Electronic supplementary information (ESI)

Hybrid nanomaterials YVO_4:Eu/Fe_3O_4 for optical imaging and hyperthermia in cancer cells

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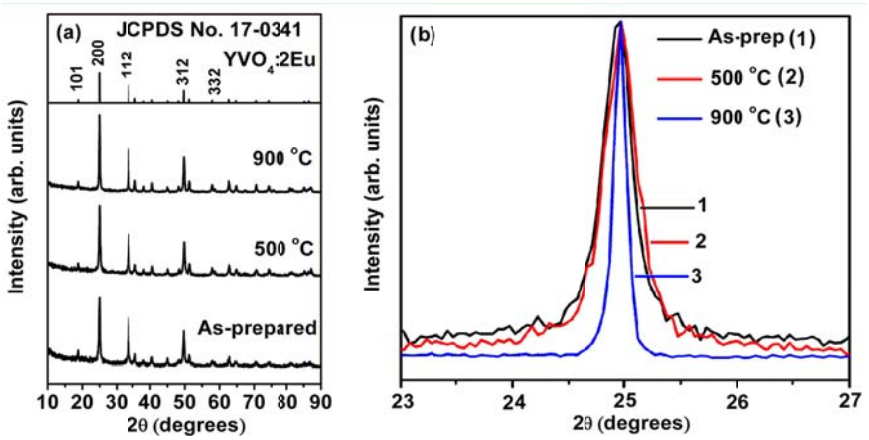

Fig. S1 (a) XRD patterns of YVO_4:Eu (2 at.%) nanoparticles prepared at different annealing temperatures (as-prepared, 500 and 900 °C), and (b) their expansion in $2\theta = 23\text{-}27^{o}$.

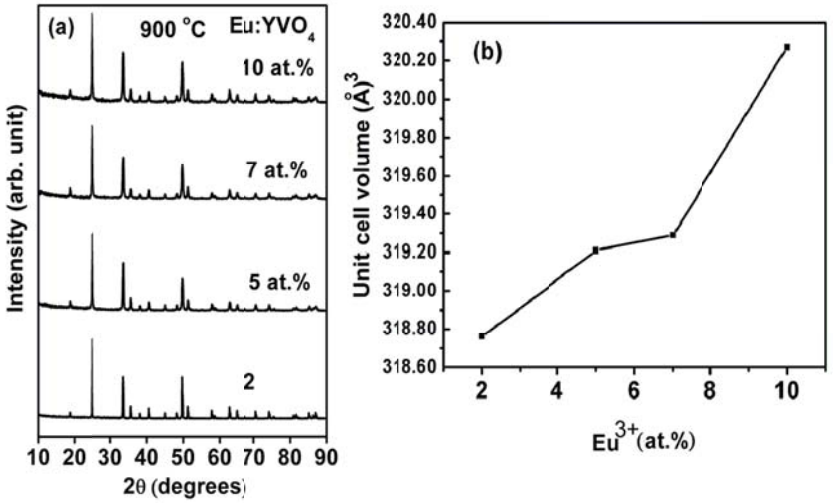

Fig. S2 (a) XRD patterns of 900 ^{o}C annealed samples of YVO_4:Eu at different doping concentrations of Eu^{3+} (2, 5, 7 and 10 at. %) and (b) their unit cell volume.

