Supporting Information

Hierarchical Spheres of Mg-Al LDH for Removal of Phosphate Ions: Effect of Alumina Polymorph as Precursor

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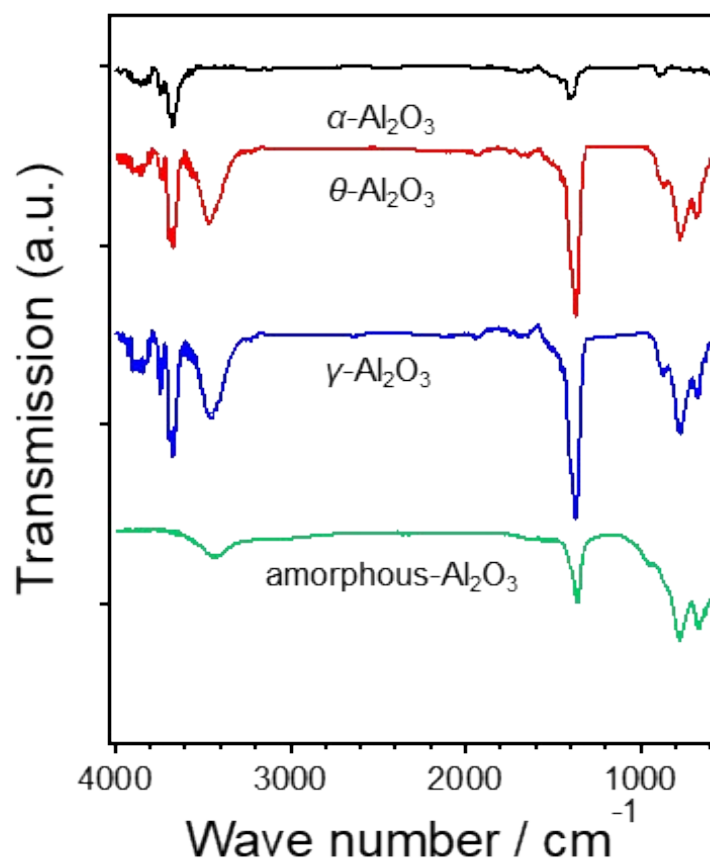
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Figure S1. FT-IR spectra of powders collected from reaction solution containing Al_2O_3 precursor and MgO after 120 h (α-Al_2O_3, θ-Al_2O_3, γ-Al_2O_3, and amorphous Al_2O_3 were used as precursors).
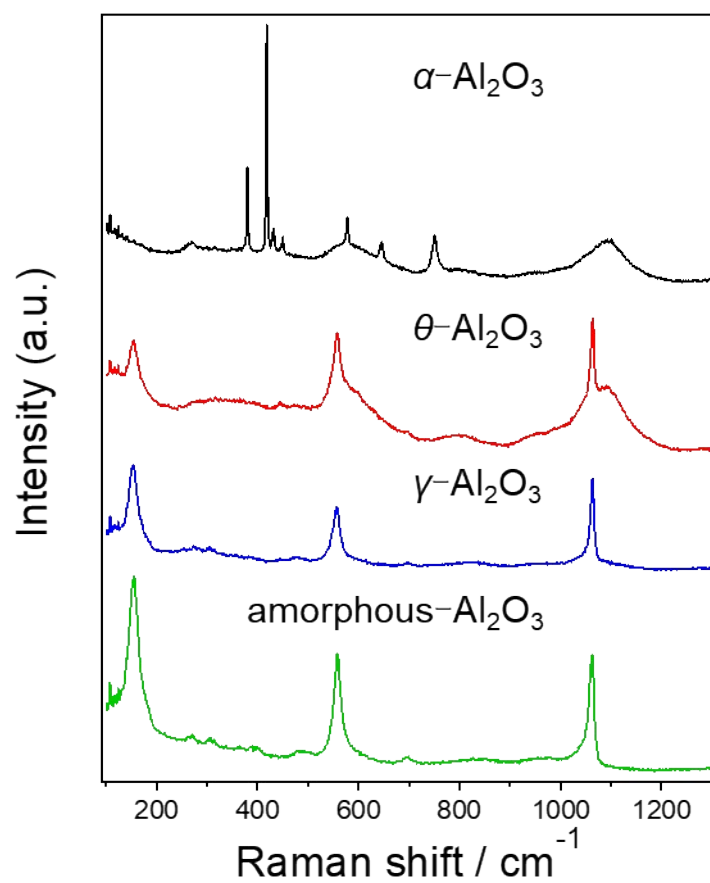
Figure S2. Raman spectra of powders collected from reaction solution containing Al_2O_3 precursor and MgO after 120 h (α-Al_2O_3, θ-Al_2O_3, γ-Al_2O_3, and amorphous Al_2O_3 were used as precursors).
