Electronic Supplementary Material (ESI) for Dalton Transactions

Electronic Supplementary Information

Novel heterometal-organic complexes as first single source precursors for up-converting $NaY(Ln)F_4$ (Ln = Yb, Er, Tm) nanomaterials

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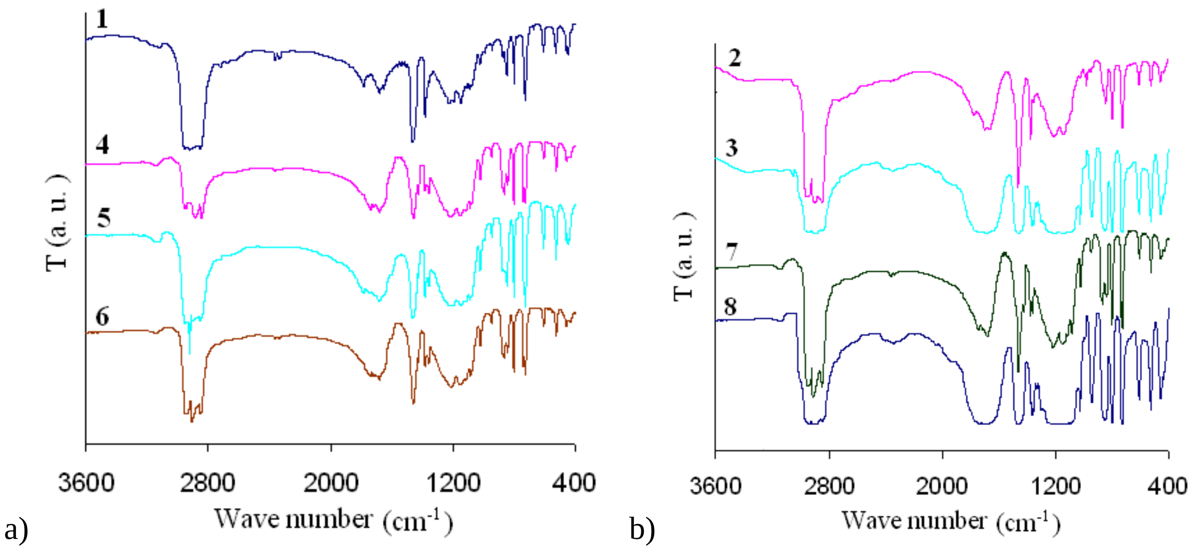


Fig. S1 FT-IR spectra of (a) diglyme complexes **1** & **4-6**, and (b) triglyme (**2**) and tetraglyme complexes (**3**, **7**, **8**).