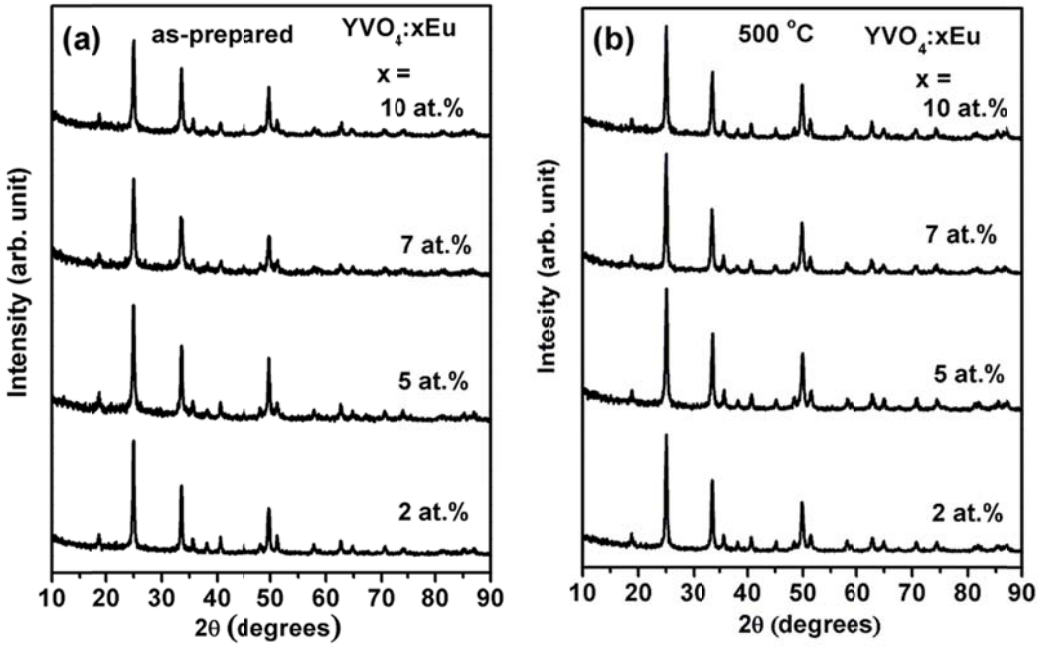

Fig. S3 XRD patterns of YVO_4:Eu nanoparticles for (a) as-prepared and (b) 500 ^oC at different doping concentrations of Eu^{3+} (2, 5, 7 and 10 at. %).

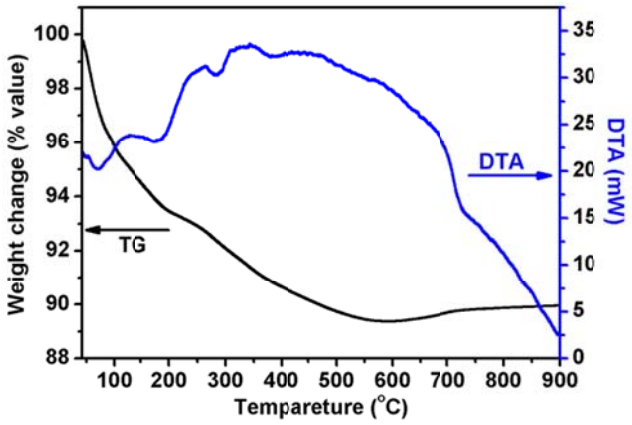

Fig. S4 TGA-DTA curves of 10 at.% Eu^{3+} ion doped YVO_4 nanoparticles. Apparent rise in weight above 600 ^oC is due to artifact.

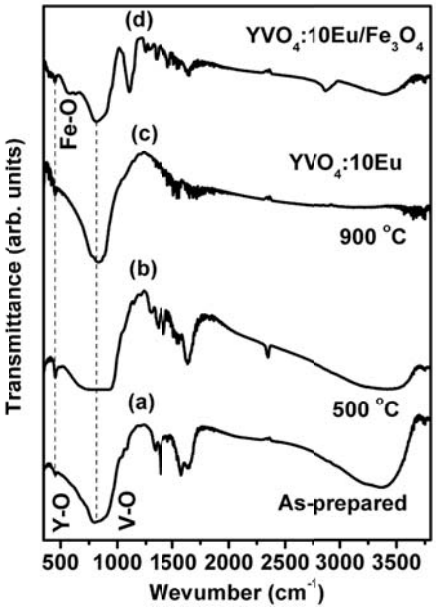

Fig. S5 FTIR spectra of 10 at.% Eu^{3+} doped YVO_4 at different annealing temperatues (a) as-prepared, (b) 500 and (c) 900 ^oC along with (d) as-prepared YVO_4:10Eu/Fe_3O_4hybrid.

