ELECTRONIC SUPPLEMENTARY DATA

Tuneable Ultra High Surface Area Specific Surface Area Mg/Al-CO_3 Layered Double Hydroxides

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Surface area theoretical prediction

A simply approach to estimate the theoretical specific surface area is shown as below: A simple supercell was constructed including 4 x 4 x 1unit cells. The formula of this LDH supercell was estimated from TGA results as $Mg_{12}Al_4(OH)_{32}(CO_3)_2$•5.6($H_2O$)•1.92(CH3COCH3). The cell parameters *a* and *c* are 3.05 and 7.78 Å, respectively (obtained from XRD).

The volume of a supercell (V_{sc}) is:

$$V_{sc} = \frac{\sqrt{3}}{2}(4a)^2 \times c$$

The density of the LDH (ρ) can be:

$$\rho = \frac{M}{N_A \times V_{sc}}$$

where, M is the molecular mass of $Mg_{12}Al_4(OH)_{32}(CO_3)_2$•5.6($H_2O$)•1.92(CH3COCH3), N_A is Avogadro's number (6.022×10^{23}).

To simplify, assume the LDH particles are cylinder shape, the total surface area ($S_{particle}$) of a LDH particle can be obtained from its particle size (diameter *d*) and thickness (*t*).

$$S_{particle} = 2 \times \pi \times (\frac{d}{2})^2 + \pi \times d \times t$$

The volume of a LDH particle ($V_{particle}$) is :

$$V = \pi \times (\frac{d}{2})^2 \times t$$

The specific surface area (SSA) is:

