Electronic Supplementary Information (ESI)

Facile synthesis and luminescence properties of monodisperse lutetium oxide nanostructures with adjustable particle sizes

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Experimental section

Chemicals and materials

The rare earth oxides including Lu_2O_3, Eu_2O_3, Yb_2O_3, Er_2O_3, Ho_2O_3, and Tb_4O_7 with high purity (99.99%) were purchased from Sinopharm Chemical Reagent Co. Ltd, China. The above rare earth oxides were dissolved in dilute HNO_3 solution and then removed the residual HNO_3 by heating and evaporation to form clear solution of the corresponding rare earth nitrates. All other chemicals were analytical grade reagents and used directly without further purification.

Characterizations

X-ray powder diffraction patterns (XRD) were examined on D8 Advance diffractometer diffractometer at a scan rate of 13°/min in the 2θ range from 10° to 80° (Bruker). Fourier transform infrared spectroscopy (FT-IR) spectra were examined on a Perkin-Elmer 580B infrared spectrophotometer in the range of 4000–400 cm^{-1}. The morphology and composition was recorded using scanning electron microscope (SEM; JSM-7500F, JEOL). Thermogravimetric analysis and differential scanning calorimetry (TGA-DSC) data were recorded with a thermal analysis instrument (SDT 2960, TA Instruments, New Castle, DE) at the heating rate of 10 °C min^{-1} in an air flow of 100 mL min^{-1}. The down-conversion (DC) and up-conversion (UC) luminescence spectra were obtained using a 150 W xenon lamp or 980 NIR laser as the excitation source and detected by Hitachi F-7000 fluorescence spectrometer from 400 to 900 nm. The photoluminescence decay curves and quantum yield were recorded by the FS5 spectrophotometer (Edinburgh) integrated steady-state transient fluorescence spectrometer. The life of the radiant energy level is estimated by fitting as an exponential function of the attenuation curve. The electroluminescence (EL) spectrum of the as-fabricated LED device was recorded on a high accuracy array rapid spectroradiometer equipped with an integrating sphere (illumia®Plus2, HalfMoon). All the measurements were performed at room temperature.