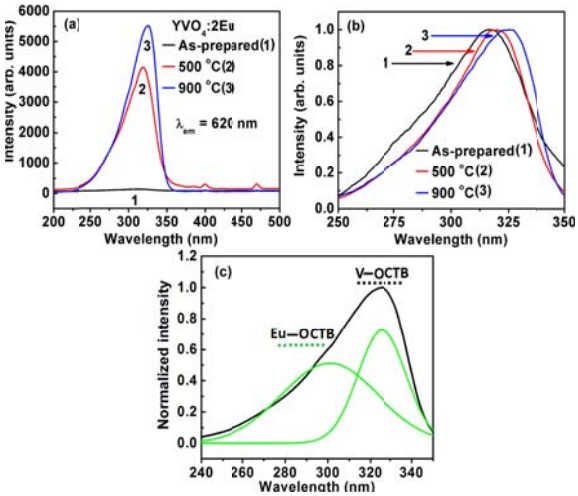

Fig. S6 (a) Excitation spectra of as-prepared, 500 and 900 °C annealed samples of 2 at.% Eu^{3+} doped YVO_4 monitored at emission wavelength of 620 nm and (b) their expansion in 250-350 nm. (c) Deconvolution of as-prepared data in 250-350 nm using Gaussian fit. The peaks corresponding to Eu-O and V-O CTB are distinguished.

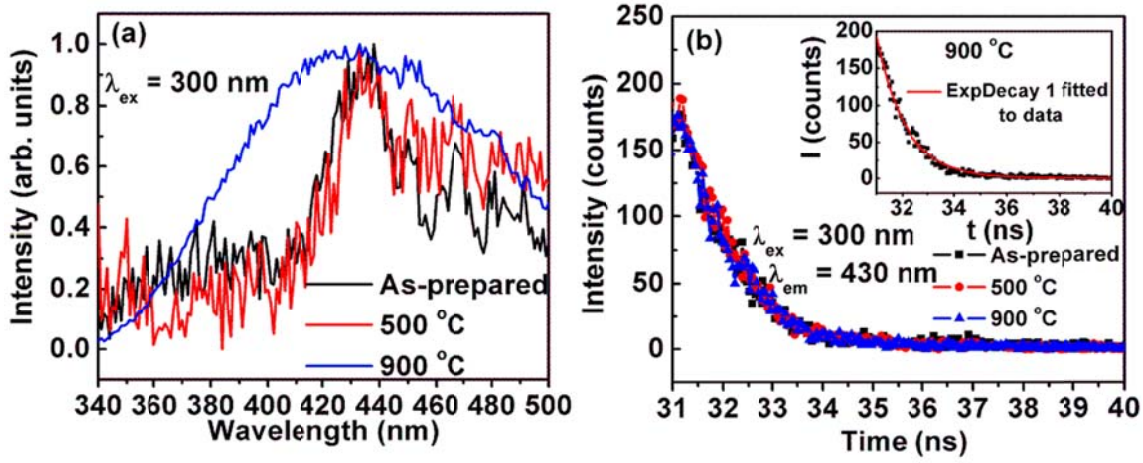

Fig. S7 (a) Normalized emission spectra of pure YVO_4 (as-prepared, 500 and 900 ^oC annealing samples) after excitation at 300 nm. (b) Decay curves of pure YVO_4 (as-prepared, 500 and 900 ^oC annealing samples) after excitation at 300 and 430 nm emission wavelength and inset shows the fitting to decay data of 900 ^oC annealed sample using monoexponential equation.

