

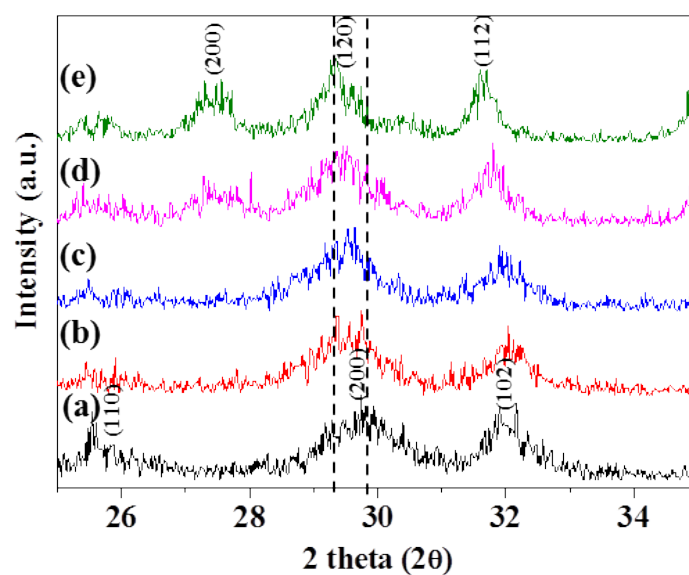
Electronic Supplementary information

## Solid-state phase transformation mechanism from hexagonal $\text{GdPO}_4:\text{Eu}^{3+}$ nanorods to the monoclinic nanoparticles

