## **Supporting Information**

## Tailored Up-conversion Luminescence Output of Al-modulated KYbF<sub>4</sub>: Er<sup>3+</sup> Nanocrystals for Low-Temperature Sensor

Zhenzhen Cui, a Lei Zhao, c Ting Wang, d Jiangyan Cao, a Yufang Qiao, a Chaojie Pi, a Zhaohui Fang, a Jianbei Qiu, a

Xuhui Xu,\*a and Xue Yu \*ab

<sup>a</sup> College of Materials Science and Engineering, Kunming University of Science and Technology, Kunming 650093,

China.

<sup>b</sup> School of Mechanical Engineering, Chengdu University, Chengdu 610000, China.

<sup>c</sup> School of Physics and Opto-Electronic Technology, Baoji University of Arts and Sciences, Baoji 721016, China.

<sup>d</sup> College of Materials and Chemistry & Chemical Engineering, Chengdu University of Technology, Chengdu

610059, China.

\* yuyu6593@126.com

\*xuxuh07@126.com



**Fig. S1** XPS spectrum of  $KYb_{0.58}Al_{0.4}F_4$ : 0.02  $Er^{3+}$  (*a*), and the corresponding high-resolution XPS spectrum of  $Al^{3+}$  2p (b).



*Fig. S2 EDS* spectra of *KYbF*<sub>4</sub>: 0.02  $Er^{3+}$  (*a*) and *KYb*<sub>0.58</sub>*Al*<sub>0.4</sub>*F*<sub>4</sub>: 0.02  $Er^{3+}$  (*b*), respectively.



**Fig. S3** Elemental mapping images of  $KYb_{0.58}Al_{0.4}F_4$ : 0.02  $Er^{3+}$ , and the corresponding detected elements.



**Fig. S4** TEM images of  $KYb_{0.98-x}Al_xF_4$ : 0.02  $Er^{3+}(x = 0.1, 0.2, 0.3, 0.4, and 0.5)$  UCNPs (a-f), respectively, and the inset is the corresponding particle size distribution diagram.