Electronic Supplementary Information

Morphology dependent effect of γ-Al_2O_3 for ethanol dehydration: nanorods and nanosheets

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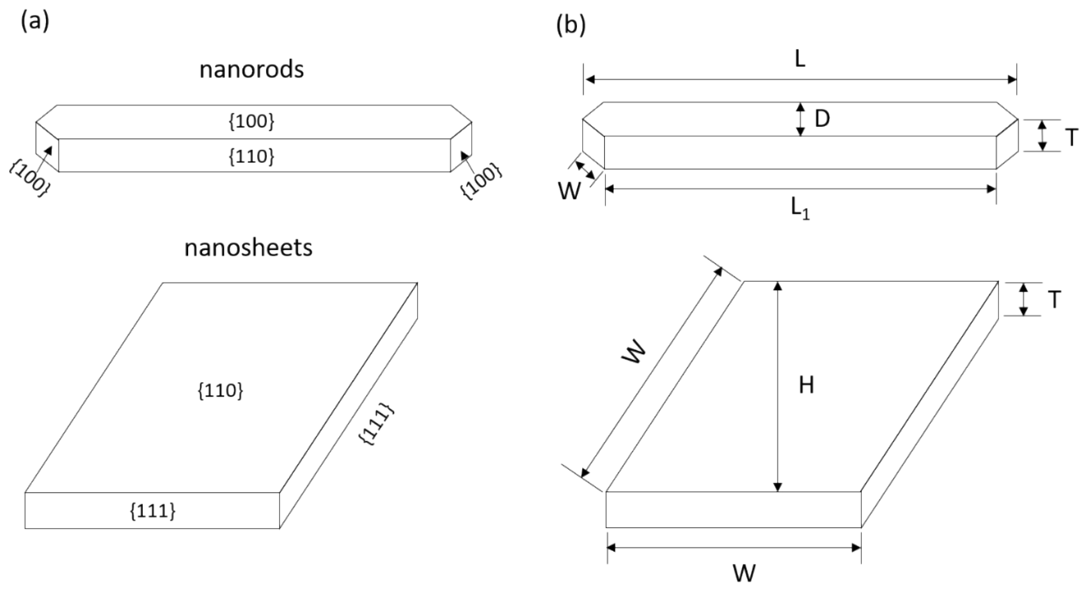

Fig. S1 (a) Schematic description of the γ-Al_2O_3 nanorods and nanosheets with the exposed facets; (b) Dimensional parameters of the γ-Al_2O_3 samples.

The length and diameter of {100} facets on nanorods were marked as L and D, respectively. L_1 and T were the length and thickness of {110} facets. The length of the {100} facets, located at the end of the rods, was marked as W. The average length (L) and diameter (D) of the γ-Al_2O_3 samples were measured through the TEM images by counting at least 150 particles. For convenience of calculations, we assumed that T equaled to D. The angle between the {100} facets at the end of rods was 90°, thus L_1 and W could be determined to be L-D and $\sqrt{2}$D/2.

The area of the {100} facet on the nanorods is

$$S_{100} = 2 \times D \times L_1 + 4 \times \frac{1}{2} \times D \times \frac{L - L_1}{2} + 4 \times W \times T$$

$$= D \times (L + L_1) + 4 \times W \times T$$

The area of the {110} facet is

$$S_{110} = 2 \times T \times L_1$$

The total area is

$$S = S_{110} + S_{100}$$

The percentage of each facet is

$$P_i = \frac{S_i}{S} \times 100\%$$

For nanosheets, W represented the side length of the rhomboid {110} facets. The height of the {110} facets was marked as H, while the thickness of the nanosheets was defined as T. The average side length (W) and height of {110} facets (H) as well as the thickness (T) of the γ-Al_2O_3 nanosheets were measured through the TEM images by counting at least 150 particles.

