Electronic Supplementary Material (ESI) for Dalton Transactions.

Supporting information

An intense NIR emission from $Ca_{14}Al_{10}Zn_6O_{35}:Mn^{4+},Yb^{3+}$ via energy transfer for solar spectral convertor

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Experimental Section

Synthesis. The $Ca_{14-x}Al_{9.85}Zn_6O_{35}$(CAZO):0.15$Mn^{4+}$,x$Yb^{3+}$(abbreviated as CAZO:$Mn^{4+}$,x$Yb^{3+}$; Mn^{2+} substitutes for Al^{3+}, Yb^{3+} substitutes for Ca^{2+}, where the x is mole percent) phosphors were synthesized by a high-temperature solid-state reaction. The constituent oxides or carbonates $CaCO_3$ (A. R.), ZnO (A. R.), Al_2O_3 (A. R.), $MnCO_3$ (A. R.) and Yb_2O_3(99.99%) were employed as the raw materials, which were mixed homogeneously by an agate mortar for 30 minutes, placed in a crucible with a lid, and then sintered in a tubular furnace at 1220°C for 4 h in air.

Characterization. The phase purity of all samples were identified by powder X-ray diffraction (XRD) analysis (Bruker AXS D8), with graphite monochromatized Cu Kα radiation (λ = 0.15405 nm) operating at 40 kV and 40 mA. The morphology and size of the as-prepared samples were inspected with a field emission scanning electron microscope equipped with an energy-dispersive spectrometer (EDS) (FE-SEM, S-4800, Hitachi, Japan). High-resolution transmission electron microscopic (HRTEM) images were recorded with a FEI Tecnai G2 S-Twin with a field-emission gun operating at 200 kV and a Gatan multiople CCD camera. Room-temperature photoluminescence (PL) spectra were measured on a Hitachi F-7000 luminescence spectrophotometer equipped with a 150 W xenon lamp as the excitation source. Absolute photoluminescence quantum yields (QYs) were measured by the absolute PL quantum yield measurement system (C9920-02, Hamamatsu Photonics K. K., Japan). The luminescence decay curves were obtained from a Lecroy Wave Runner 6100 digital oscilloscope (1GHz) using a tunable laser (pulse width = 4 ns, gate = 50 ns) as the excitation source (Continuum Sunlite OPO).

