

Electronic Supplementary Information (ESI)

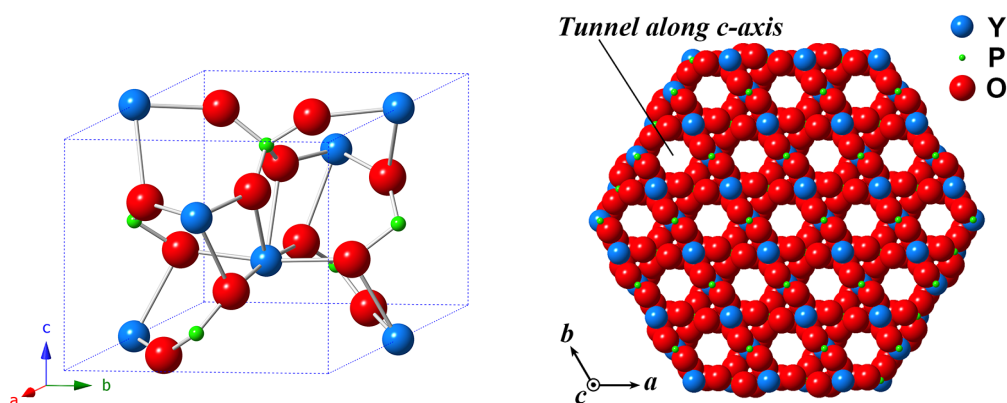
## **Formation and Aspect Ratio Control of Rhabdophane-Type Yttrium Orthophosphate Hexagonal Prism Particles Synthesized by a Citrate-Assisted Hydrothermal Process**

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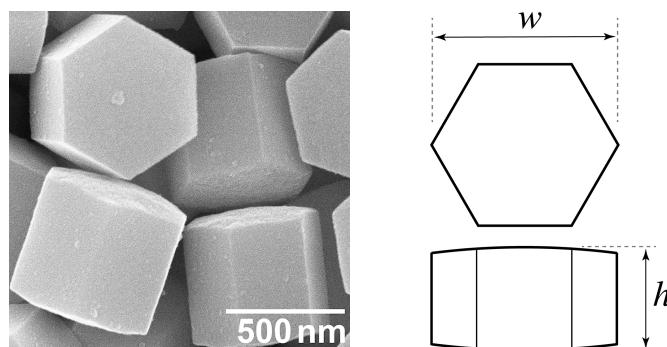
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## Crystal structure of rhabdophane-type $\text{YPO}_4$



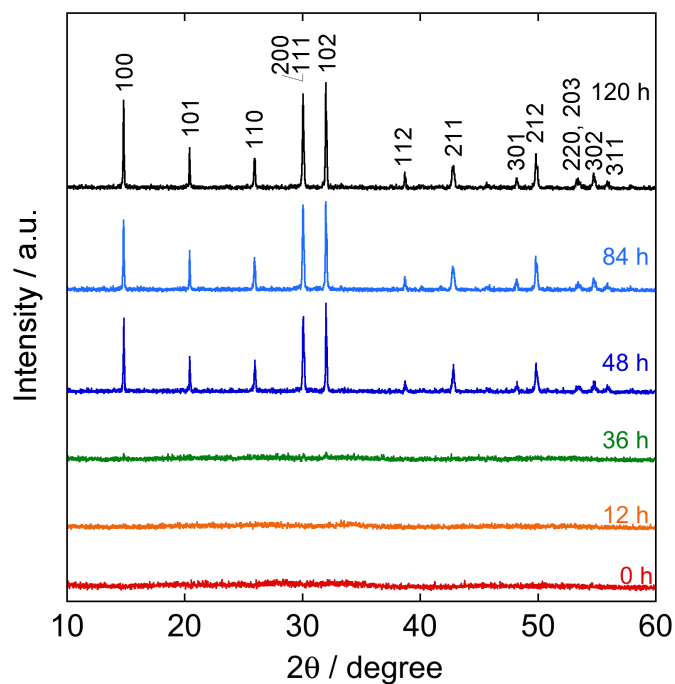
**Fig. S1** Structure of rhabdophane-type  $\text{YPO}_4$  indicating the atomic arrangement in one unit cell (left) and observed from the  $[001]$  direction (right). The crystalline water molecules in the tunnels are omitted.