$$SSA = \frac{S_{particle}}{\rho \times V_{particle}}$$

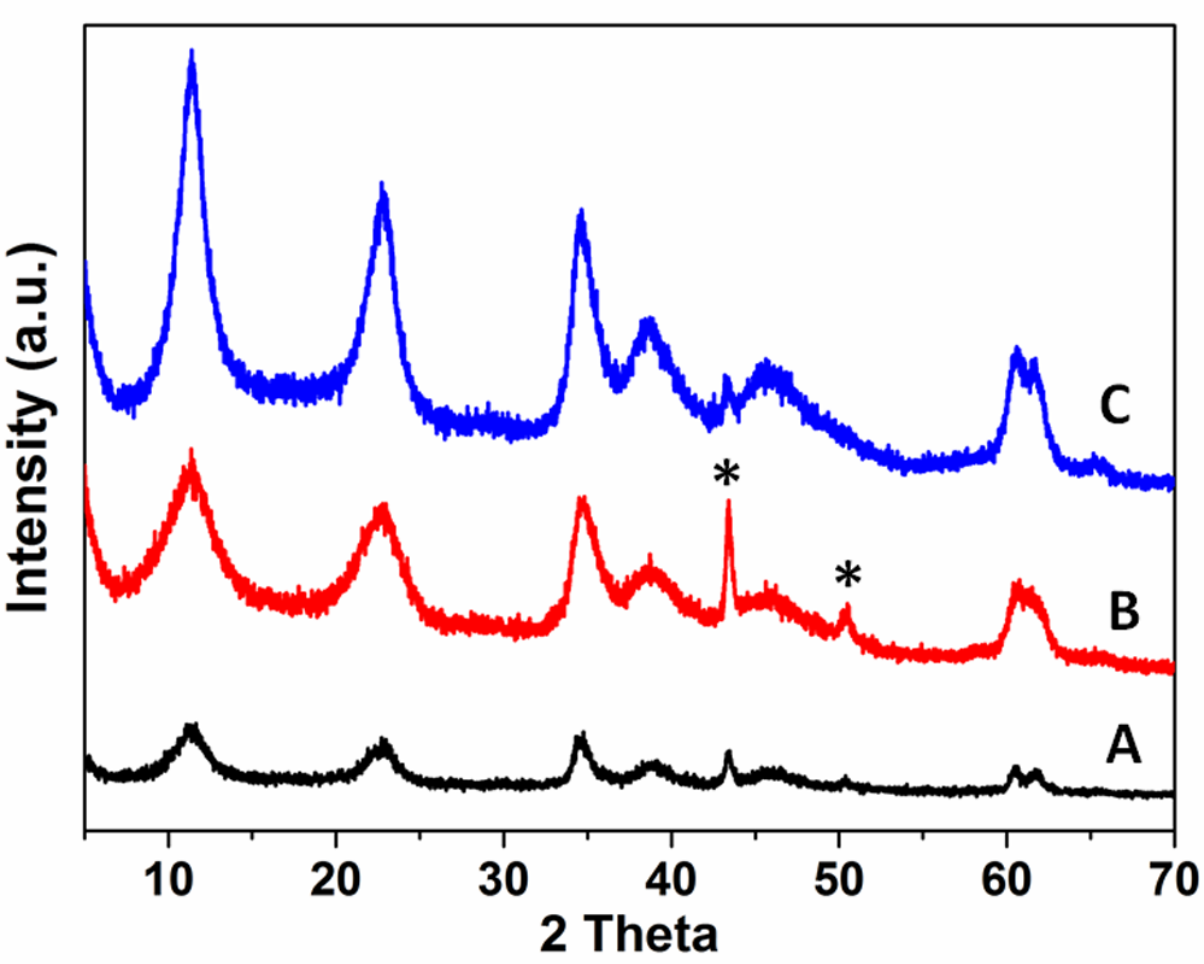

Fig. S1 XRD pattern of Mg_3Al-CO_3 LDH (prepared at pH = 10) with different particle sizes (A) 200 nm, (B) 50 nm and (C) 20 nm. (*) are the Bragg diffraction from the sample holder.

