Soft Templated Room Temperature Fabrication of Nanoscale Lanthanum Phosphate: Synthesis, Photoluminescence and Energy Transfer Behaviour

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Supporting Information

Lifetime measurement:

In lifetime measurements, the biexponential photoluminescence decay curves were analyzed by a iterative fitting program provided by IBH such as Eq. S1,[47]

$$I(t) = \sum_i \alpha_i \exp(-t/\tau_i) \ldots\ldots\ldots\ldots \mathbf{S1}$$

where α_i is a pre-exponential factor representing fractional contribution to the time-resolved decay of the component with a lifetime τ_i. Mean (average) lifetimes □τ□ for biexponential decays of PL were calculated from the decay times and pre-exponential factors using the following Eq. S2,[47]

$$\langle\tau\rangle = \frac{\alpha_1\tau_1 + \alpha_2\tau_2}{\alpha_1 + \alpha_2} \ldots\ldots\ldots\ldots \mathbf{S2}$$

Figure S1:

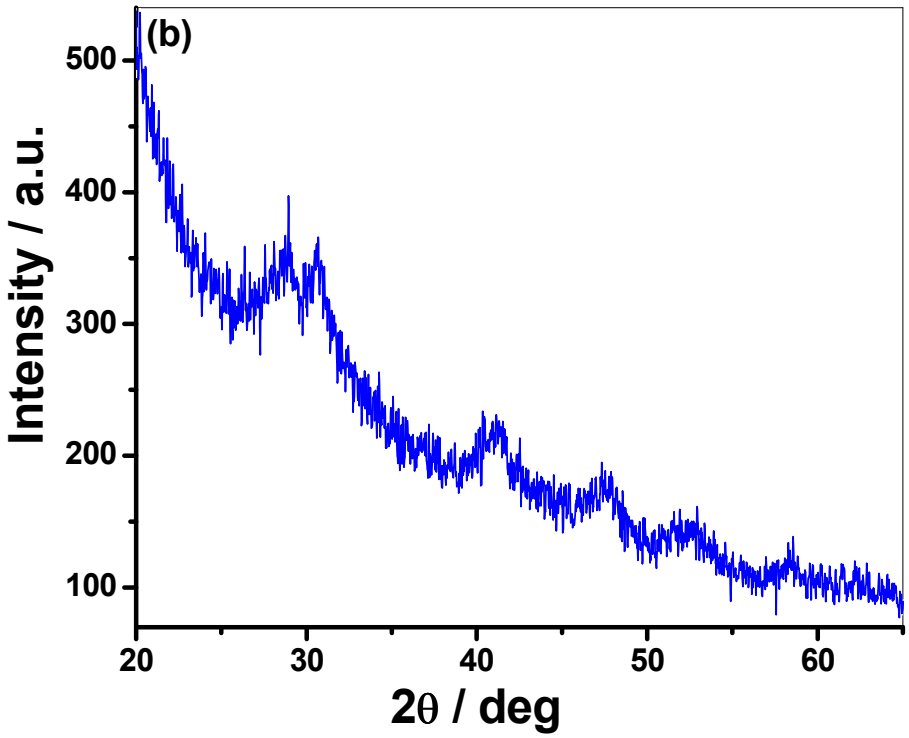

Figure S1: XRD pattern of Ce^{3+} activated $LaPO_4$; $[Ce^{3+}]$ = 0.5 mol dm^{-3}; ω = 25; [AOT] = 0.1 mol dm^{-3}; $[La^{3+}]$ = 0.5 mol dm^{-3}; $[H_2PO_4^-]$ = 0.5 mol dm^{-3}.

