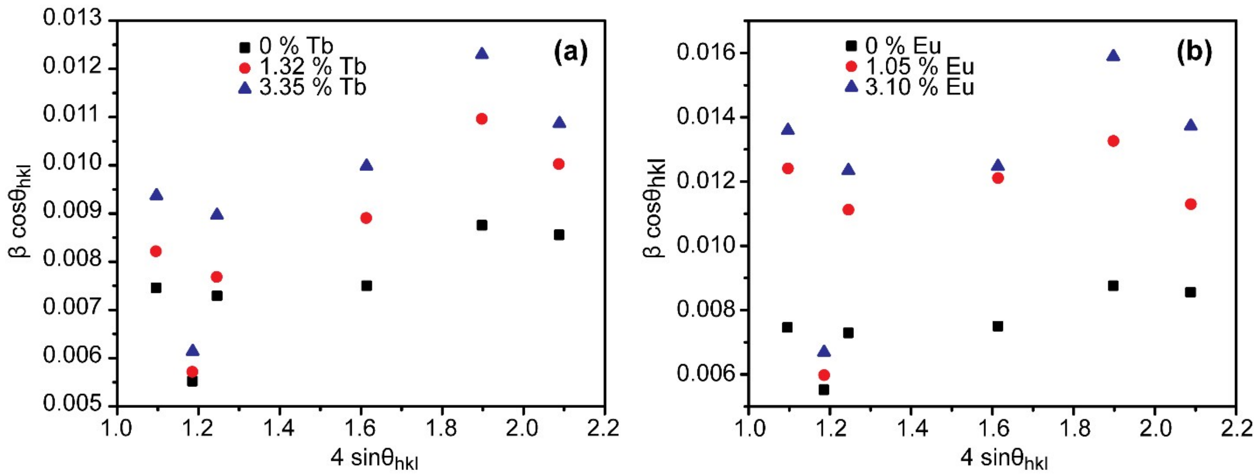

Fig. S2 The Williamson-Hall (W-H) analysis of XRD peak broadening of (a) Tb-doped and (b) Eu-doped ZnO nanorods respectively. The non-linear behavior W-H plot indicates anisotropic strain. It is noted that there is plausible increase in strain with higher dopant content in ZnO host.

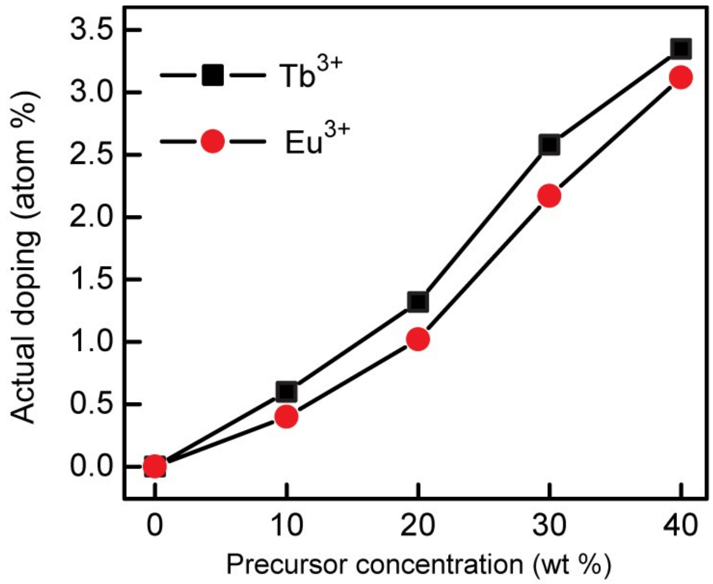

Fig. S3 Variation of actual doping in atom% of RE^{3+} doped in nanorods as obtained from EDS against the amount of RE^{3+} precursors in weight% of $Zn(NO_3)_2$, used during the synthesis of doped ZnO nanorods.