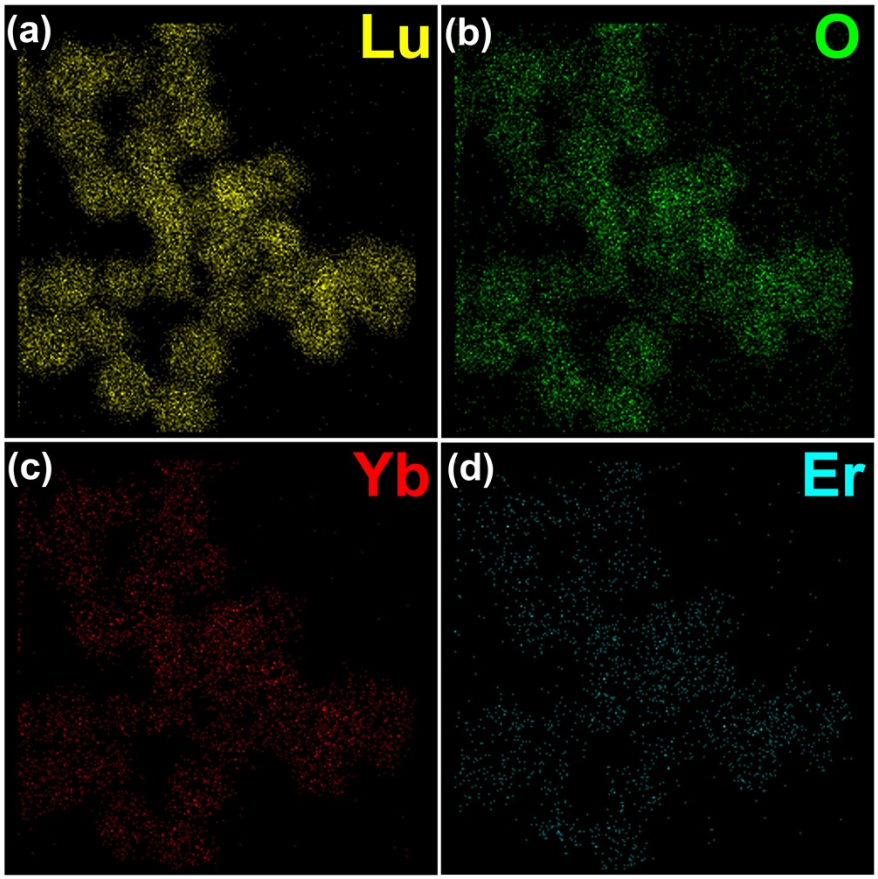

Fig. S1. EDX elemental mapping images for Lu, Yb, Er, and O in Lu_2O_3:Yb^{3+},Er^{3+} sample.

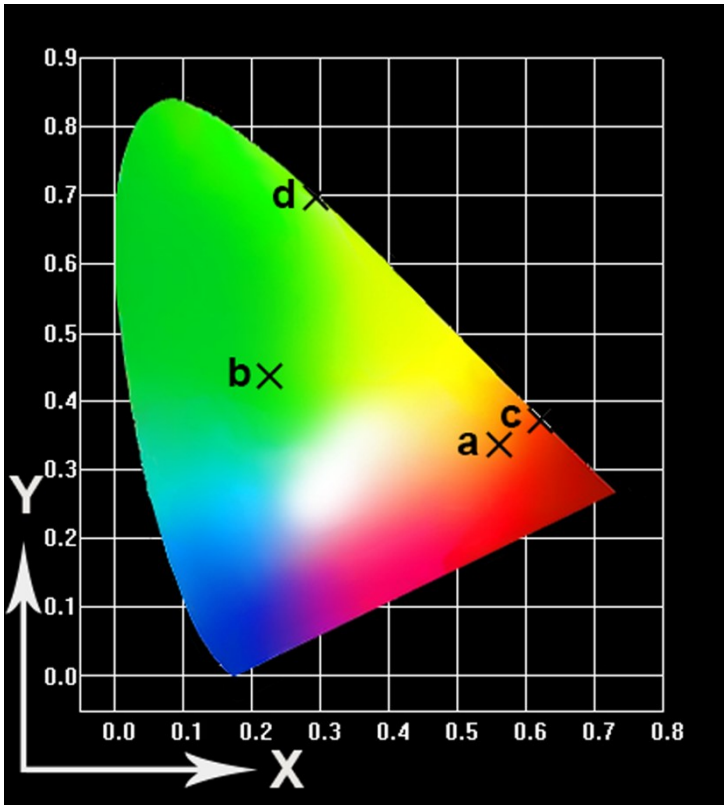

Fig. S2. CIE chromaticity diagram of (a) $Lu_2O_3:Eu^{3+}$, (b) $Lu(OH)CO_3:Tb^{3+}$, (c) $Lu_2O_3:Yb^{3+}$, Er^{3+}, and (d) $Lu_2O_3:Yb^{3+}$, Ho^{3+} samples.