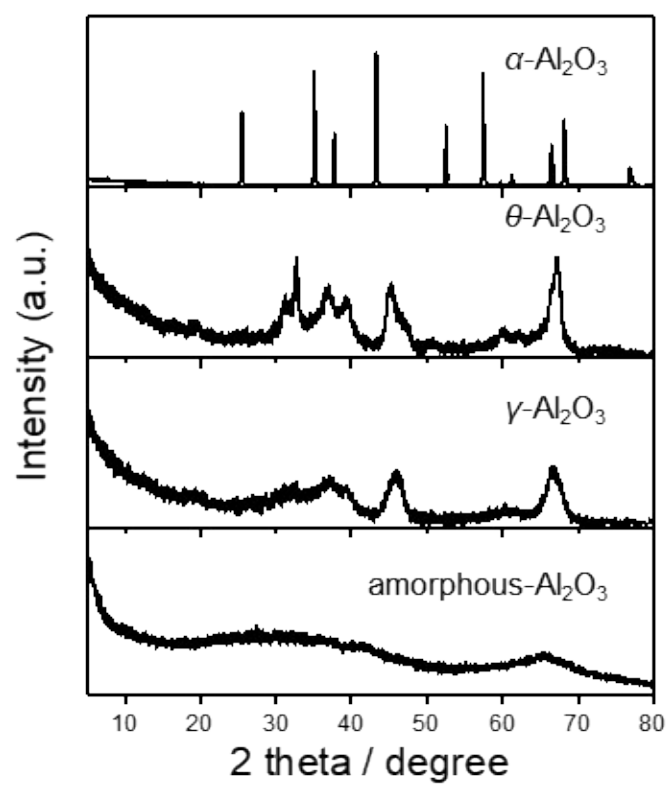
Figure S3. XRD patterns of (a) α-Al$_2$O$_3$, (b) θ-Al$_2$O$_3$, (c) γ-Al$_2$O$_3$, and (d) amorphous-Al$_2$O$_3$ used as precursors.
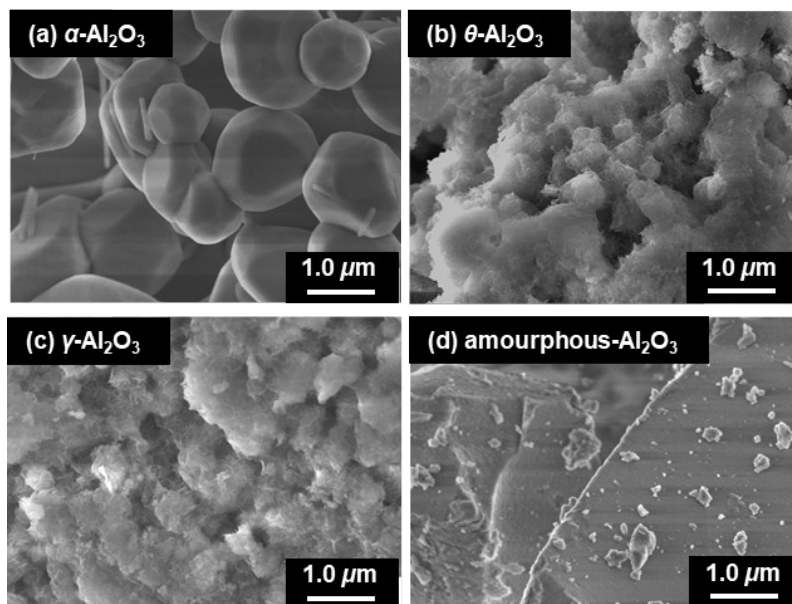
Figure S4. SEM images of (a) α-Al_2O_3, (b) θ-Al_2O_3, (c) γ-Al_2O_3, and (d) amorphous-Al_2O_3 used as precursors.