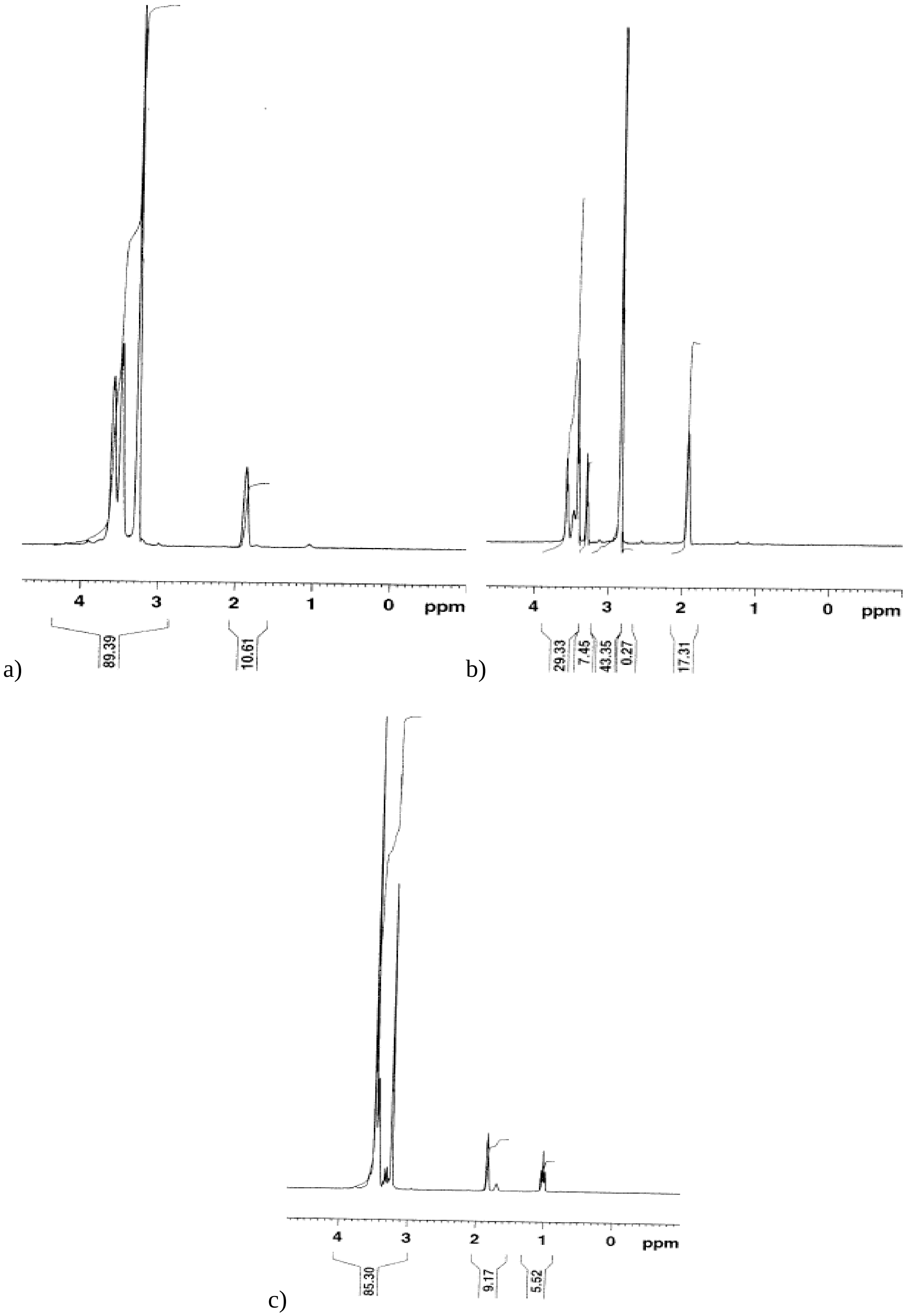
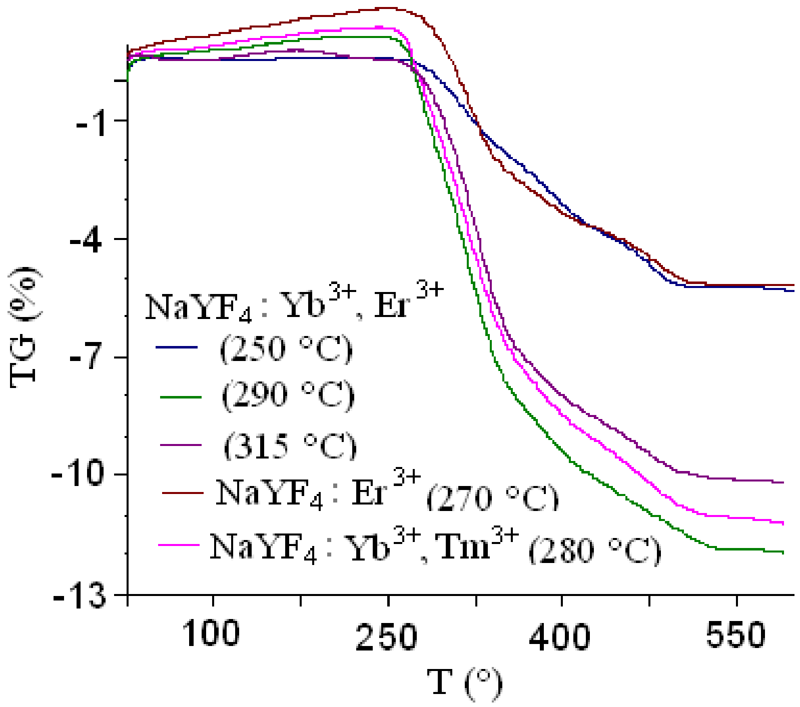