Figure S1

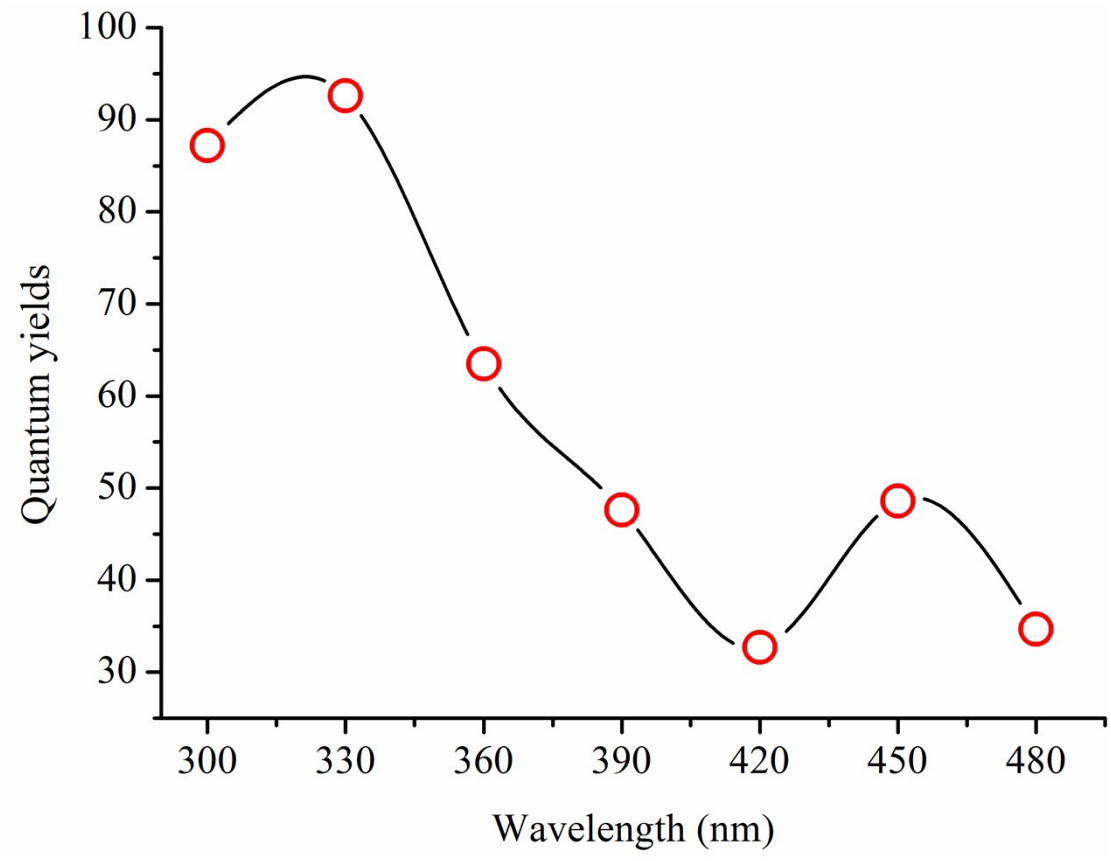

Figure S1.Absolute quantum yields of the $Ca_{14}Al_{10}Zn_6O_{35}:Mn^{4+}$ excited with different wavelength.

Figure S2

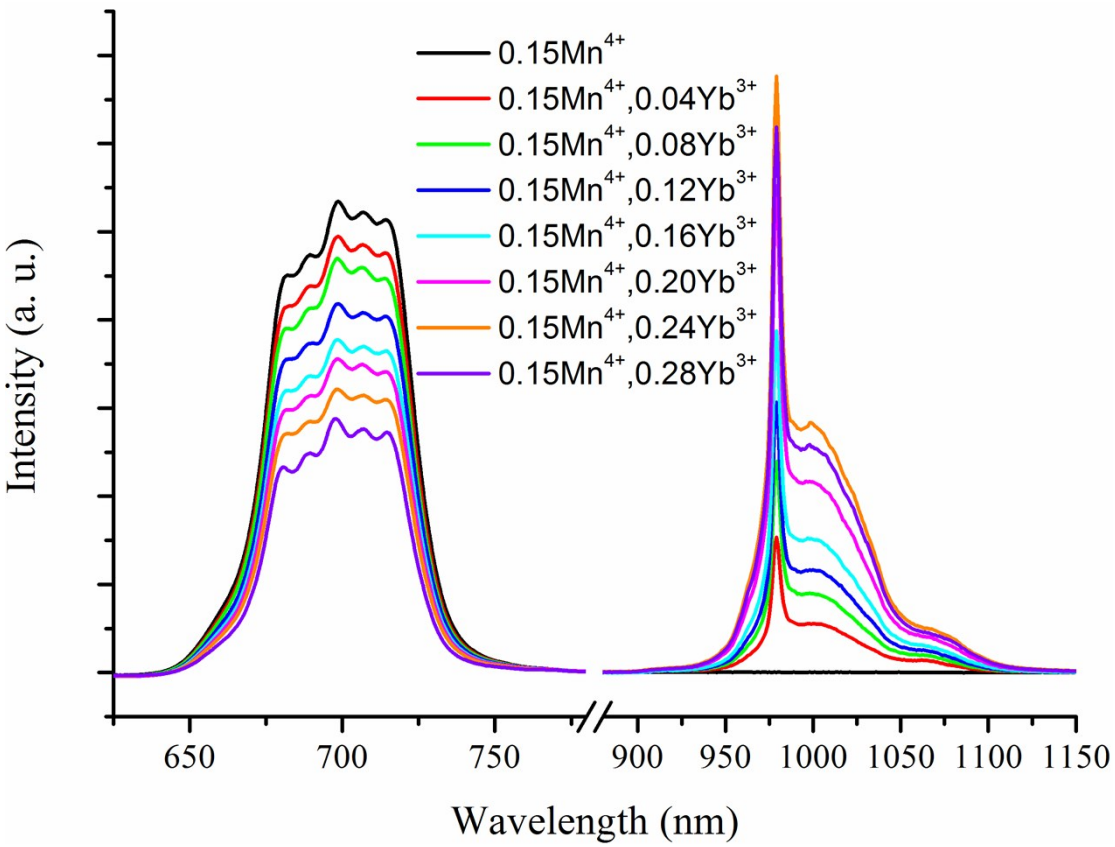

Figure S2. PL spectra of CAZO:Mn^{4+},xYb^{3+} phosphors with different Yb^{3+} concentrations under the excitation at 460 nm.