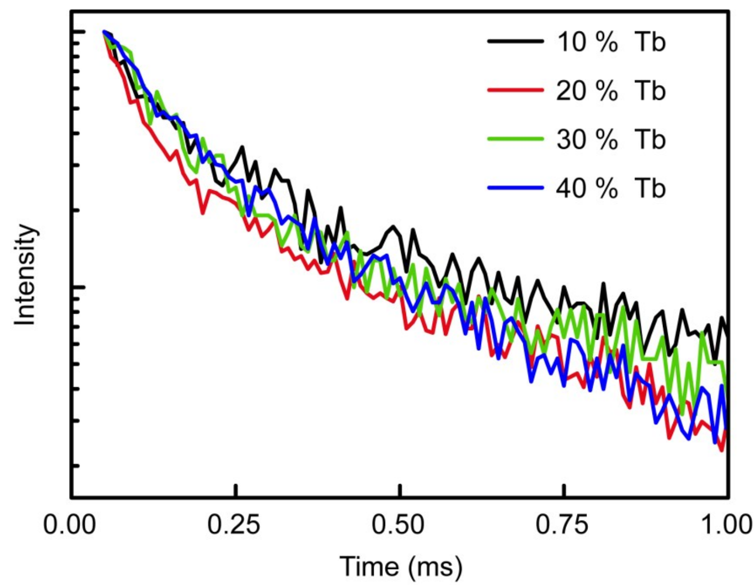

Fig. S4 Fluorescence decays recorded for Tb^{3+} doped ZnO nanorods at the excitation wavelength of 290 nm and emission wavelength of 545 nm. Individual decay traces relate to different amount (weight %) of Tb^{3+} precursors used for doping: 10 weight% (black trace), 20 weight% (red trace), 30 weight% (green trace) and 40 weight% (blue trace).

Table S1. Fluorescence lifetimes (τ) and amplitude (A) recovered from fluorescence decays recorded for the solutions of ZnO nanorods with different Tb^{3+} content at the excitation wavelength of 290 nm and emission wavelength of 545 nm.

atom% of Tb^{3+} precursor	**A_1**	**τ_1/µs**	**A_2**	**τ_2/ µs**
0.6	0.77	84.5	0.23	385
1.32	0.84	89.5	0.16	382
2.58	0.90	97.2	0.10	387
3.35	0.77	84.5	0.23	385

Note: All decays were analyzed by non linear curve fitting using origin 8.5 software.

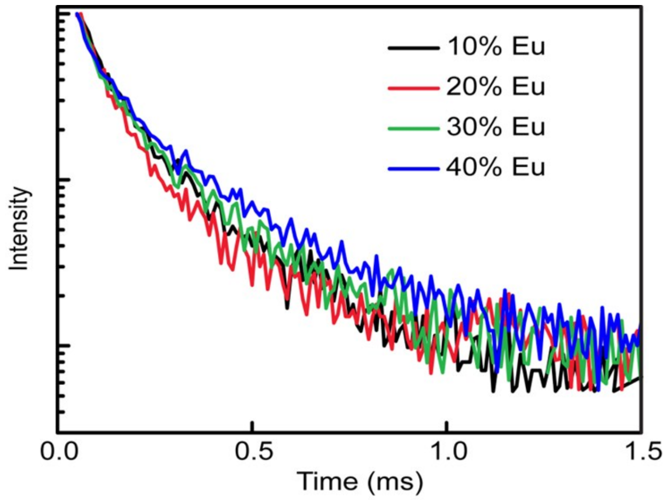

Fig. S5 Fluorescence decays recorded for Eu^{3+} doped ZnO nanorods at the excitation wavelength of 290 nm and emission wavelength of 615 nm. Individual decay traces relate to different amount of Eu^{3+} precursors used for doping: 10 (black trace), 20 (red trace), 30 (green trace), and 40 weight% (blue trace).

Table S2. Fluorescence lifetimes (τ) and amplitude (A) recovered from fluorescence decays recorded for the solutions of ZnO nanorods with different Eu^{3+} content at the excitation wavelength of 290 nm and emission wavelength of 615 nm.

atom% of Eu^{3+} precursor	**A_1**	**τ_1/µs**	**A_2**	**τ_2/ µs**
0.4	0.88	70.5	0.12	301
1.05	0.96	70.9	0.04	280
2.17	0.84	51.1	0.16	266
3.12	0.82	55.0	0.18	311

Note: All decays were analyzed by non linear curve fitting using origin 8.5 software.

Table S3. Fluorescence lifetime (τ) and amplitude (A) recovered from fluorescence decays of 40 weight% Tb^{3+} doped ZnO nanorods at different emission wavelengths.

λ_{em}	A_1	τ_1/ns	A_2	τ_2/ns	$\langle\tau\rangle$/ns	χ^2
520	0.25	5.02	0.75	39.03	41.0	1.10
540	0.65	5.1	0.36	40.1	43.8	1.07
580	0.22	6.35	0.78	43	45.2	1.02

Table S4. Fluorescence lifetime (τ) and amplitude (A) recovered from fluorescence decays of 40 weight% Eu^{3+} doped ZnO nanorods at different emission wavelengths.

λ_{em}	A_1	τ_1/ns	A_2	τ_2/ns	$\langle\tau\rangle$/ns	χ^2
520	0.57	6.10	0.43	41.1	45.0	1.04
540	0.24	7.30	0.76	43.8	46.3	1.07
580	0.23	7.10	0.78	13.9	46.3	1.12