

## Supporting information

### Controlled synthesis and morphology dependent luminescence of $\text{Lu}_2\text{O}_2\text{S}:\text{Eu}^{3+}$ phosphors

Bowen Zhang, Haifeng Zou, Yunzhi Dai, Yanhua Song, Keyan Zheng, Xiuqing Zhou and  
Ye Sheng<sup>a</sup>

<sup>a</sup>College of chemistry, Jilin University, Changchun 130012, P. R. China.

\*Corresponding author: E-mail address: [shengye@jlu.edu.cn](mailto:shengye@jlu.edu.cn).

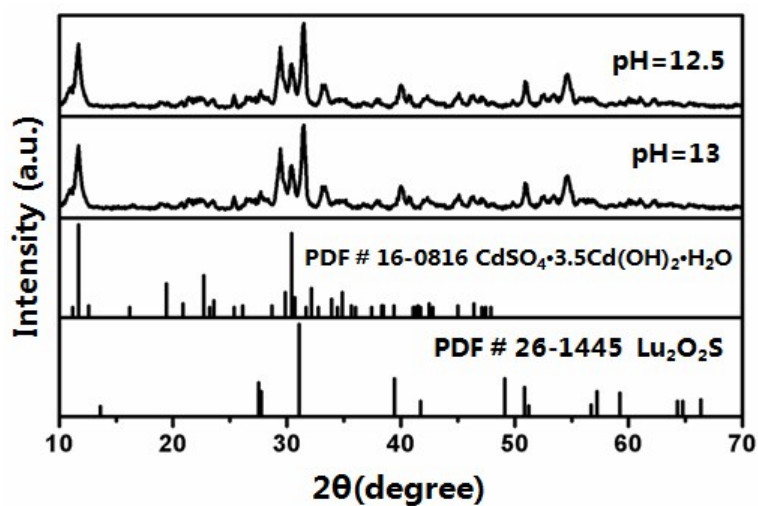


Fig. S1 XRD patterns of precursors obtained at pH = 12.5, pH = 13.0, the JCPDS cards No.16-0816 and No.26-1445.

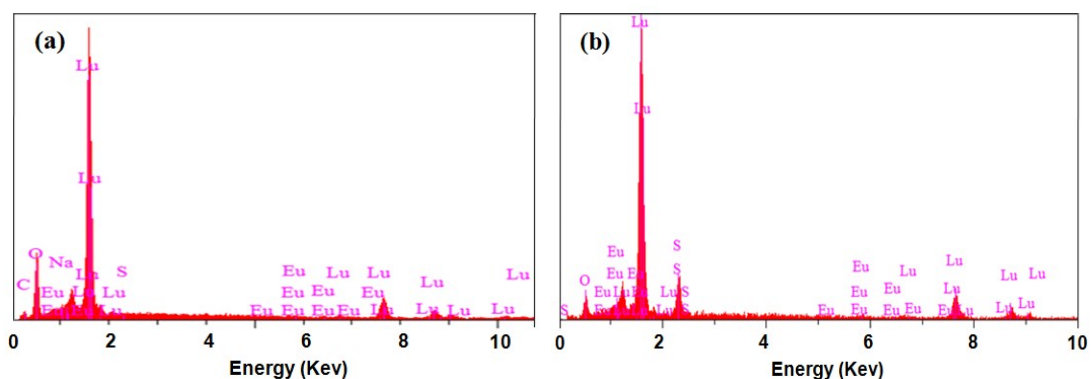


Fig. S2 EDS spectrum of precursors obtained at (a) pH = 12.5, (b) pH = 13.0.

