Supplementary Material (ESI) for Chemical Communications

Supplementary Information

Preparation of Layered Double Hydroxide Films with Different Orientations on the Opposite Sides of a Glass Substrate by *in situ* Hydrothermal Crystallization

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Experiment and Characterization

Materials: Glass slides were cut into small pieces with a size of 25 mm ×15 mm to act as substrates for film growth. They were immersed in an ultrasonic bath first containing alcohol, and subsequently deionized water, for 10 min in each case. Finally, the substrates were dried in an oven. PVA (M_w=1750 ± 50) was reagent grade obtained from Beijing Yili Fine Chemicals Co., Ltd. $Mg(NO_3)_2$•$6H_2O$, $Al(NO_3)_3$•$9H_2O$, urea, were used as received. Deionized water was used in all the experimental processes.

Film Preparation: PVA was dissolved in distilled water, and then one side of the glass substrate was modified with the dissolved PVA by spin-coating followed by annealing at 200 °C for 0.5 h to obtain a PVA film. In a typical procedure, $Mg(NO_3)_2$•$6H_2O$ (1.71 g), $Al(NO_3)_3$•$9H_2O$ (1.25 g) and urea (5.60 g) were dissolved in deionized water to form a clear solution with a total volume of 100 mL. The modified glass substrate was placed vertically in a Teflon-lined stainless steel autoclave, which was placed in a conventional oven at 90 °C for 9 h. After completion of the LDH film growth, the substrate was taken out of the autoclave, thoroughly rinsed with deionized water, and then dried at room temperature. The LDH coating on the PVA-modified side is denoted as the PLDH-film; the LDH coating on the other side is denoted as the OLDH-film.