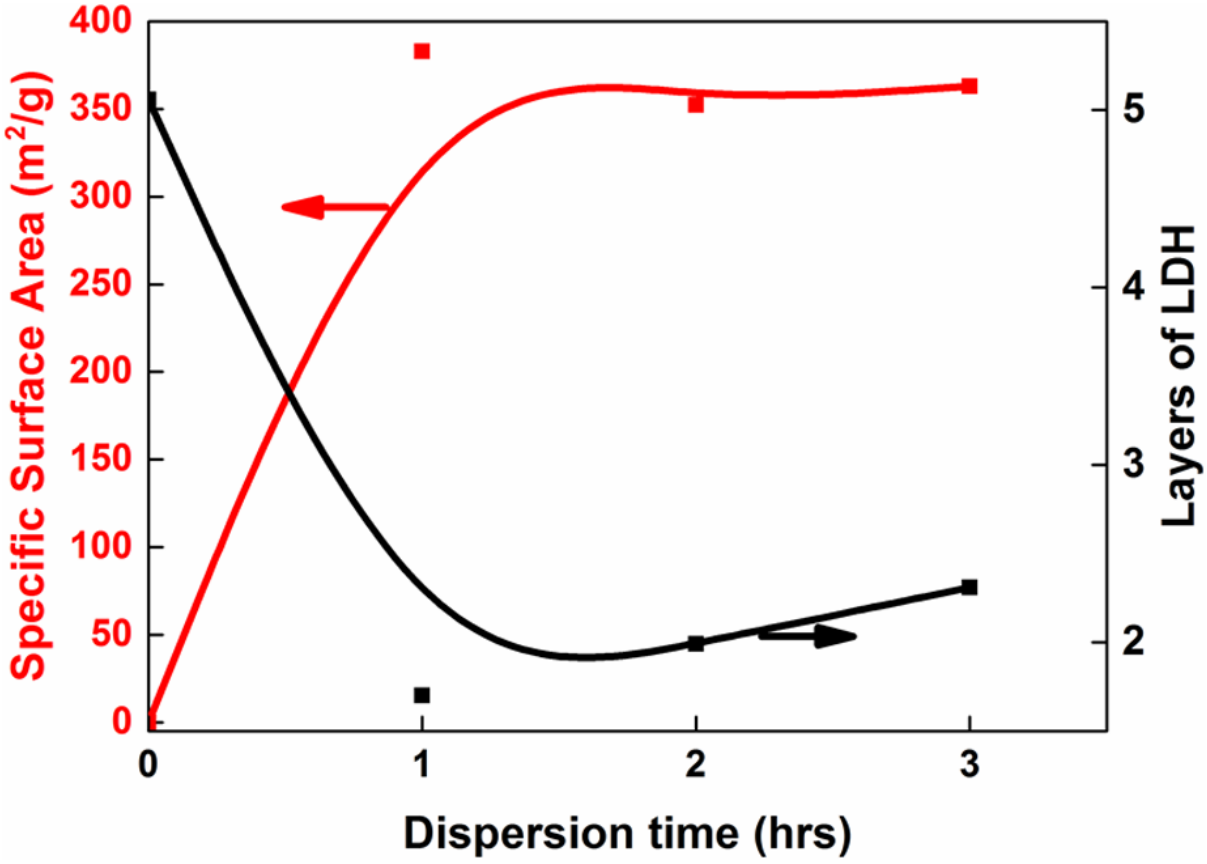

Figure S2. Specific surface area and LDH layers of 3 g AMO-LDH flowers dispersed in acetone (300 mL) for different durations.