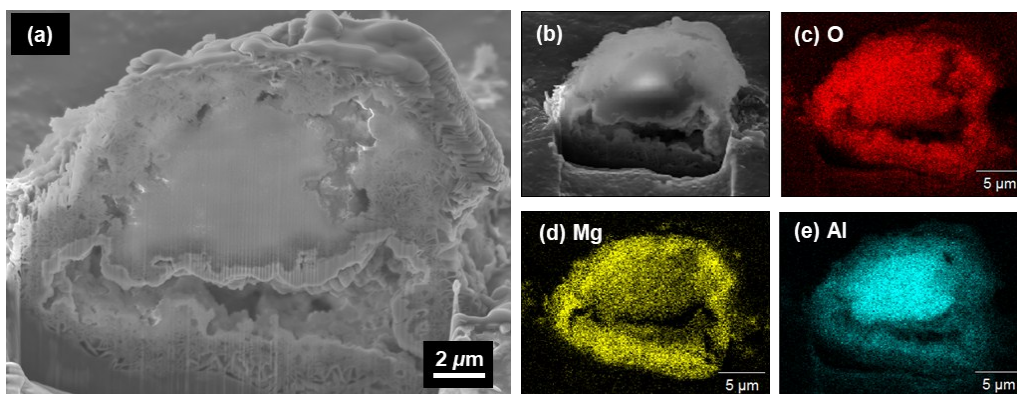
Figure S5. (a) Cross-sectional SEM images and (b-e) elemental maps of LDH particles prepared using γ-Al$_2$O$_3$.
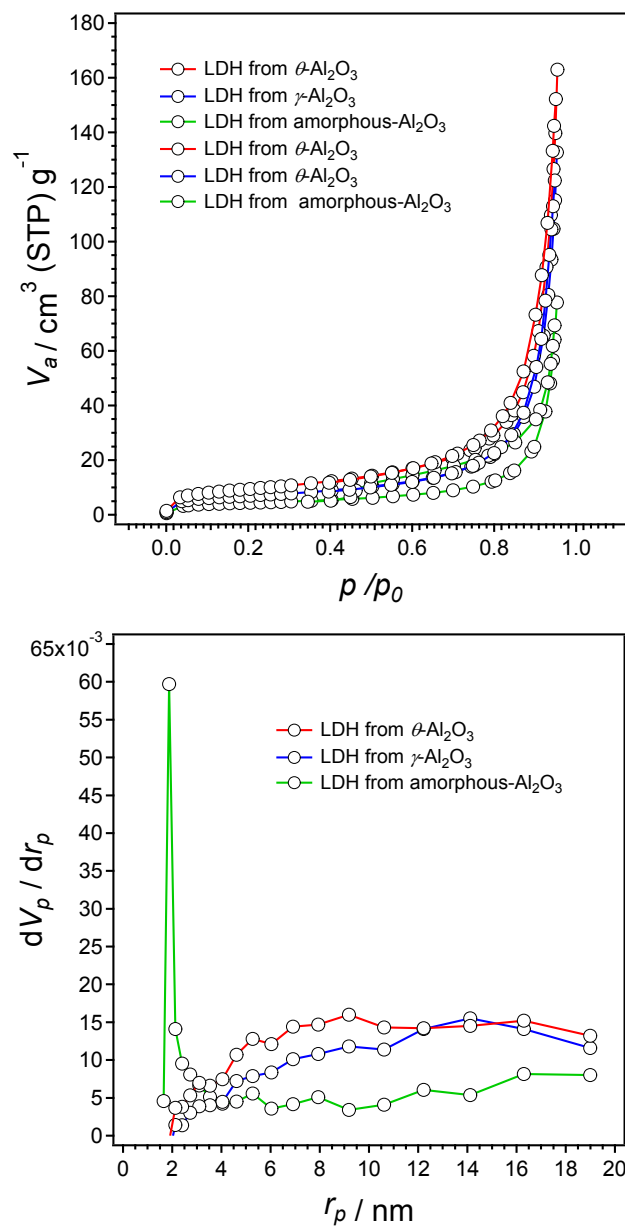
Figure S6. (top) N_2 adsorption/desorption isotherms and (bottom) pore-size distribution of powders collected from reaction solution containing Al_2O_3 precursor and MgO after 120 h (θ-Al_2O_3, γ-Al_2O_3, and amorphous Al_2O_3 were used as precursors).