Figure S2:

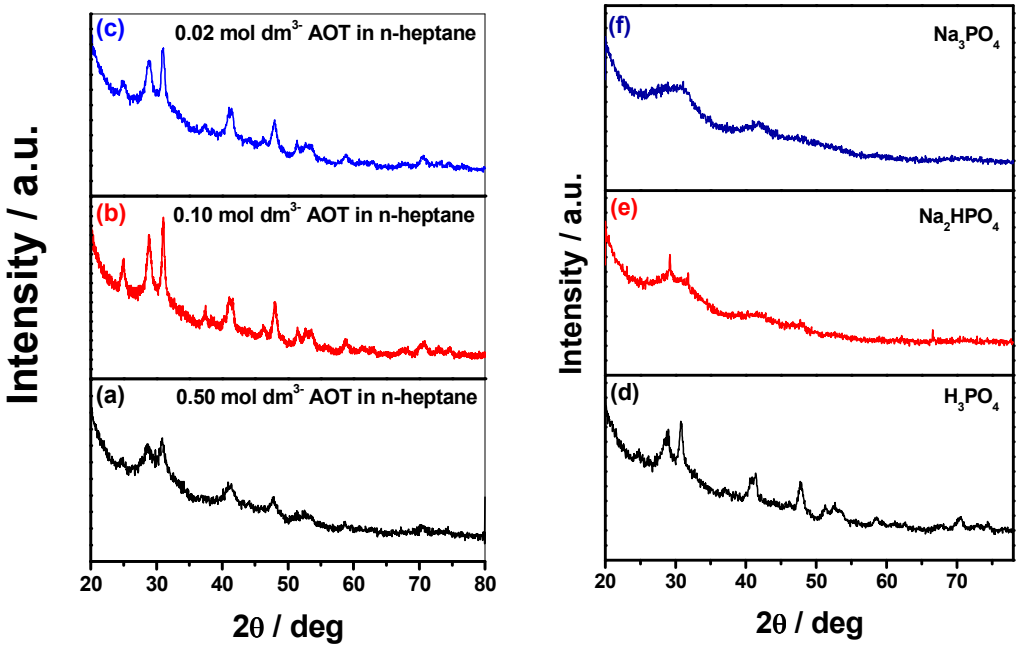

Figure S2: XRD pattern of LAP synthesized at different surfactant concentrations (a) 0.50 mol dm^{-3}; (b) 0.50 mol dm^{-3}; (c) 0.02 mol dm^{-3}; at different phosphate sources (d) H_3PO_4; (e) Na_2HPO_4; (f) Na_3PO_4; in all cases, $\omega = 25$, [AOT] = 0.1 mol dm^{-3}; $[La^{3+}]$ = 0.5 mol dm^{-3}; $[Ce^{3+}]$ = 0.5 mol dm^{-3}; $[Tb^{3+}]$ = 0.5 mol dm^{-3}; all PO_4 precursors have concentration 0.5 mol dm^{-3}.

Figure S3:

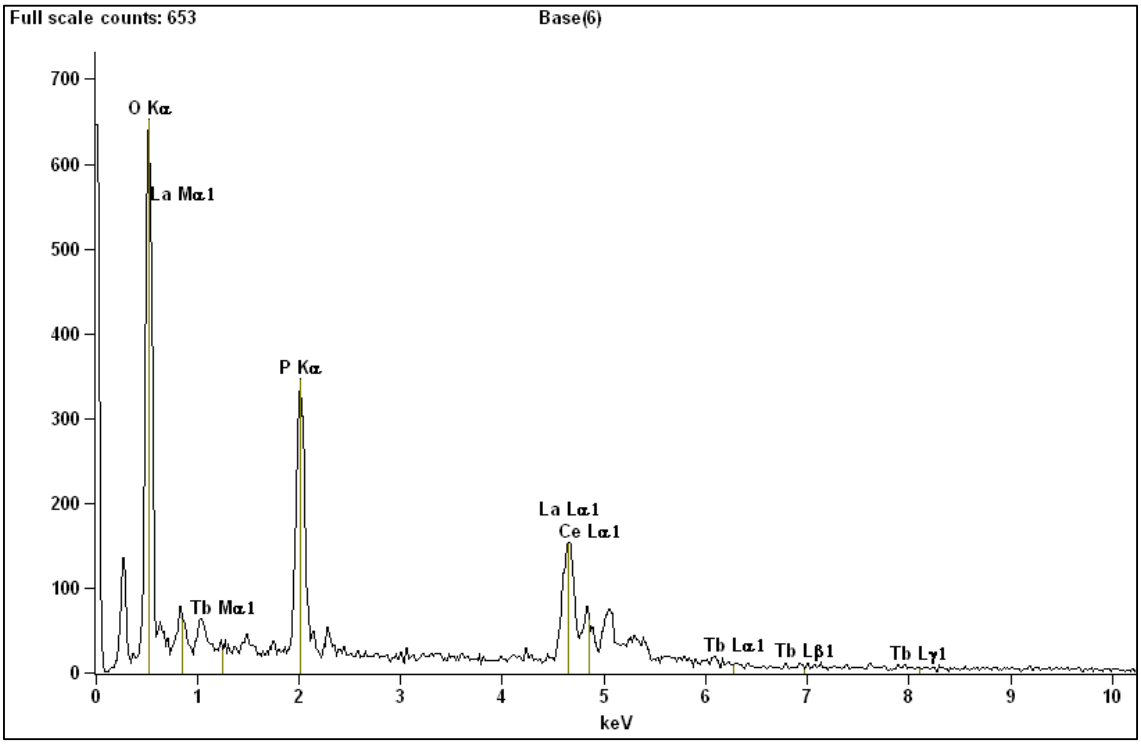

Figure S3: Energy dispersive X-Ray spectrum of $LaPO_4:Ce^{3+},Tb^{3+}$ prepared in AOT/n-heptane reverse micelles at $\omega = 25$.

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Figure S4:

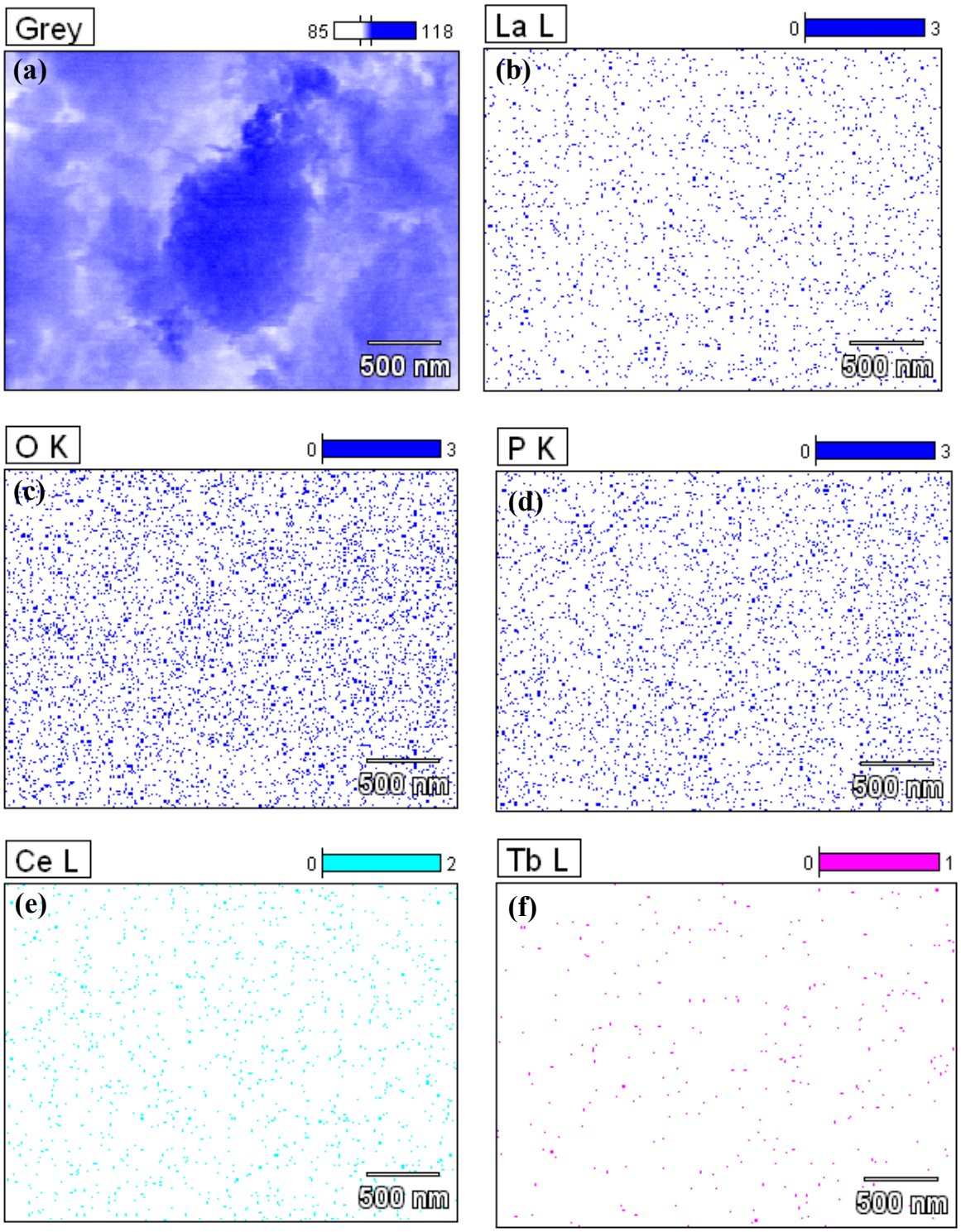

Figure S4: Elemental mapping of the prepared $LaPO_4:Ce^{3+},Tb^{3+}$ nanomaterials confirming elemental composition of the desired material.

Figure S5:

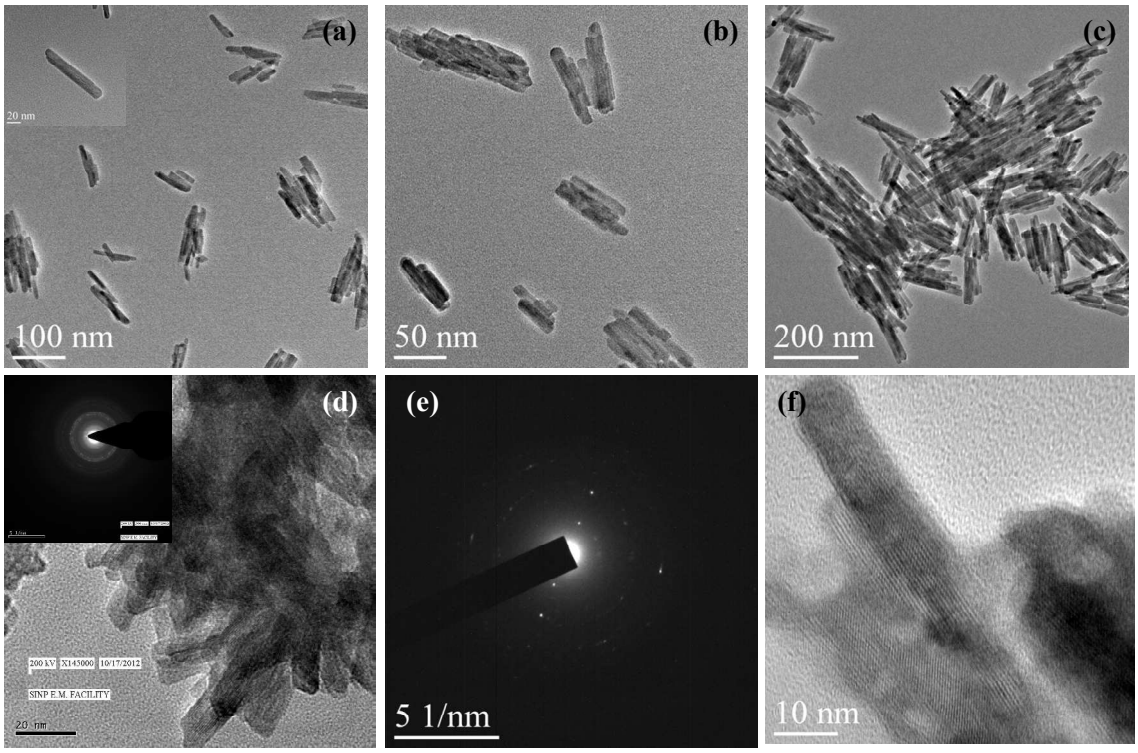

Figure S5: TEM images of LAP:Ce^{3+},Tb^{3+} particles synthesized in (a) n-hexane (Inset: image of a single particle); (b) n-octane; (c) n-decane; (d) at 0.5 mol dm^{-3} AOT concentration (Inset: illustrate corresponding SAED image); (e) SAED image of the particles synthesized in AOT/n-octane RMs; (f) HRTEM image of the LAP:Ce^{3+},Tb^{3+} synthesized in AOT/n-decane RMs.

Figure S6:

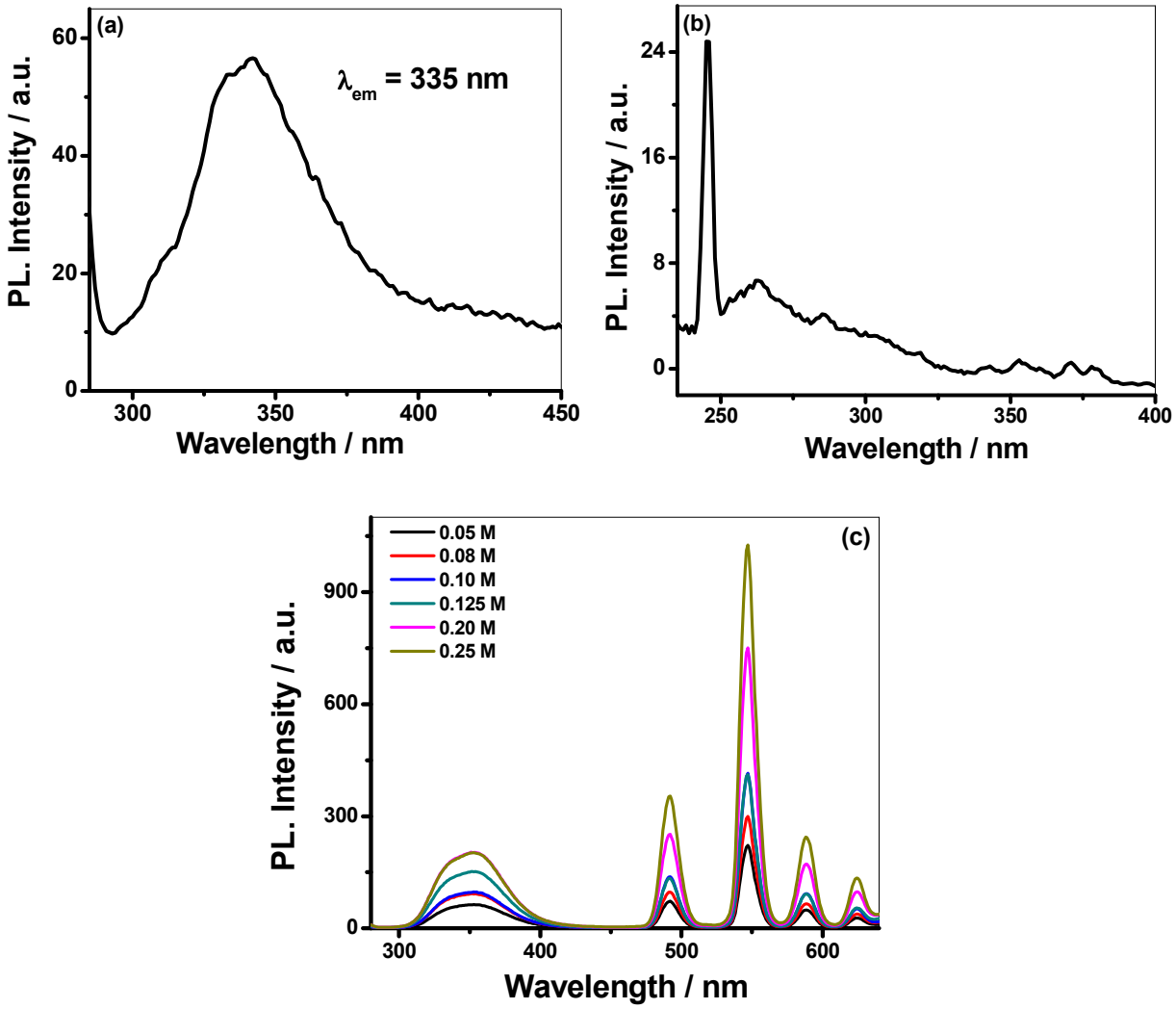

Figure S6: Photoluminescence spectra of (a) undoped $LaPO_4$; (b) excitation spectra of $LaPO_4:Tb^{3+}$ (λ_{em} = 544 nm); (c) $LaPO_4:Ce^{3+},Tb^{3+}$ with increasing La^{3+} concentration; all spectra were taken at ω = 25, AOT/n-heptane RMs, $[Ce^{3+}]$ = 0.5 mol dm^{-3}; $[Tb^{3+}]$ = 0.5 mol dm^{-3}; $[H_2PO_4^-]$ = 0.5 mol dm^{-3}.

Figure S7:

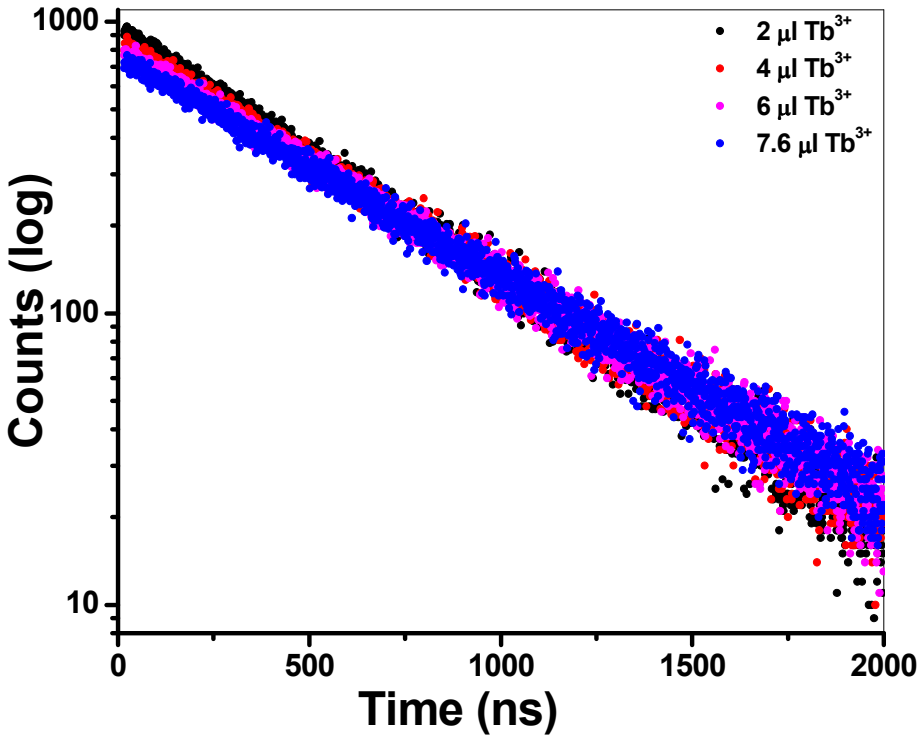

Figure S7: Time resolved decay study reveals gradual increase of Tb^{3+} life time with increasing Tb^{3+} concentration, therefore confirm energy transfer between Ce^{3+} and Tb^{3+}.