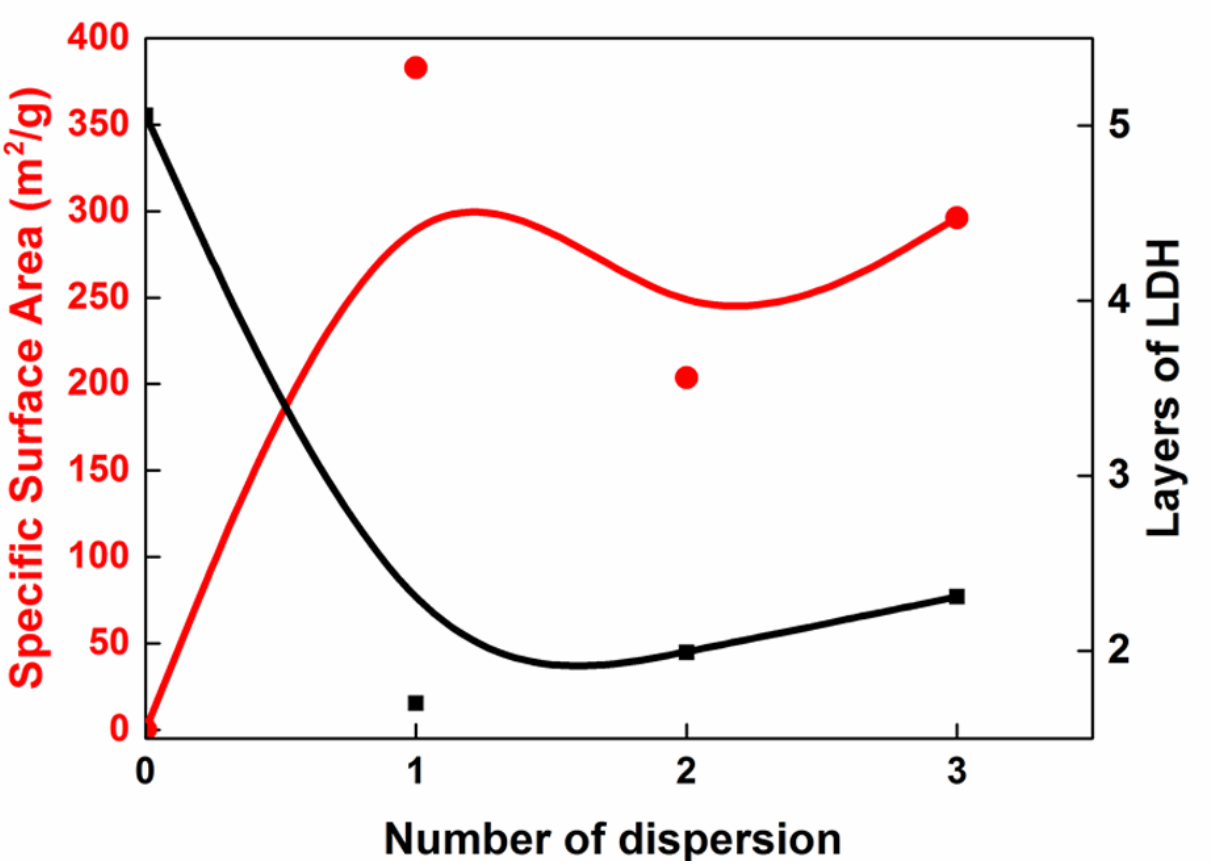

Figure S3. Specific surface area and LDH layers of 3 g AMO-LDH flowers washed with acetone (300 mL) for different dispersion cycles.

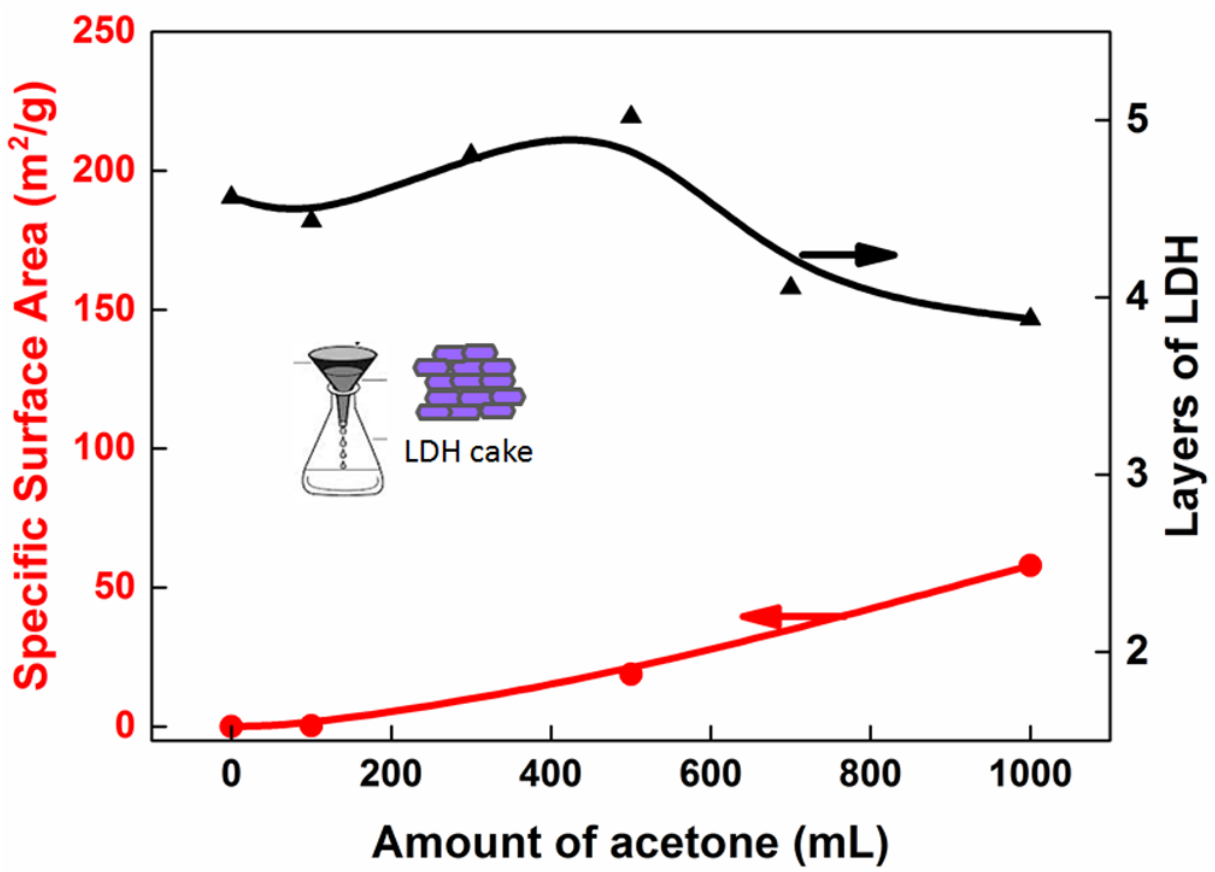

Figure S4. Specific surface area and LDH layers of 3 g AMO-LDH plates treated with different volumes of acetone.