The area of the {110} facet on nanosheet is

$$S_{110} = 2 \times W \times H$$

The area of the {111} facet is

$$S_{111} = 4 \times W \times T$$

The total area is

$$S = S_{110} + S_{111}$$

The percentage of each facet is

$$P_i = \frac{S_i}{S} \times 100$$

Table. S1 Crystallite sizes of the γ-AlOOH particles synthesized at different pH values (453 K for 48 h).

pH	Crystallite size (nm)[a]
5.4	12.3
7.0	13.2
8.0	11.3
9.0	15.1

[a]Calculated from the (020) diffraction line by Scherrer's equation.

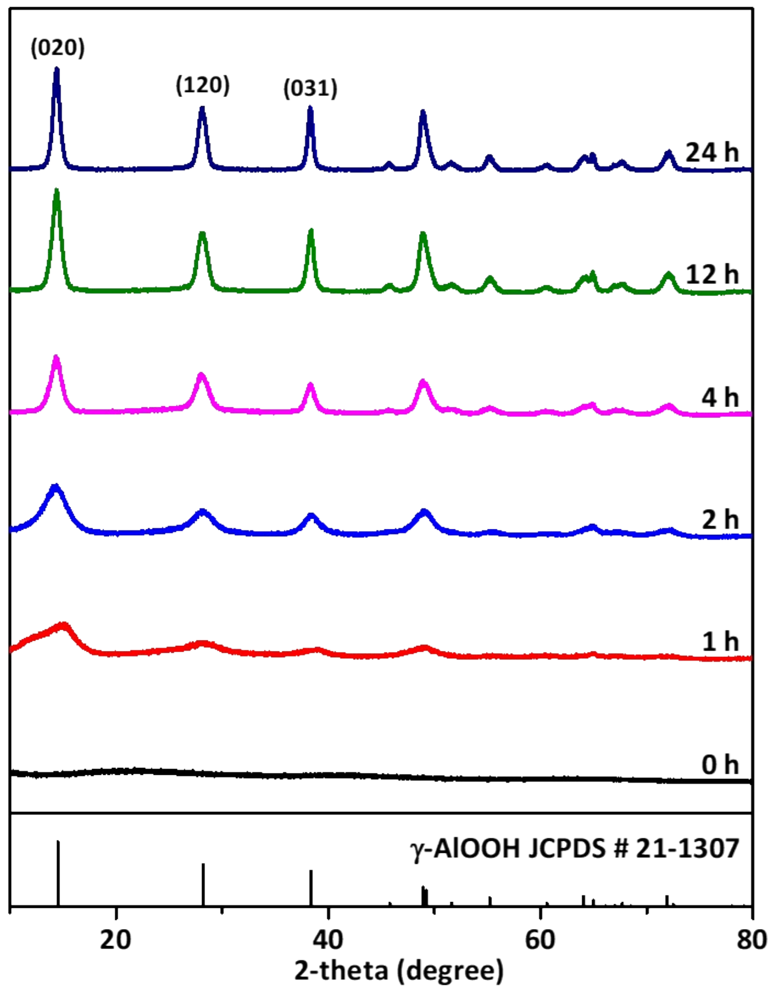

Fig. S2 XRD patterns of the intermediate products during the synthesis of nanorods (pH = 7.0, 453 K) at 0 h, 1 h, 2 h, 4 h, 12 h and 24 h.