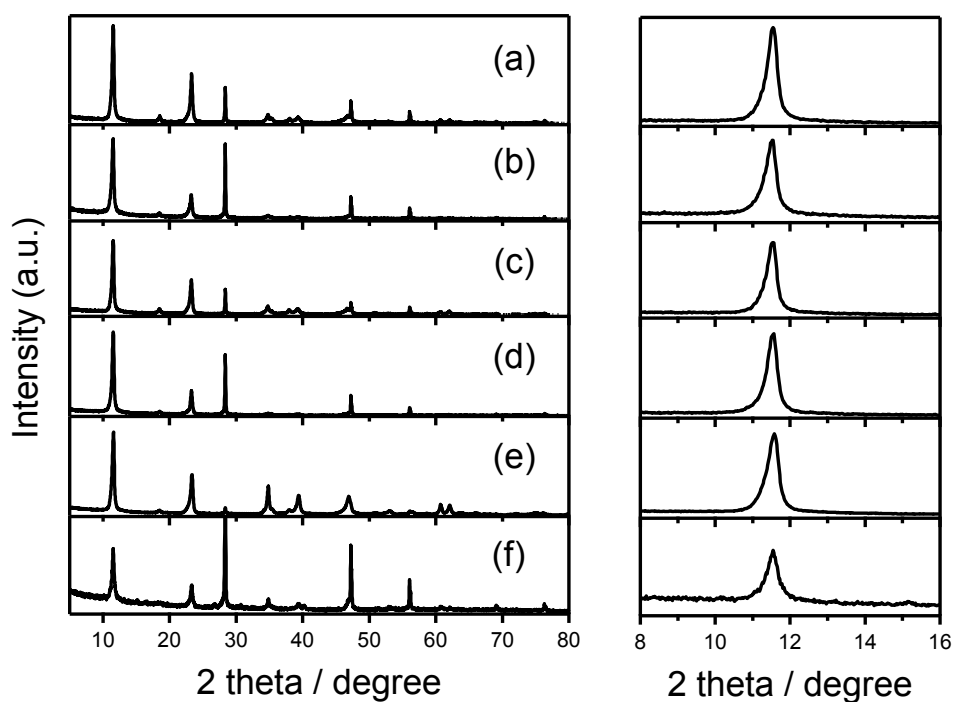
Figure S7. XRD patterns of LDH powders (a, c, e) before and (b, d, f) after replacement of interlayer anionic species in LDH particles with Cl⁻ ions (PDF 0511525, and PDF 08301141 were obtained from ICDD database); (a, b) θ-Al$_2$O$_3$, (c, d) γ-Al$_2$O$_3$, and (e, f) amorphous-Al$_2$O$_3$ were used as precursors.