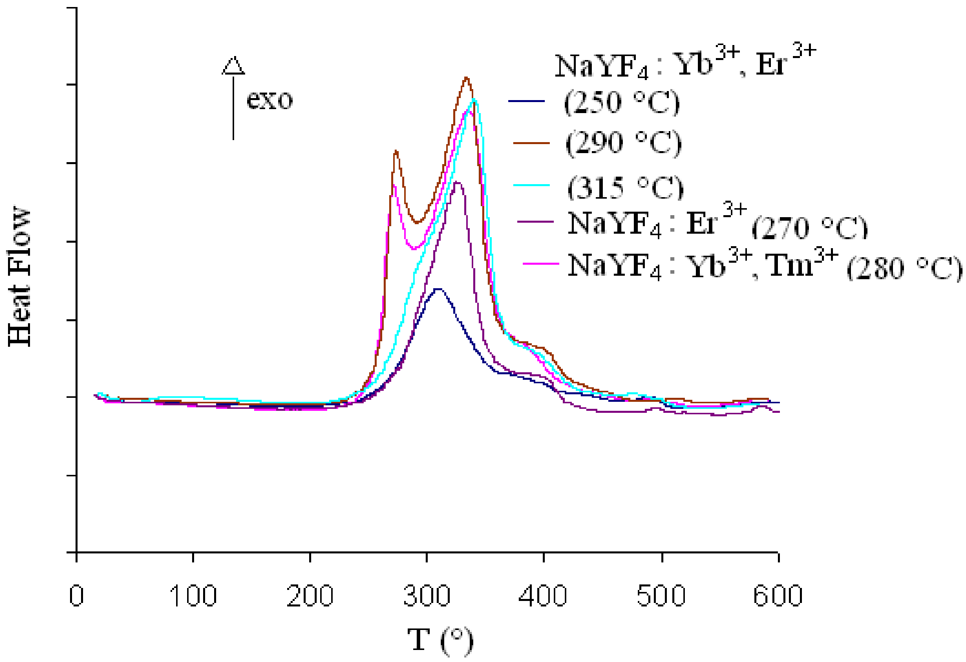