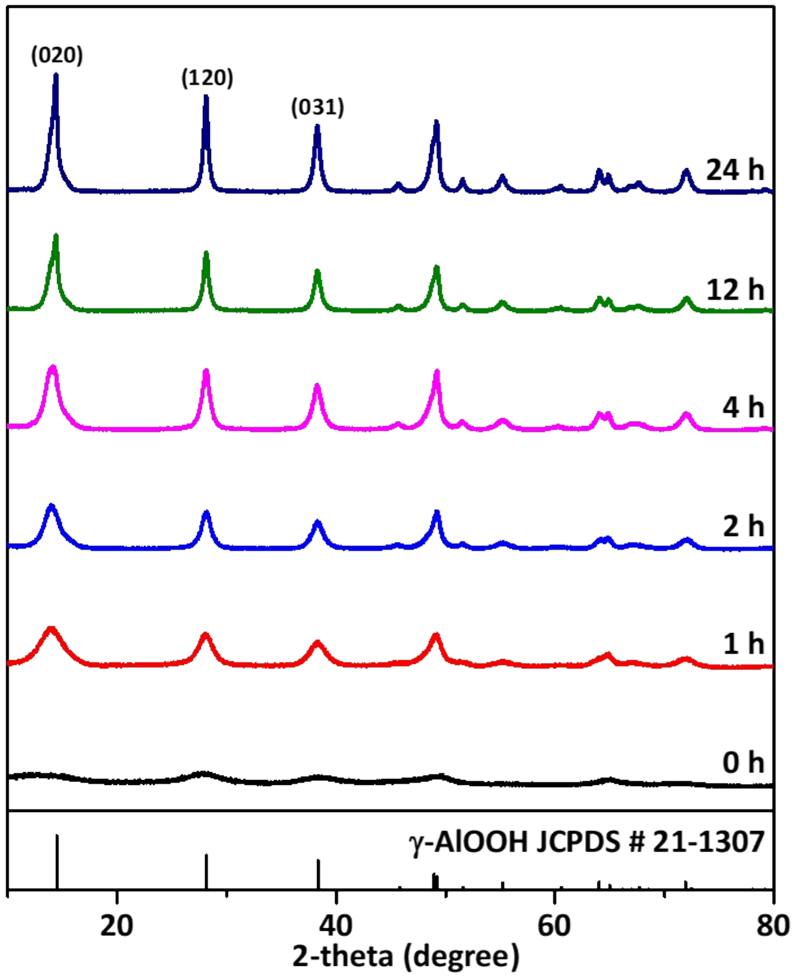

Fig. S3 XRD patterns of the intermediate products during the synthesis of nanosheets (pH = 9.0, 453 K) at 0 h, 1 h, 2 h, 4 h, 12 h and 24 h.

Table S2 Crystallite Sizes of the γ-AlOOH nanorods (pH = 7.0, 453 K) and nanosheets (pH = 9.0, 453 K) synthesized at different intervals.

Synthesis Time / h	Crystallite size (nm)[a]	
	nanorods	nanosheets
1	2.3	7.7
2	7.8	8.1
4	9.4	8.6
12	10.2	8.8
24	12.1	14.7

[a]Calculated from the (020) diffraction line by Scherrer's equation.

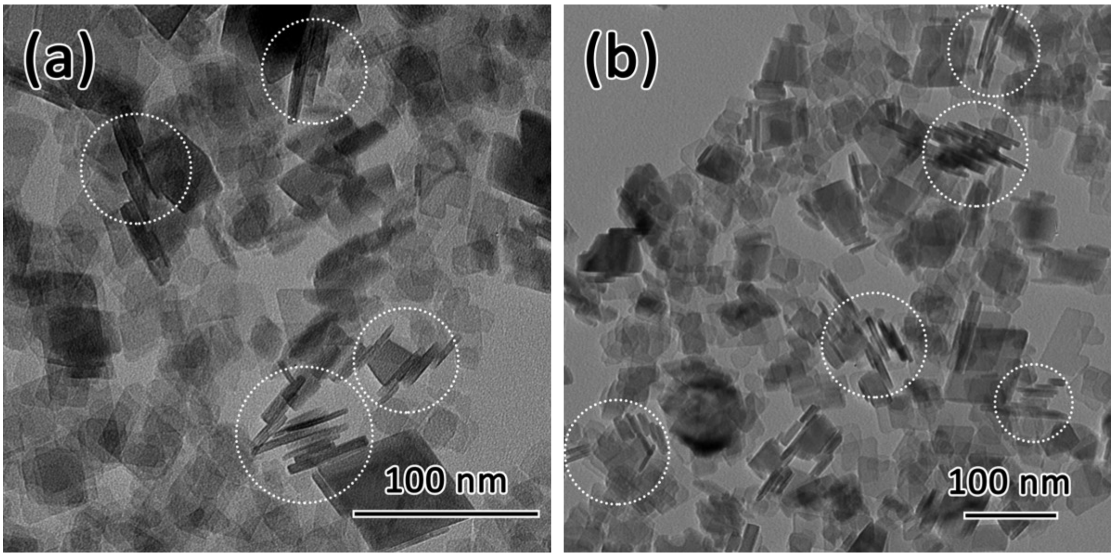

Fig. S4 TEM images of the side view of γ-AlOOH nanosheets synthesized at pH 9.0 for 12 h (a) and 24 h (b). The thickness was determined from the side view of the nanosheets (vertical direction, highlighted in white circle) in the TEM images.