## Determination of the width and height of the hexagonal prism particles



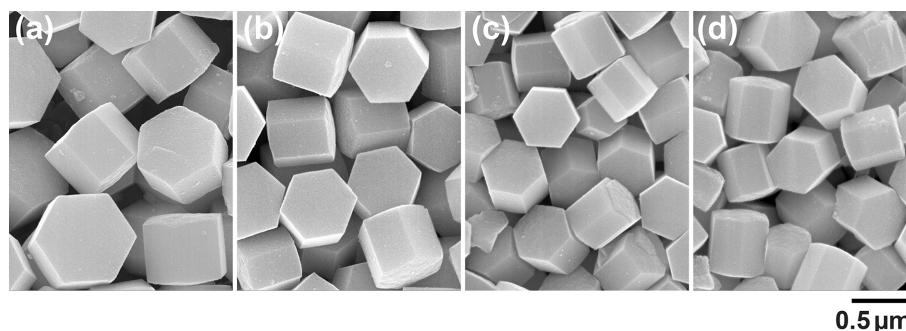
**Fig. S2** FE-SEM image for the hexagonal prisms of the rhabdophane  $\text{YPO}_4$  particles obtained under the typical condition ( $C_{\text{Cit}} = 60$  mmol/L, pH 5.62, 100 °C) and the definition in the present study for the prism's width,  $w$ , and height,  $h$ .

### XRD patterns of the precipitate at various reaction time under the typical reaction condition



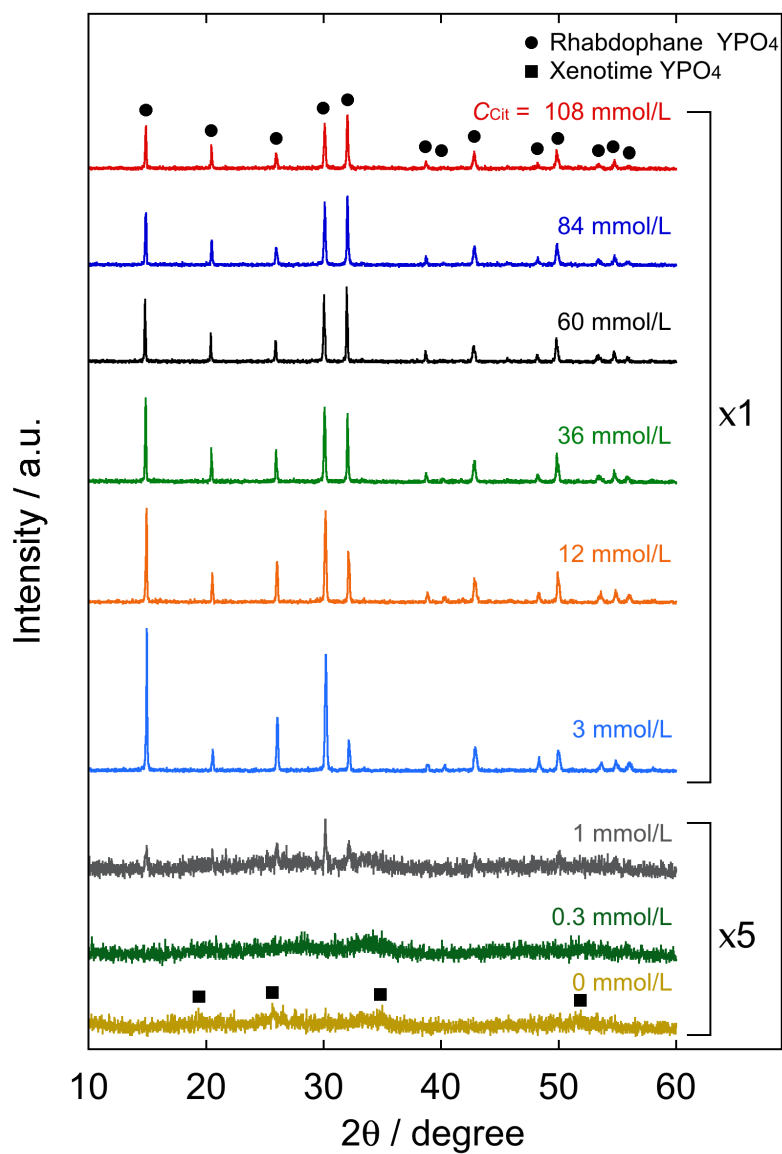
**Fig. S3** XRD patterns for the precipitates at various reaction times under the typical condition ( $C_{\text{Cit}} = 60$  mmol/L, pH 5.61, 100 °C; Cu K $\alpha$  radiation  $\lambda = 1.5418$  Å).