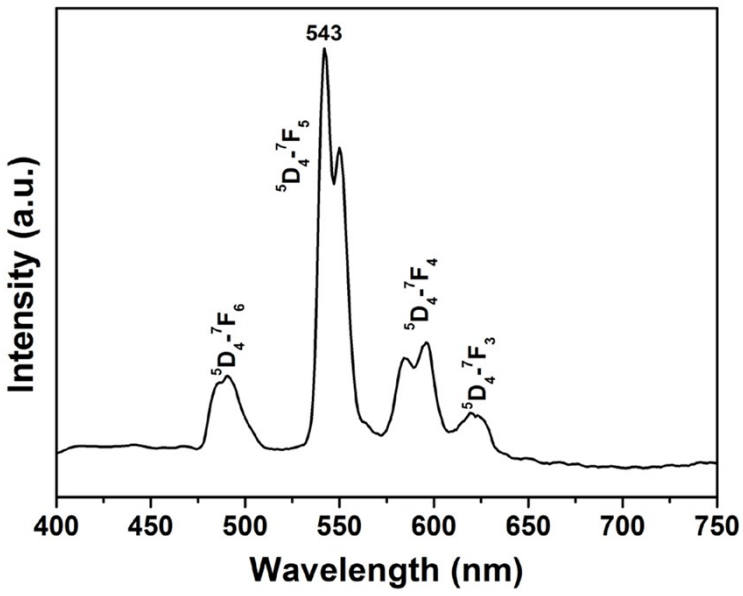

Fig. S3. PL emission spectra of 5mol%Tb^{3+}-doped sample calcined at 800 ^oC for 2h in an Ar atmosphere.

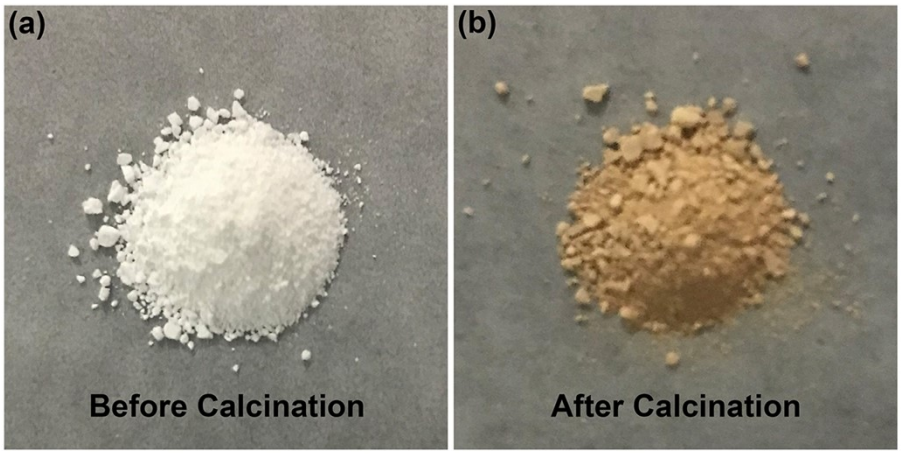

Fig. S4. The digital photos of the Tb doped samples (a) before and (b) after calcination at 800 °C for 2h in air.

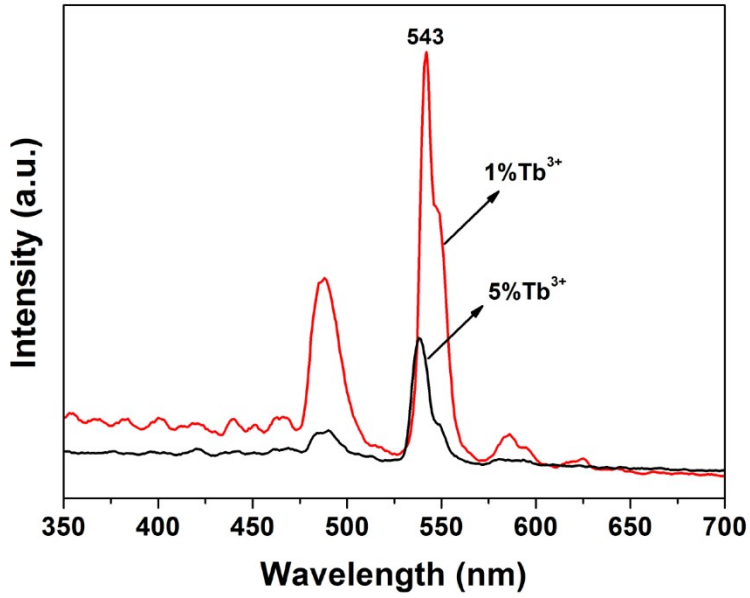

Fig. S5. PL emission spectra of Tb doped L17-800 samples with different doping concentrations.