Fig. S2 ^{1}H NMR spectra of **1** (a), **2** (b) and **3** (c).

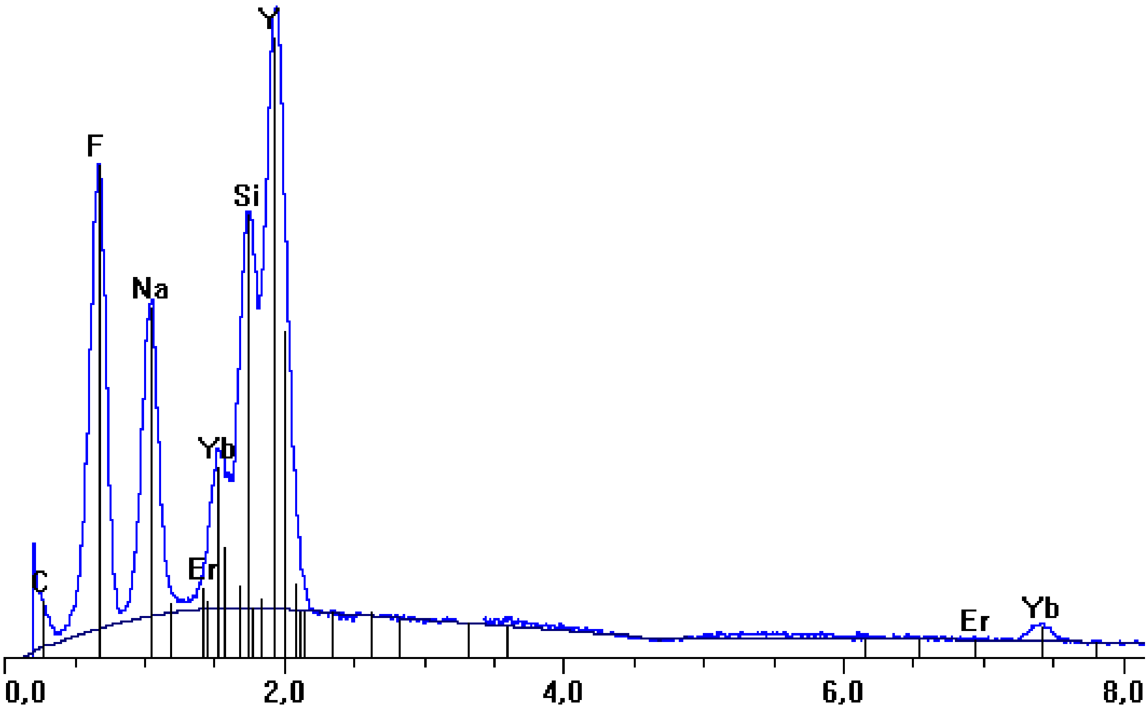


(a)

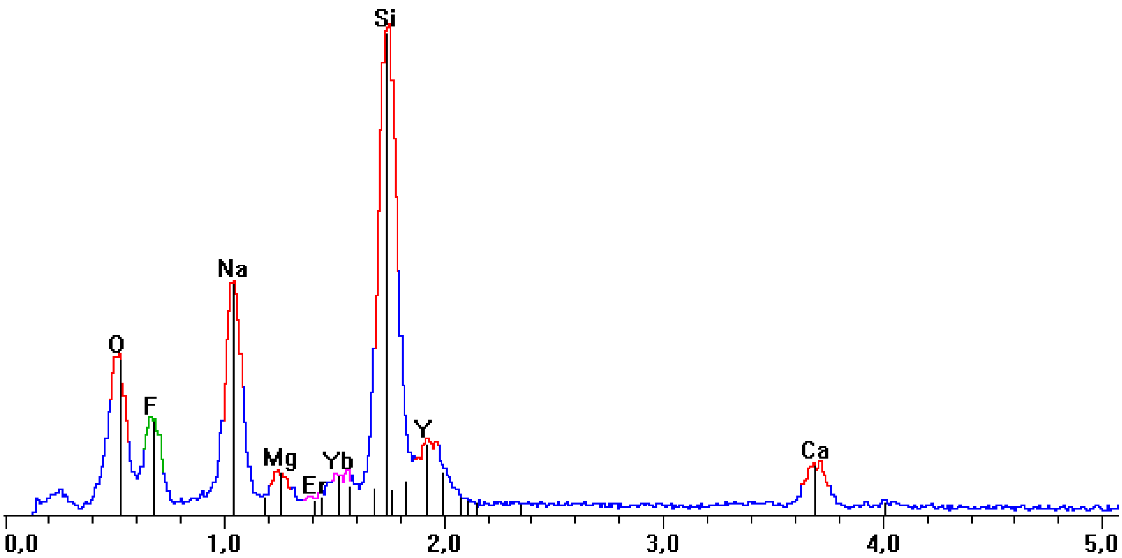


b)

Fig. S3 TGA (a) and DTA (b) of $NaYF_4$: Yb^{3+}, Er^{3+}/Tm^{3+} NCs obtained at different temperature.



a)



b)

Fig. S4 EDX analysis of the thin films obtained by spin-coating of the diglyme precursors **1**, **4** and **6**. Above: $NaYF_4$: Yb^{3+}, Er^{3+} films on Si wafer & calcined at 400 °C under nitrogen. Below: thin films consisting of the NaF and Y(Ln)OF phases on glass substrate (calcined at 400 °C in air).