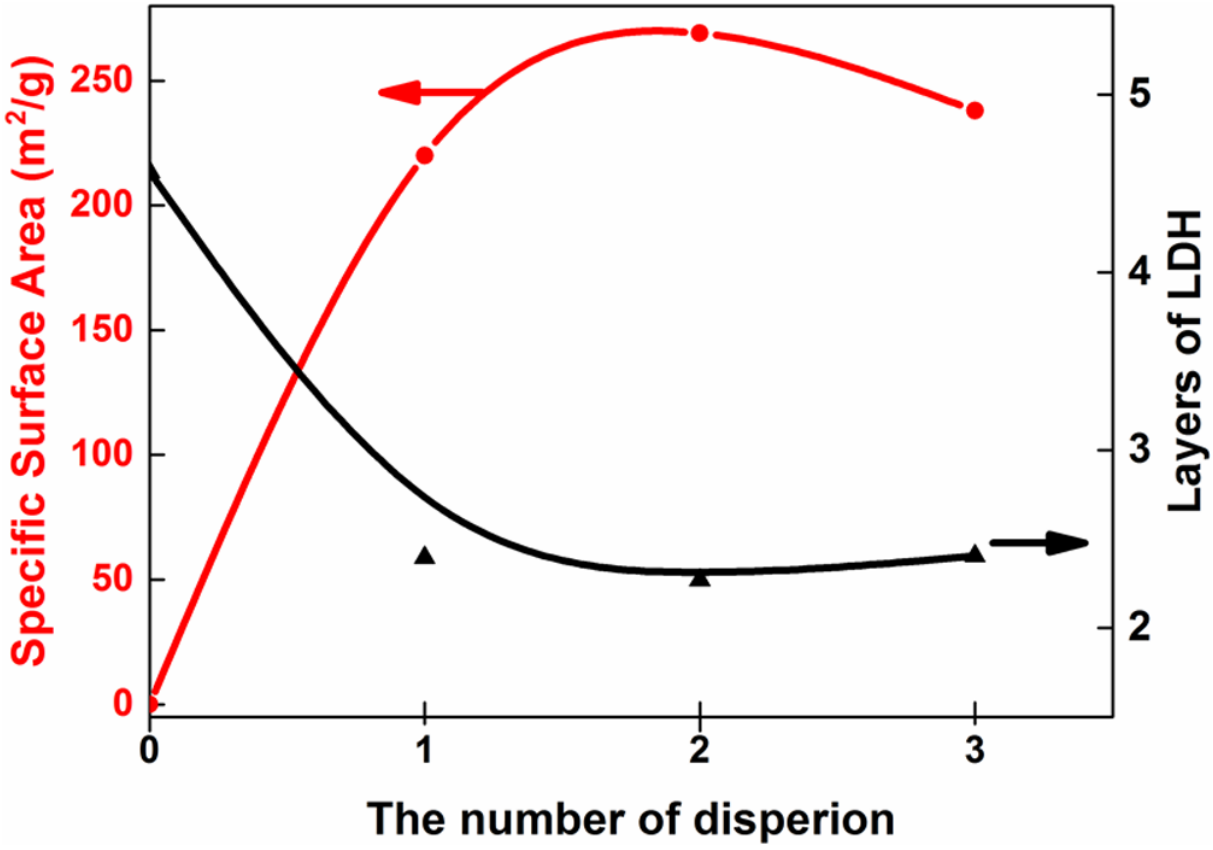

Figure S5. Specific surface area and LDH layers of 3 g AMO-LDH plates washed with acetone (300 mL) for different dispersion cycles.