### Rhabdophane-type YPO<sub>4</sub> particles synthesized at different temperatures



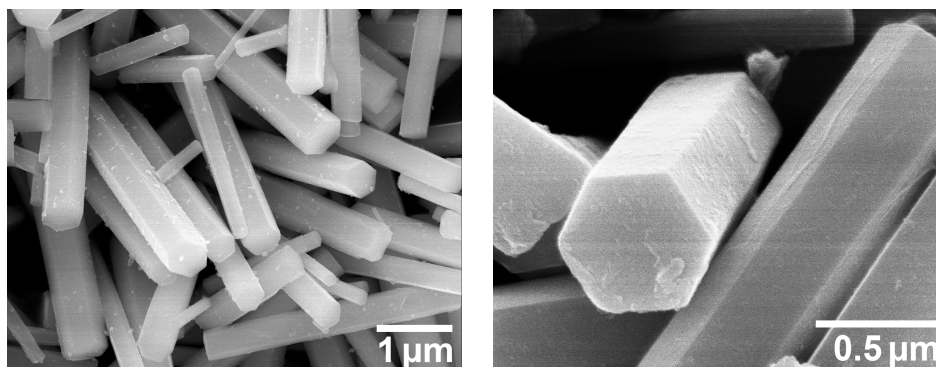
**Fig. S4** SEM images of rhabdophane YPO<sub>4</sub> particles synthesized at different reaction temperatures: (a) 95 °C (168 h), (b) 100 °C (120 h), (c) 110 °C (47 h), and (d) 120 °C (23 h): at pH 5.62 and  $C_{\text{Cit}} = 60$  mmol/L.

## XRD patterns of the precipitate at various sodium citrate conditions



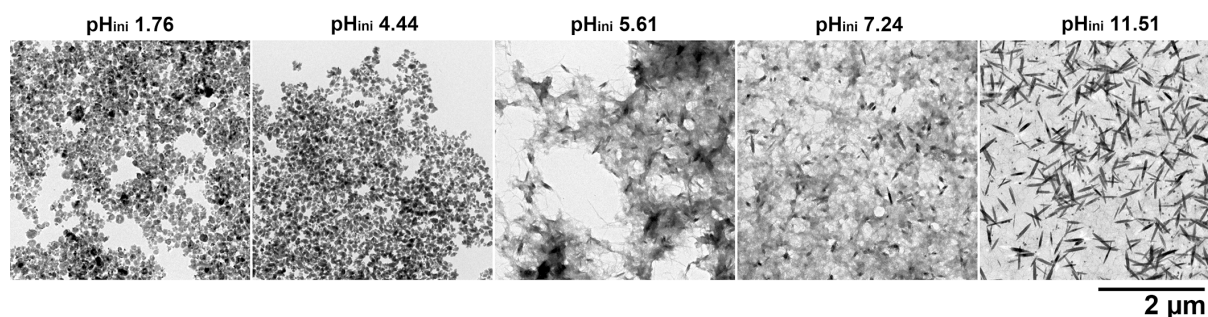
**Fig. S5** XRD patterns for precipitates prepared under various  $\text{Na}_3\text{-Cit}$  concentration conditions (pH 5.6, 100 °C). The intensities for the 0, 0.3, and 1 mmol/L conditions are quintuplicated to enhance the small peaks.

## Rhabdophane-type $\text{YPO}_4$ particles synthesized at low citrate concentration condition



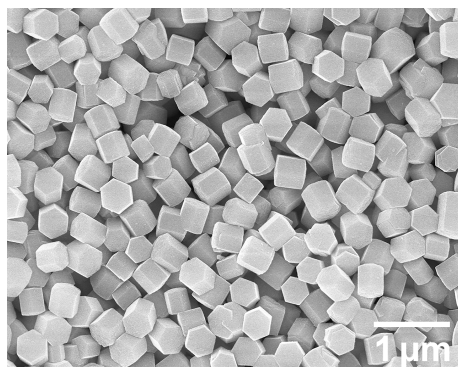
**Fig. S6** SEM images of rhabdophane-type  $\text{YPO}_4$  particles synthesized under a low  $\text{Na}_3\text{-Cit}$  concentration ( $C_{\text{Cit}} = 3 \text{ mmol}$  at pH 5.6, 100  $^\circ\text{C}$ ) observed at different magnifications.

## TEM imaged of the precipitates obtained at various pH conditions without trisodium citrate



**Fig. S7** TEM images of the precipitates synthesized without  $\text{Na}_3\text{-Cit}$  at different pH conditions. Reaction temperature 100  $^\circ\text{C}$  (120 h).

**FE-SEM image of the  $\text{YPO}_4:\text{Tb}^{3+}$  particles**



**Fig. S8** FE-SEM image of the  $\text{YPO}_4:\text{Tb}^{3+}$  particles prepared with  $\text{Na}_3\text{-Cit}$  at pH 5.62, 110 °C for 72 h ( $\text{Tb}^{3+}/\text{Y}^{3+}$  ratio = 2 mol%).