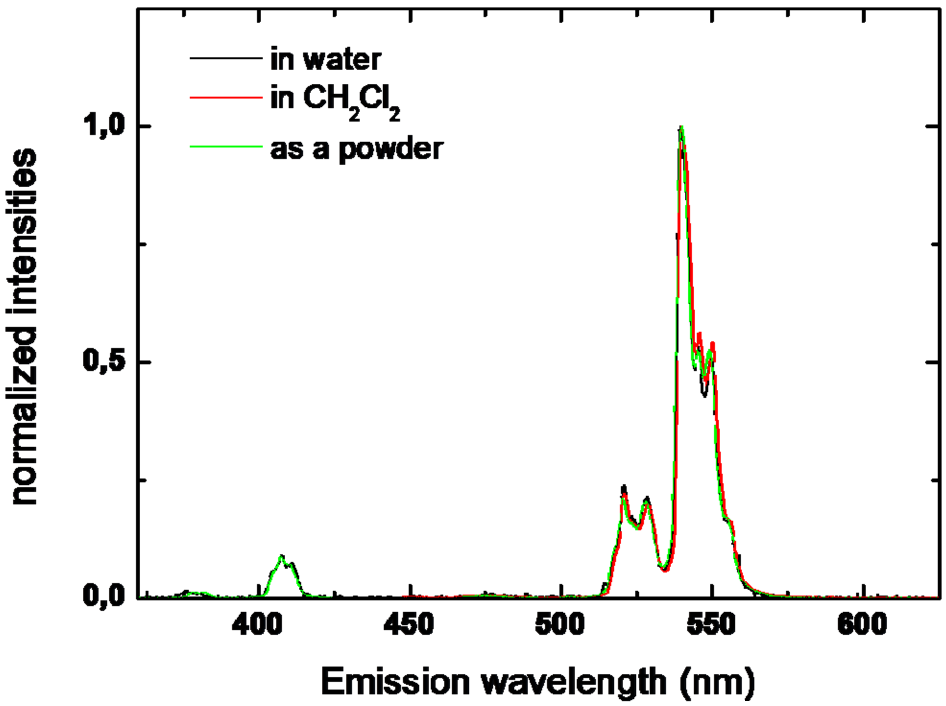


Fig. S5 Emission spectra of $NaYF_4$: Yb^{3+}, Er^{3+} NCs when taken in solid or solution states.