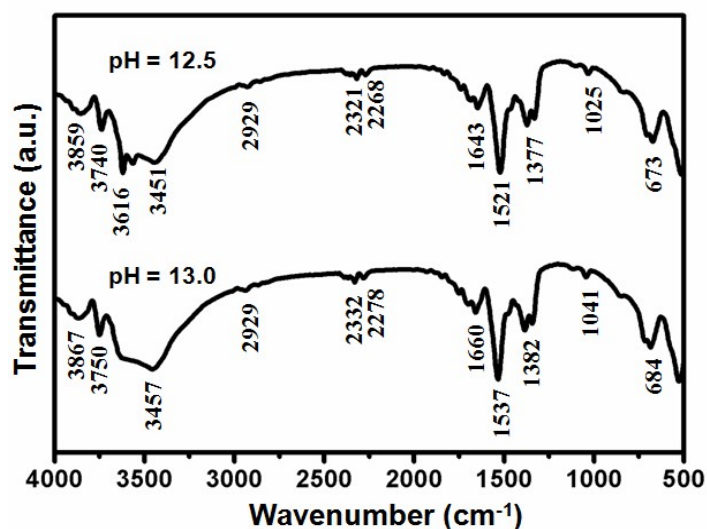


Fig. S3 FT-IR spectra of lutetium oxysulfide precursors prepared at pH = 12.5 and pH = 13.0.

The precursors obtained at pH = 12.5 and pH = 13.0 indicated a crystalline phase with good repeatability, but their crystal structures could not be indexed to any known lutetium compounds on the basis of the Joint Committee on Powder Diffraction Standards (JCPDS). We have conducted detailed XRD analyses to the unidentified crystalline phase. As shown in Fig. S1, the diffraction peaks near  $2\theta = 12$  and  $2\theta = 30$  can be indexed to  $\text{CdSO}_4 \cdot 3.5\text{Cd}(\text{OH})_2 \cdot \text{H}_2\text{O}$  (JCPDS No. 16-0816). However, still two major peaks could not be indexed to any known compounds on the basis of the JCPDS reference database. So, the EDS and FT-IR spectra were further performed to determine the composition and structure of the obtained precursors. On the basis of the EDS results (Fig. S2), it can be seen that the precursors obtained at pH = 12.5 and pH = 13.0 all confirm the presence of lutetium (Lu), oxygen (O), europium (Eu), carbon (C) and little sulfur (S) elements. Fig. S3 show the Infrared spectra of the precursors obtained at pH = 12.5 and pH = 13.0, except some excursion of the diffractions, both of them have an analogous result. Taking the precursors obtained at pH = 12.5 as an instance, the absorption band located from  $3450 \text{ cm}^{-1}$  to  $3859 \text{ cm}^{-1}$  is assigned to O–H groups from the adsorbed ethylene glycol and ethanol. The peak located at  $1643 \text{ cm}^{-1}$  is attributed to the C=O stretching, which red-shifts compared to that of pure PVP, indicating that the PVP is coordinated with lanthanide ions on the surface of the precursors<sup>1, 2</sup>. The blue shift of the C–N stretching vibration from  $1474$

cm<sup>-1</sup> in pure thiourea to 1521 cm<sup>-1</sup> implies that the sulfur atom is bonding with the metal ion in the precursors<sup>3</sup>. The absorption peak in the regions around 1377 cm<sup>-1</sup> may signify the presence of C–H bending vibration. The C=S stretching vibration at 1084 cm<sup>-1</sup> in pure thiourea is shift to 1025 cm<sup>-1</sup> which may be caused by the formation of a metal-sulfur bond<sup>4, 5</sup>. Finally, the peak located at 673 cm<sup>-1</sup> is attributed to the Lu–O stretching. A similar result has been obtained in sample at pH = 13.0. On the basis of the above analysis, the lutetium oxysulfide precursor can be presumed as an inorganic-organic complex compound which constitutes Lu–O, Lu–S, O–H, –CH<sub>2</sub>–, C=O, C–N and C=S bonds.

## References

1. J. Thirumalai, R. Chandramohan, S. Valanarasu, T. A. Vijayan, R. M. Somasundaram, T. Mahalingam and S. R. Srikumar, *Journal of Materials Science*, 2009, **44**, 3889-3899.
2. D. A. Long, *Journal of Raman Spectroscopy*, 2004, **35**, 905-905.
3. Z. Qi, Y. Zheng, G. Ning, Y. Jia, Q. Hui, W. Lv and H. You, *Crystengcomm*, 2012, **14**, 6659-6664.
4. H. N. Pandey, L. Mishra and V. J. Ram, *Transition Metal Chemistry*, 1978, **3**, 66-68.
5. A. Yamaguchi, R. B. Penland, S. Mizushima, T. J. Lane, C. Curran and J. V. Quagliano, *J.am.chem.soc*, 1958, **80**, 527-529.