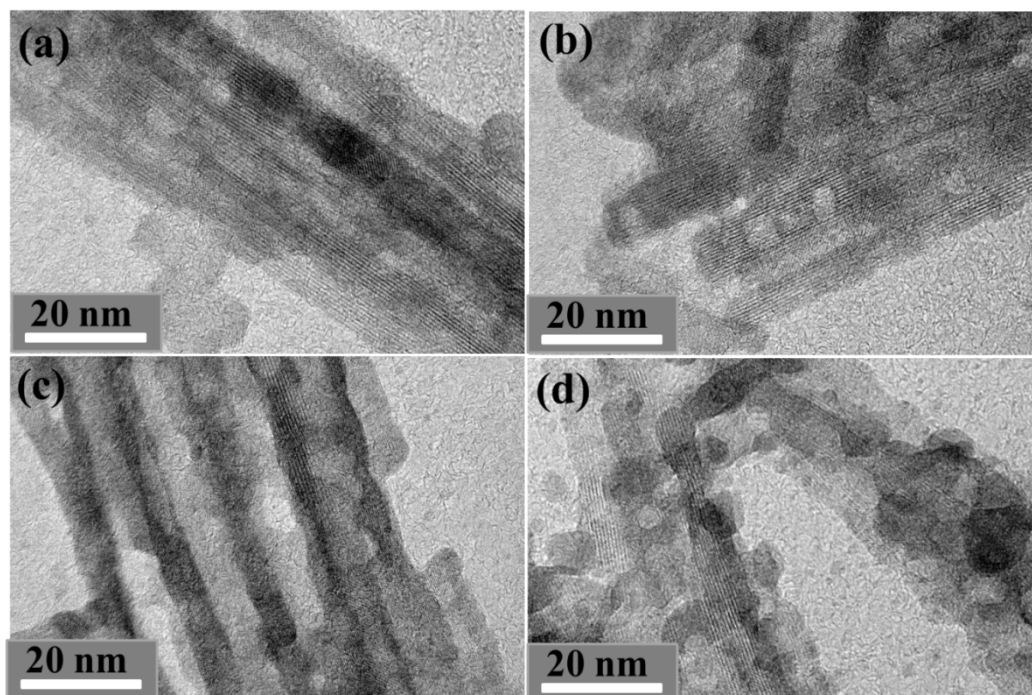
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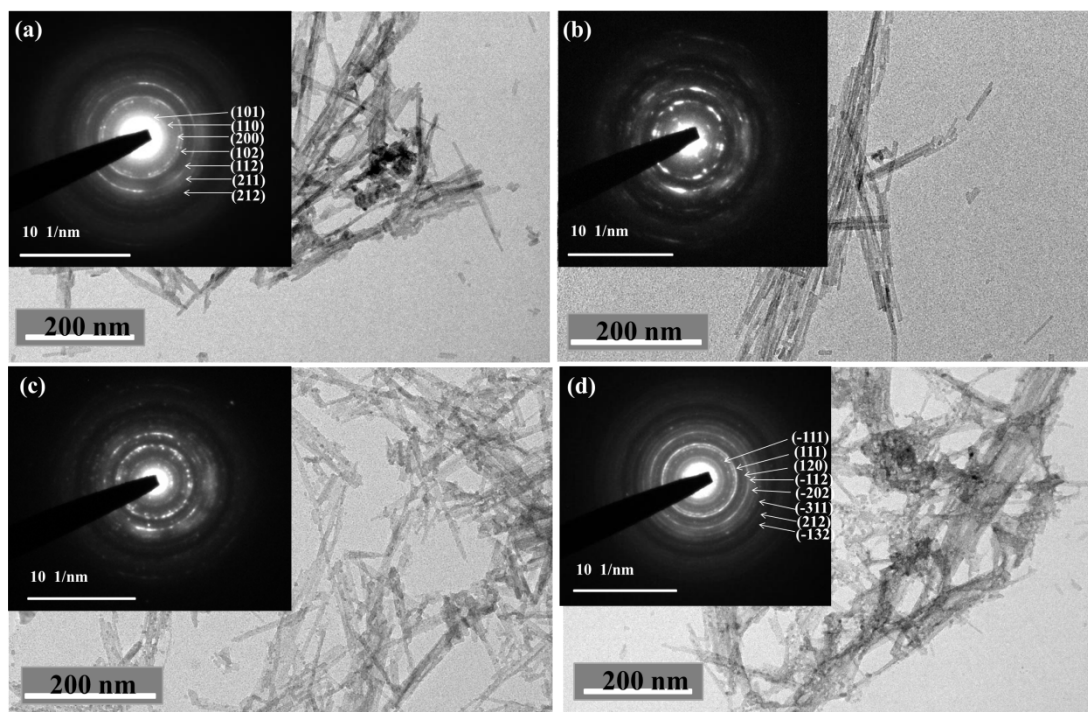
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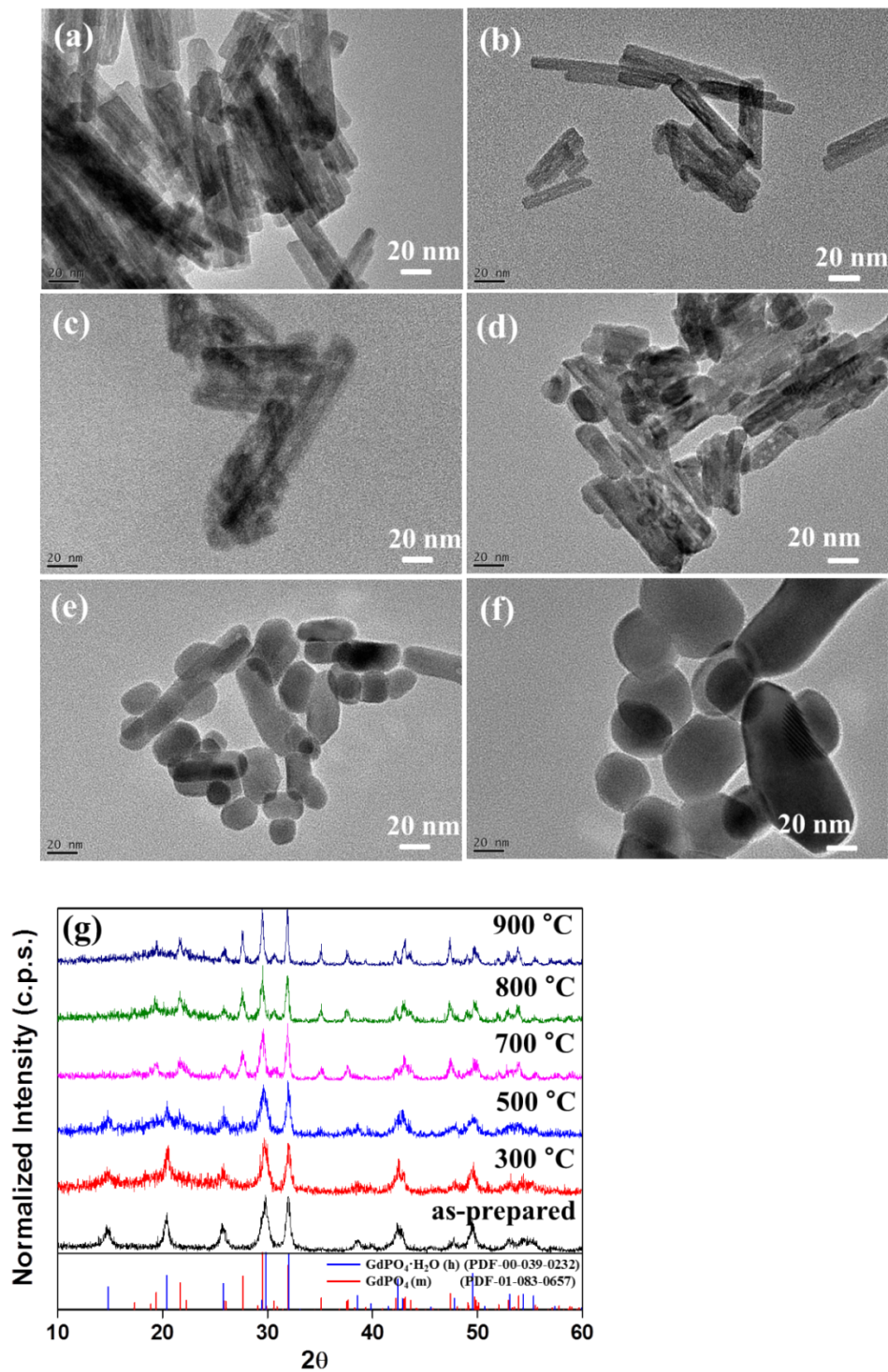
**Fig. S1** The *In-situ* XRD measurement of  $\text{GdPO}_4:\text{Eu}^{3+}$  nanorods at different heating temperature in the  $2\theta$  range of 25- 35°: (a) as-prepared, (b) 500 °C, (c) 700 °C, (d) 800 °C, and (e) 900 °C, respectively.



