Synthesis and Mechanism Exploration of Europium-Doped LiYF$_4$
Micro-octahedron Phosphors with Multilevel Interiors

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Figure S1. SEM image and XRD pattern of resulting YF$_3$:Eu nanoparticles prepared
at a designed reaction temperature of 120 °C for 24 h. The standard data of
tetragonal-phase LiYF$_4$ (JCPDS file number 17-0874) as reference.
Figure S2. SEM image of resulting LiYF₄:Eu micro-particles prepared in absence of NH₄F in precursor solution.

Figure S3. SEM images of resulting LiYF₄:Eu micro-particles prepared with (a) and without (b) EDTA, respectively.
Figure S4. FTIR spectra of tetragonal LiYF$_4$:2% Eu samples with and without annealing at 500 °C for 2 h.

Figure S5 TG-DSC curves of LiYF$_4$:(2 mol% Eu) microcrystals prepared at a reaction temperature of 200 °C for 36 hrs.
Figure S6. Low magnification and high-magnification SEM images and XRD pattern of the resulting LiYF₄:Eu micro-particles prepared with untraditional hydrothermal route.
Figure S7. Schematic energy levels of Eu$^3+$ ions describing the luminescence of Eu$^3+$.

The dashed arrows denote multiphonon nonradiative transitions, the straight ones denote radiative transitions, and double-headed arrow denotes cross-relaxation.