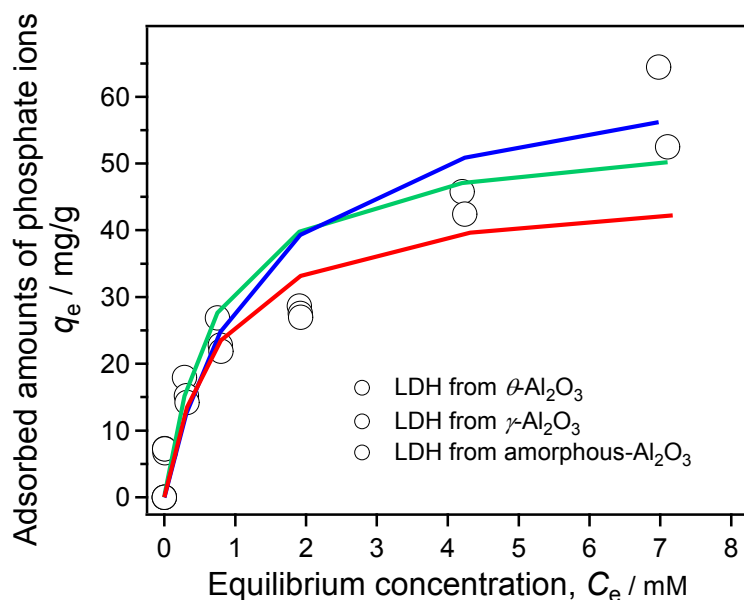
Figure S8. Adsorption isotherms for phosphate ions with respect to LDH prepared using θ-Al$_2$O$_3$, γ-Al$_2$O$_3$, and amorphous-Al$_2$O$_3$ were used as precursors after replacement of interlayer anionic species in LDH particles with Cl$^-$ ions. The value of the Langmuir constant, b_L (1.25, 0.74, and 1.32 mM), and the maximum amount of adsorbate, phosphate ions here, corresponding to the Langmuir model, q_L (64.95, 67.11, and 55.56 mg g^{-1}), sums of the mean squared errors for the Langmuir model, R^2 (0.95, 0.86, and 0.96) with respects to LDH prepared from θ-Al$_2$O$_3$, γ-Al$_2$O$_3$, amorphous-Al$_2$O$_3$, respectively.

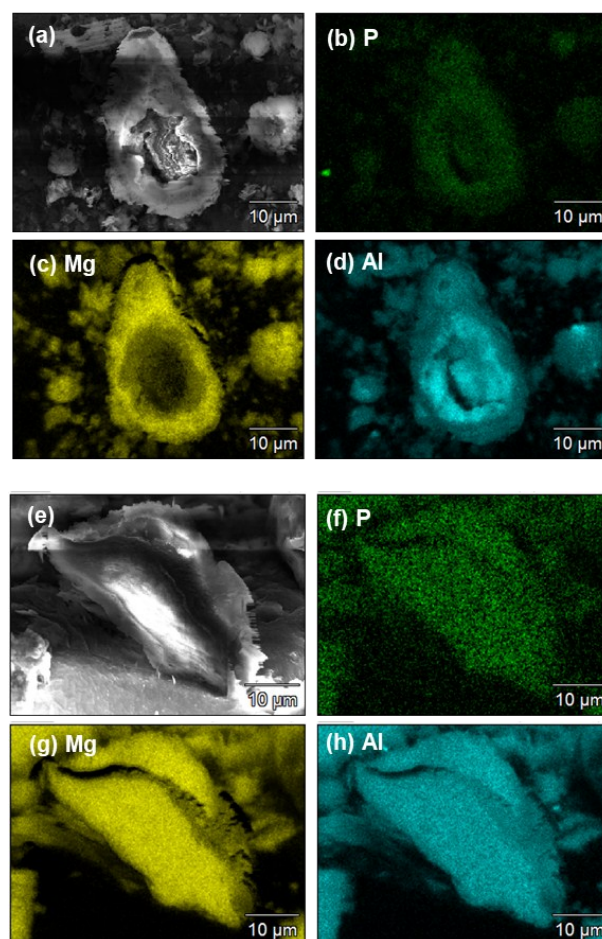**Figure S9.** (a, e) Cross-sectional SEM images and (b-d, f-h) elemental maps of LDH particles prepared from (a-e) θ-Al$_2$O$_3$ and (f-j) γ-Al$_2$O$_3$. Images and maps were obtained after HPO$_4{}^{2-}$ ion adsorption test.