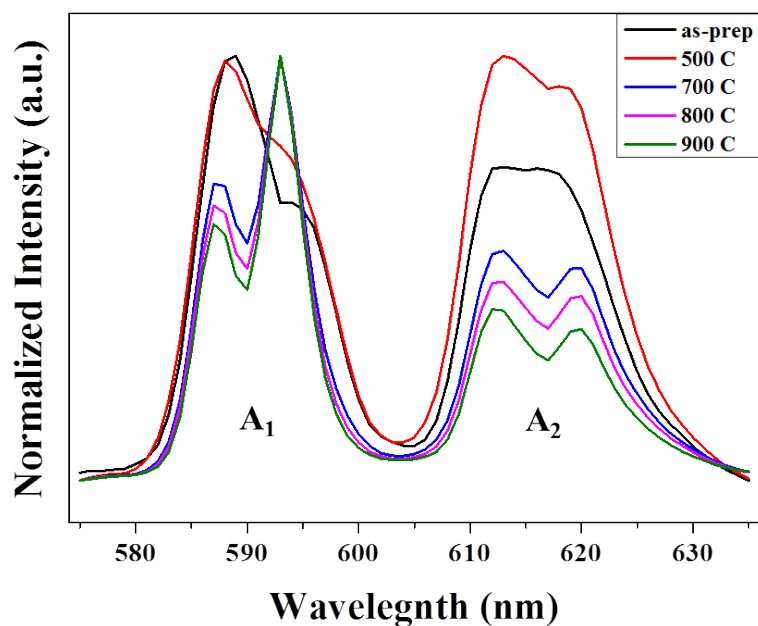
**Fig. S2** Magnified the *In-situ* TEM images with heating GdPO<sub>4</sub>:Eu<sup>3+</sup> nanorods at different temperatures: (a) 500 °C, (b) 700 °C, (c) 800 °C, and (d) 870 °C, respectively.



**Fig. S3** SAED patterns with corresponding TEM images of GdPO<sub>4</sub>:Eu<sup>3+</sup> sample with added *hkl* indices, measured at various heating temperature: (a) at room temperature, (b) at 700 °C which are similar to SAED of the hexagonal structure, (c) at 800 °C which are similar to SAED of the monoclinic structure, and (d) at 870 °C.



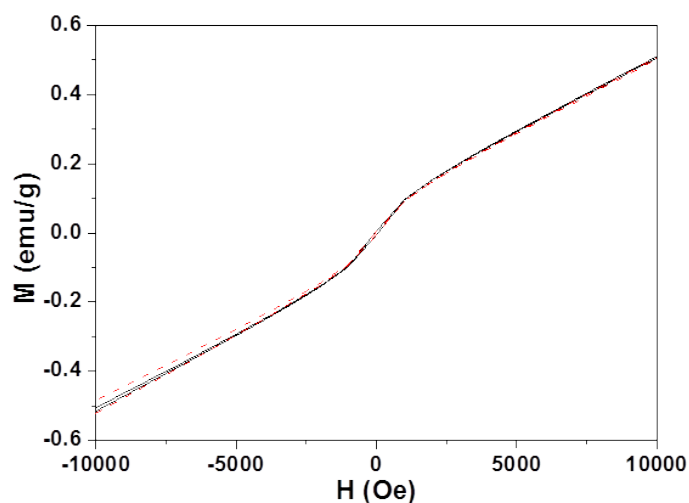
**Fig. S4** TEM images and XRD patterns of sample prepared by calcinating the as-prepared nanorods at different temperature, separately, (a) TEM images of as-prepared  $\text{GdPO}_4:\text{Eu}^{3+}$  nanorods, (b) calcined at  $300^\circ\text{C}$ , (c)  $500^\circ\text{C}$ , (d)  $700^\circ\text{C}$ , (e)  $800^\circ\text{C}$ , (f)  $900^\circ\text{C}$ , and (g) XRD patterns of them.