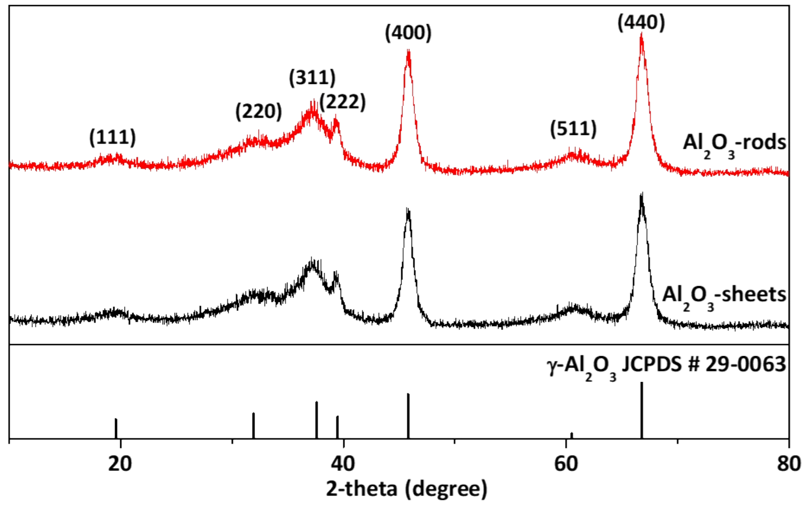

Fig. S5 XRD patterns of γ-Al_2O_3 obtained by thermal calcination of γ-AlOOH nanorods and nanosheets at 873 K.

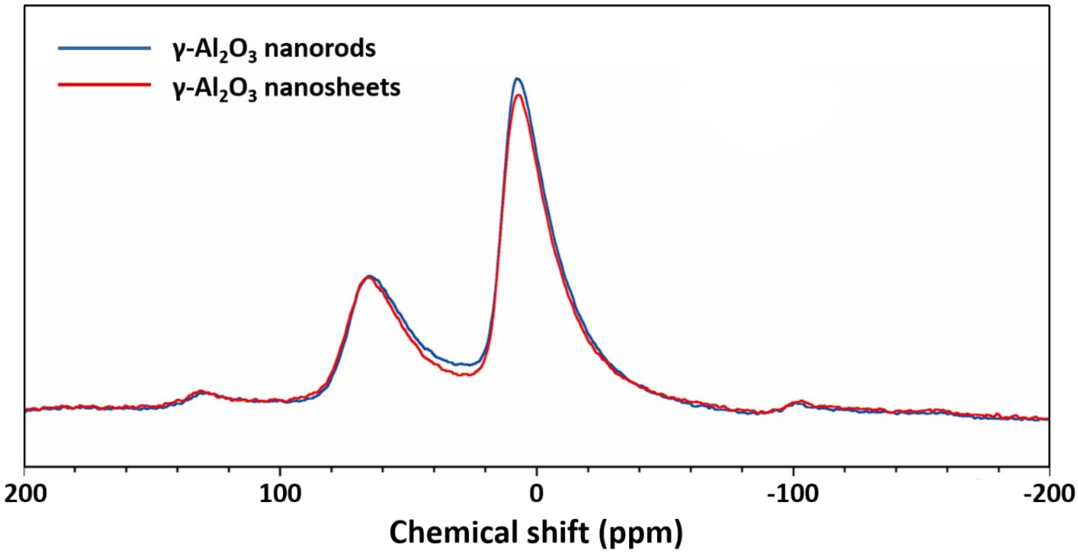

Fig. S6 Solid-state ^{27}Al MAS-NMR spectra of γ-Al_2O_3 nanorods and nanosheets.