Table S1. Specific surface area of AMO-LDH plates dried in different methods

Drying method	Specific **surface area (m^2/g)**
Oven	141
Vacuum	180
Spray dryer	248

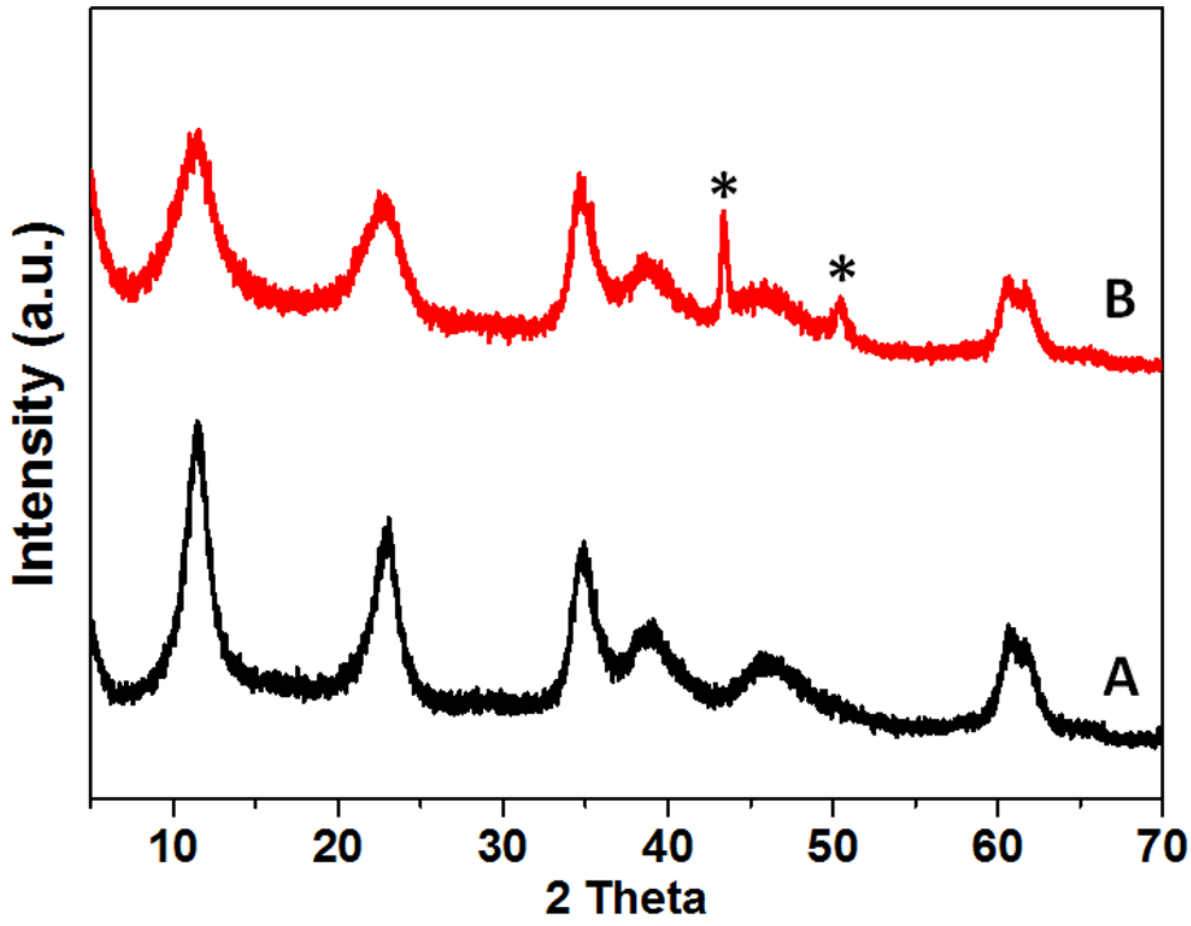

Figure S6. XRD pattern of Mg_3Al-CO_3 LDH (prepared a pH = 10) (A) without AMOST treatment, (B) with AMOST treatment. (*) are the Bragg diffraction from the sample holder.