Supplementary Information

Synthesis and characterization of Nd^{3+}:$NaGdF_4$ nanoparticles

1 to 5 at. % Nd^{3+}:$NaGdF_4$ nanoparticles were synthesized by a hydrothermal method. 0.70 g of NaOH (Prolabo, 97%) and malonic acid (Aldrich, 99%) were dissolved in 50 ml of water until the solution became transparent. After that, NaF (Aldrich, 99%) was added and mixed during 15 min. At the same time, stoichiometric amounts of Gd_2O_3 and Nd_2O_3 (Aldrich, 99.9%) were dissolved with the minimum volume of HNO_3 (Labkem, 65%). The solution was maintained at 100 ºC until the liquid was completely evaporated and finally we added this nitrates to the solution previously obtained. The solution obtained was located in a 66.6 ml sealed Teflon vessel, and heated at 200 ºC for 12 hrs. After that, the reactor was cooled at room temperature. Finally, the solution was centrifuged and the supernatant removed, followed of washing with distilled water twice and dry the nanoparticles at 80 ºC for 8 hrs.

Figure S1(a) and (b) show typical TEM images of the Nd^{3+}:$NaGdF_4$ nanoparticles obtained. Figure S1(c) shows the XRD patterns obtained, confirming that the nanoparticles correspond to the β-phase, crystallizing in the hexagonal system, with space group P6, as evidenced by the comparison to the JCPDS 28-1192 reference pattern. Finally, Figure S1(d) shows the comparison of the emission intensity of 5% Nd^{3+}:$NaGdF_4$ nanoparticles with that of 3% Nd^{3+}:$KGd(WO_4)_2$ obtained in an integrating sphere using the same pumping conditions. The spectra clearly shows that the intensity that can be achieved with Nd^{3+}:$NaGdF_4$ nanoparticles is substantially smaller than the one that can be achieved with Nd^{3+}:$KGd(WO_4)_2$ nanoparticles, possibly related to the high absorption cross-section of Nd^{3+} in the latter.

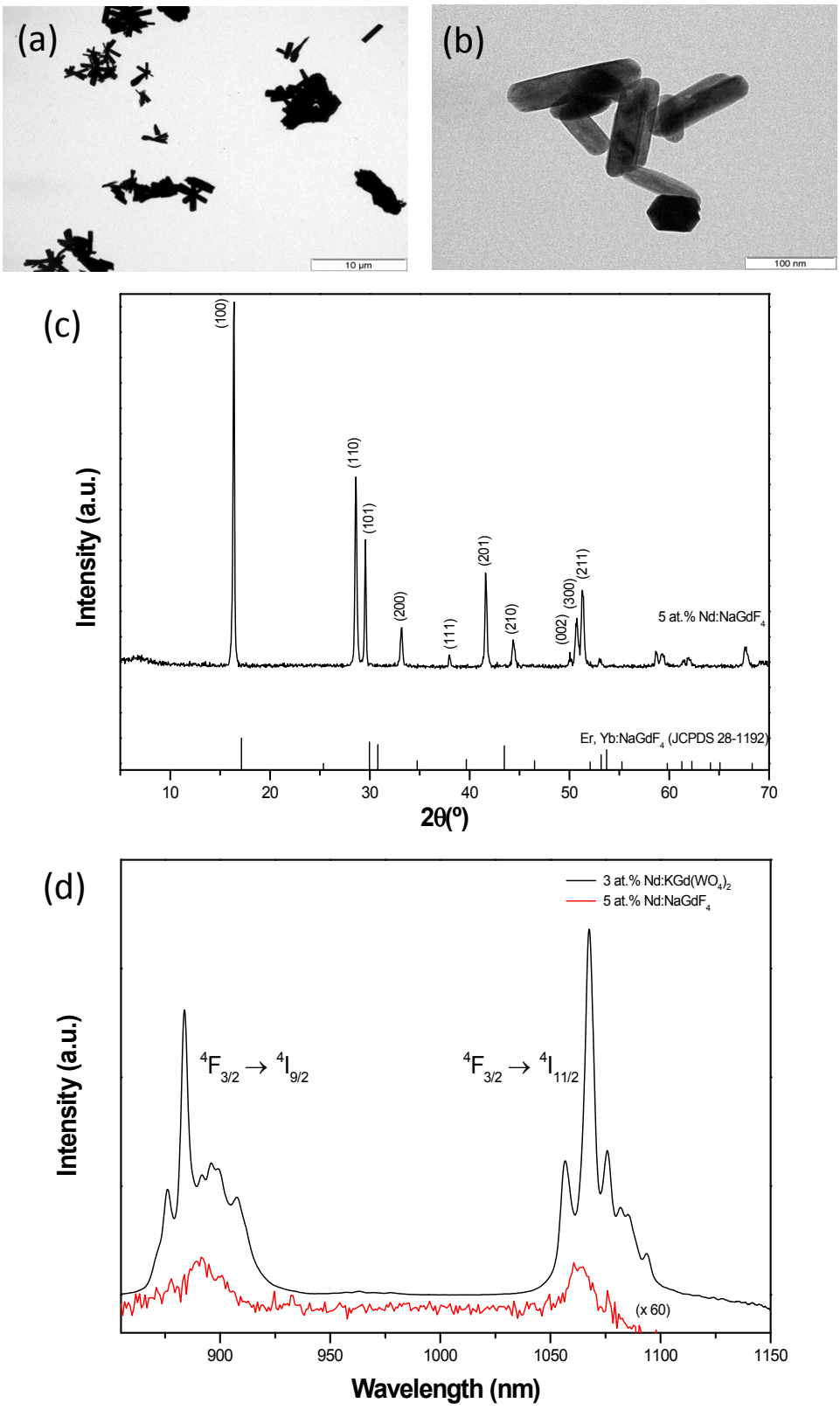

Figure S1. (a) and (b) TEM images of the Nd^{3+}:$NaGdF_4$ nanoparticles synthesized by a hydrothermal method. (c) XRD pattern of the nanoparticles obtained. The JCPDS 29-1192 reference pattern corresponding to the β-phase of Er,Yb:$NaYF_4$ has been added for comparison. (d) Comparison of the emission intensity of 5% Nd^{3+}:$NaGdF_4$ and 3% Nd:$KGd(WO_4)_2$ nanoparticles under the same excitation conditions.