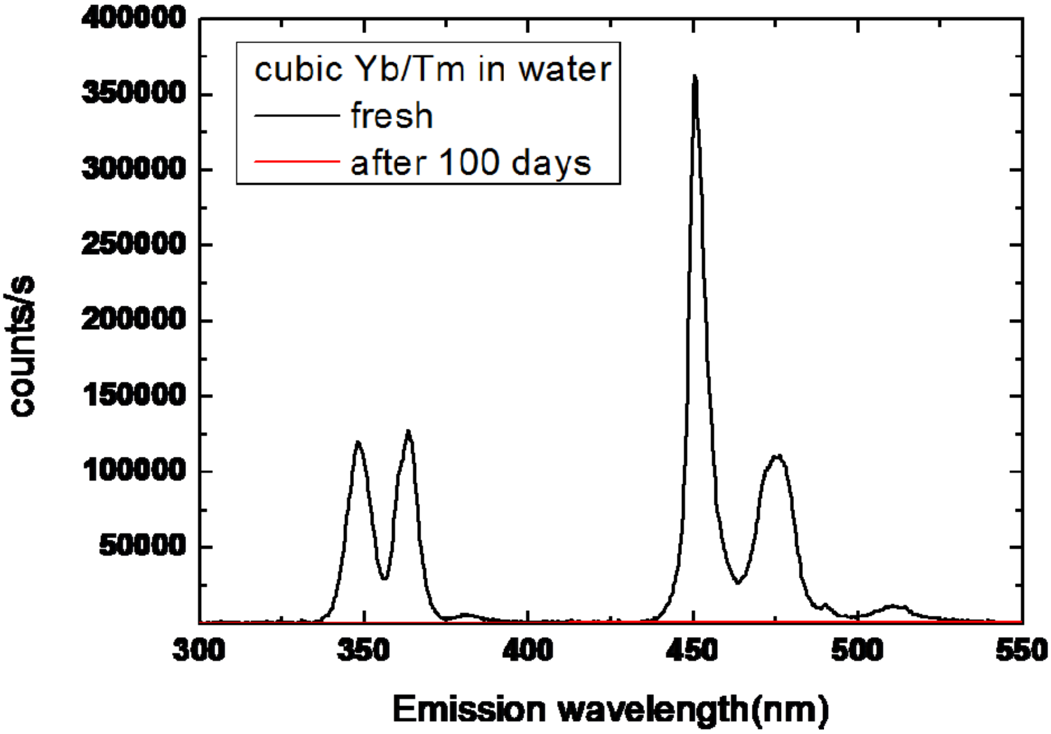
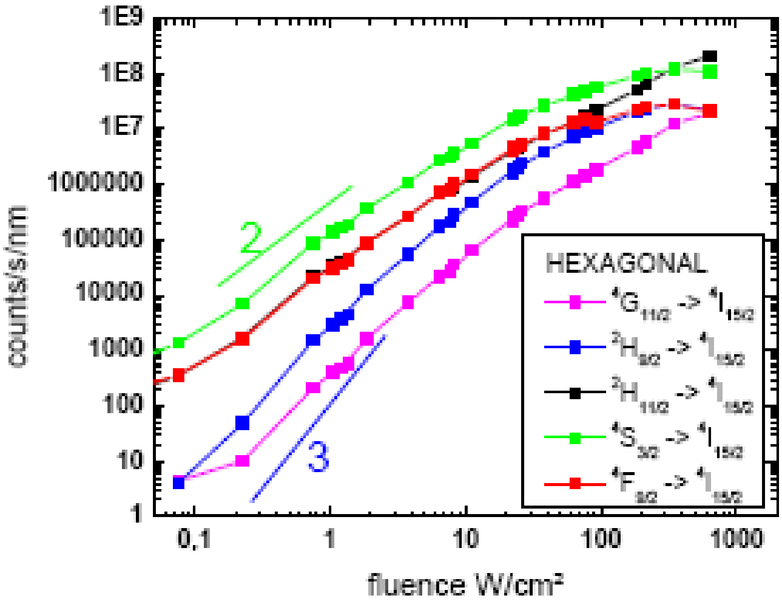
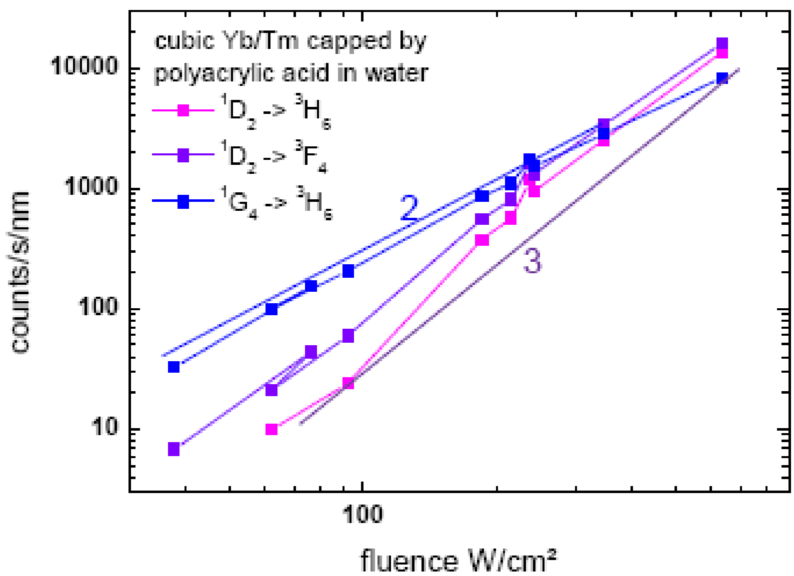


Fig. S6 Effect of aging of $NaYF_4$: 20% Yb^{3+}, 2% Tm^{3+} NCs.



a)



b)

Fig. S7: Evolution of the intensity of the difference bands with the excitation power: (a) hexagonal phase of $NaYF_4$: Yb^{3+}, Ln^{3+} NCs taken as a solid powder, and b) the cubic phase of $NaYF_4$: Yb^{3+}, Tm^{3+} NCs taken in water.