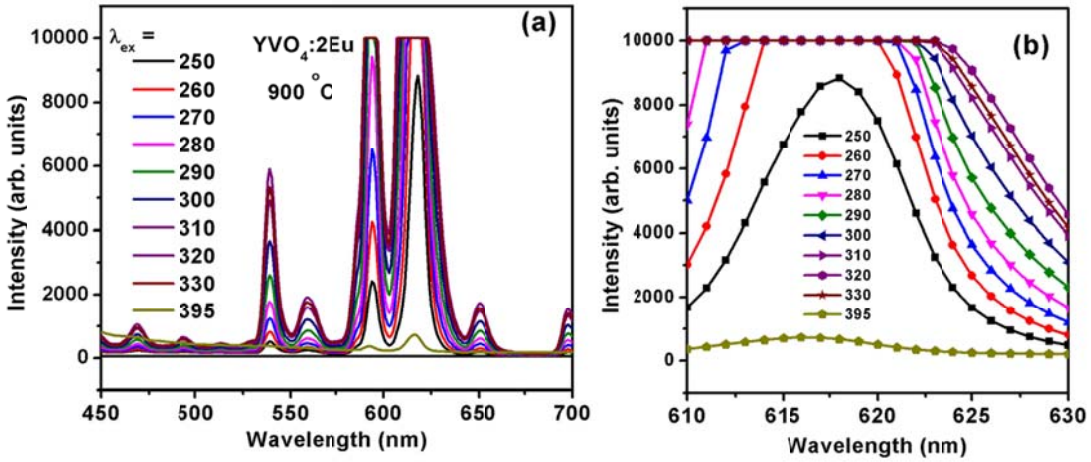

Fig. S8 (a) Emission spectra of 900 °C annealed samples of 2 at.% of Eu^{3+} doped YVO_4 after excitation at different wavelengths and (b) their corresponding expansions in 610-630 nm fixed at 5 nm, slit with.

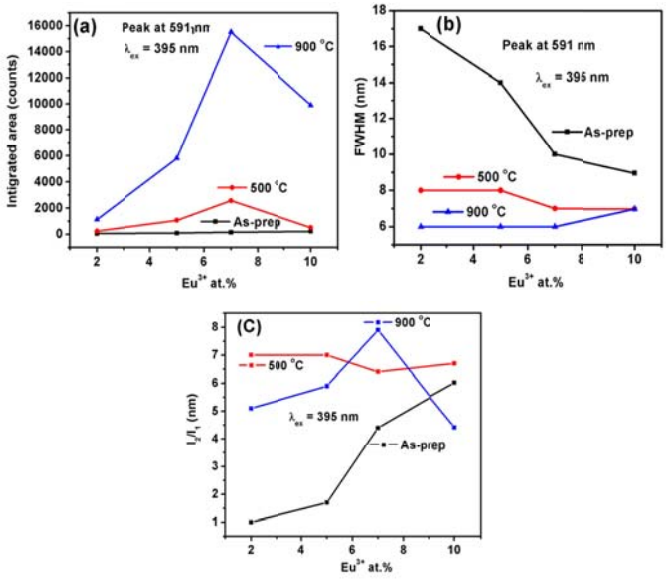

Fig. S9 (a) Integrated area, (b) FWHM under $^5D_0$-$^7F_2$ transition and (c) corresponding asymmetric ratio of $^5D_0 \rightarrow {}^7F_2/{}^5D_0 \rightarrow {}^7F_1$ transitions as a function of Eu^{3+} ion concentration and at different annealing temperature excited at 395 nm excitation.

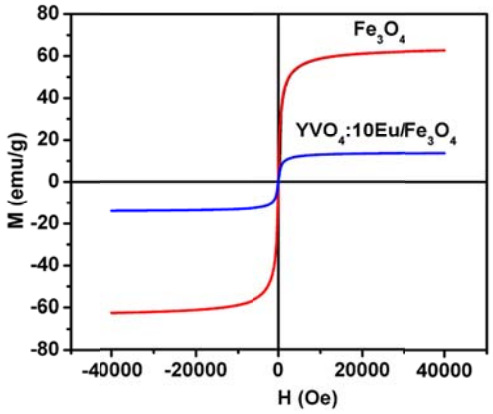

Fig. S10 Magnetization (M) vs. applied magnetic field (H) for pure Fe_3O_4 and YVO_4:10Eu/ Fe_3O_4 hybrid.