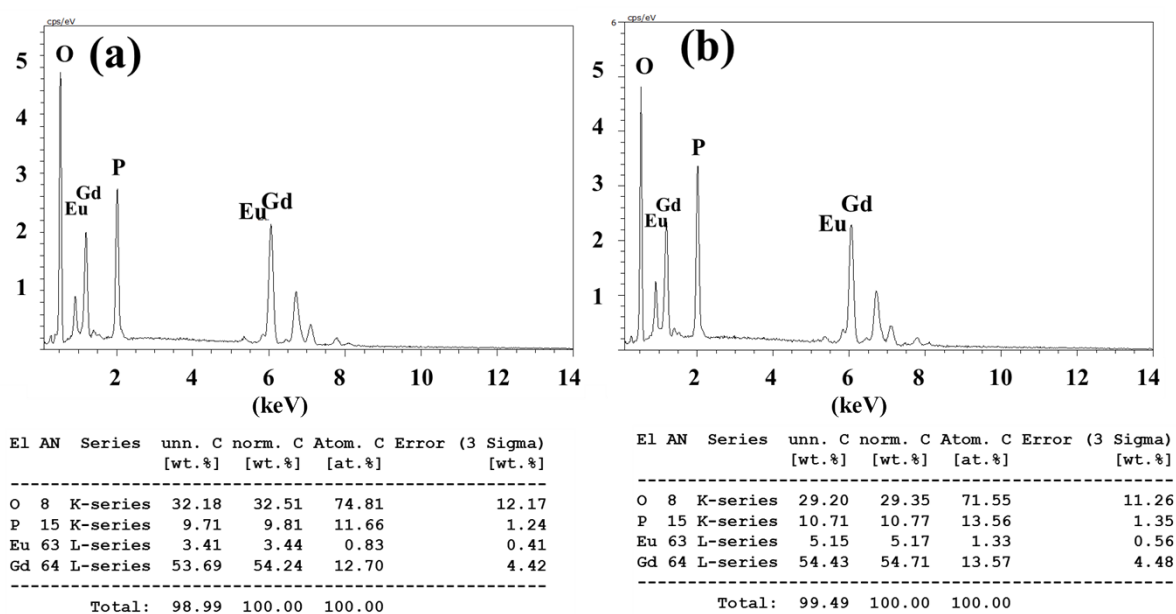
**Fig. S5** Normalized PL emission spectra in the range of 575- 635 nm under the excitation of wavelength 254 nm in order to investigate the orange-red emission in detail, originated from the transition of  $\text{Eu}^{3+}$  ions  $4f^6-4f^6$  ( $^5\text{D}_{0\rightarrow}^7\text{F}_1$ ) and ( $^5\text{D}_{0\rightarrow}^7\text{F}_2$ ), respectively; A1 and A1 denoted the integrated areas for each transition.

**Table 1.** Asymmetric ratio of  $^5\text{D}_{0\rightarrow}^7\text{F}_2$  to  $^5\text{D}_{0\rightarrow}^7\text{F}_1$  with a function of calcination temperature from the room temperature to 900 °C.

Temperature	Integrated area ( $^5\text{D}_{0\rightarrow}^7\text{F}_1$ : A <sub>1</sub> )	Integrated area ( $^5\text{D}_{0\rightarrow}^7\text{F}_2$ : A <sub>2</sub> )	Asymmetric ratio ( $I_{AS}=A_2/A_1$ )
as-prepared	11.66	11.40	0.98
500 °C	12.20	15.19	1.24
700 °C	9.41	8.13	0.86
800 °C	8.75	6.99	0.80
900 °C	8.23	5.81	0.70



**Fig. S6** Magnetization curve of as-prepared  $\text{GdPO}_4:\text{Eu}^{3+}$  nanorods (solid) and  $\text{GdPO}_4:\text{Eu}^{3+}$  nanoparticles (dotted) as a function of applied magnetic field at 300 K.



**Fig. S7** EDS spectra of (a) as-prepared  $\text{GdPO}_4:\text{Eu}^{3+}$  nanorods and (b)  $\text{GdPO}_4:\text{Eu}^{3+}$  nanoparticles calcined at 900 °C.