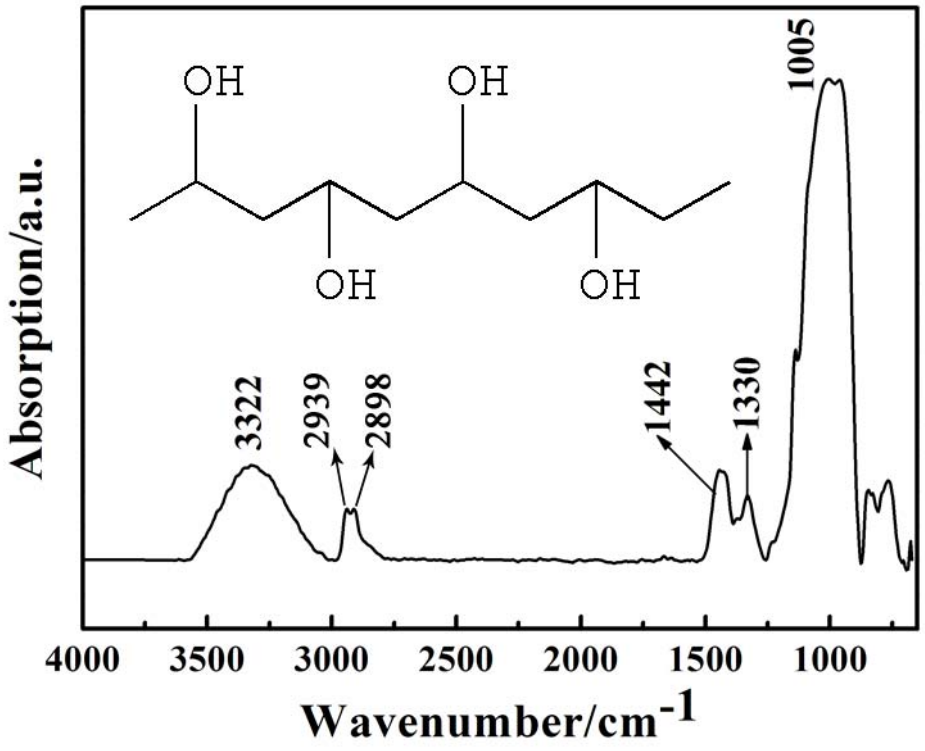

Fig. S1. ATR-FTIR spectrum of the PVA coating on the glass substrate

In the ATR-FTIR spectrum of the PVA coated glass, the broad peak located around 3322 cm^{-1} arises from intermolecular hydrogen bonded hydroxyl groups and the O–H stretching vibrations. The antisymmetric and symmetric $–CH_2$ stretching vibrations give rise to the absorption peaks at 2939 and 2898 cm^{-1}, respectively. The two peaks at 1442 and 1330 cm^{-1} are attributed to the coupling of the secondary O–H in-plane bending and the C–H wagging vibrations. (S. D. Xiao, R. Y. M. Huang, X. S. Feng, *J. Membrane Sci.,* 2006, **286**, 245.) The broad band in the 800–1300 cm^{-1} region is assigned to the stretching vibrations of SiO_4 tetrahedra in the glass substrate with different numbers of bridging oxygen atoms. (A. Goel, D. U. Tulyaganov, E. R. Shaaban, C. S. Knee, S. Eriksson, J. M. F. Ferreira, *Ceram. Int.,* 2009, **35**, 1529.) The spectrum clearly demonstrates the formation of a PVA film on the surface of the glass.

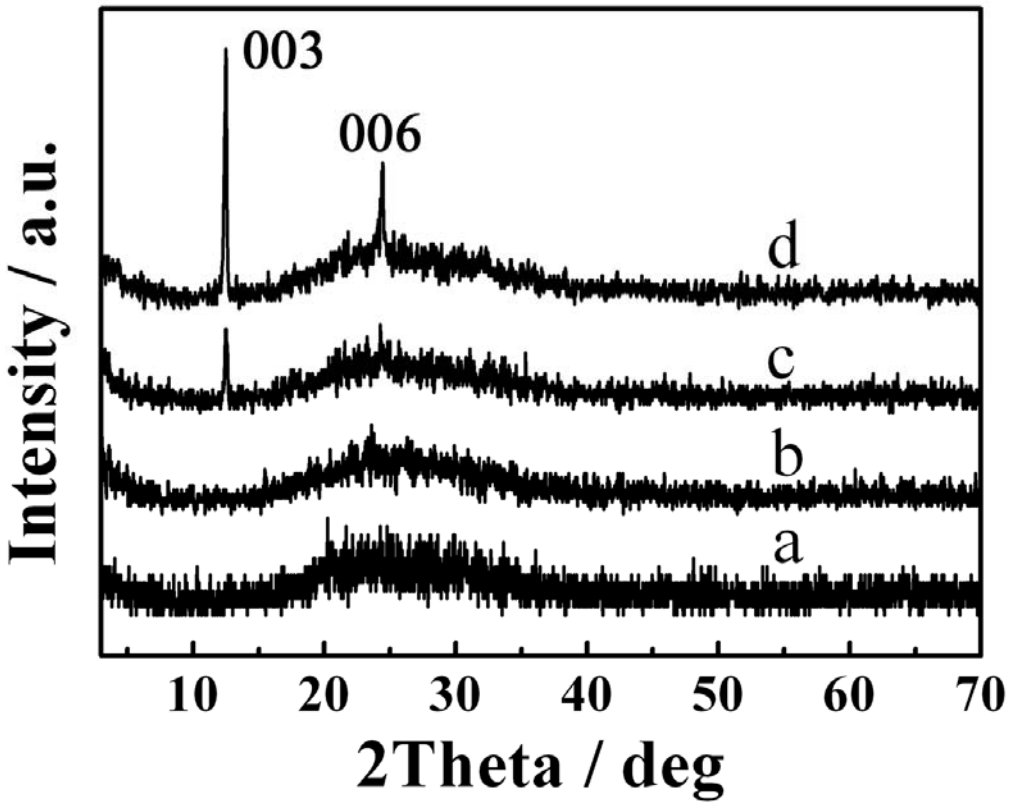

Fig. S2 The XRD pattern of (a) the substrate and the PLDH-film prepared with different reaction times: (b) 3 h, (c) 6 h and (d) 9 h.

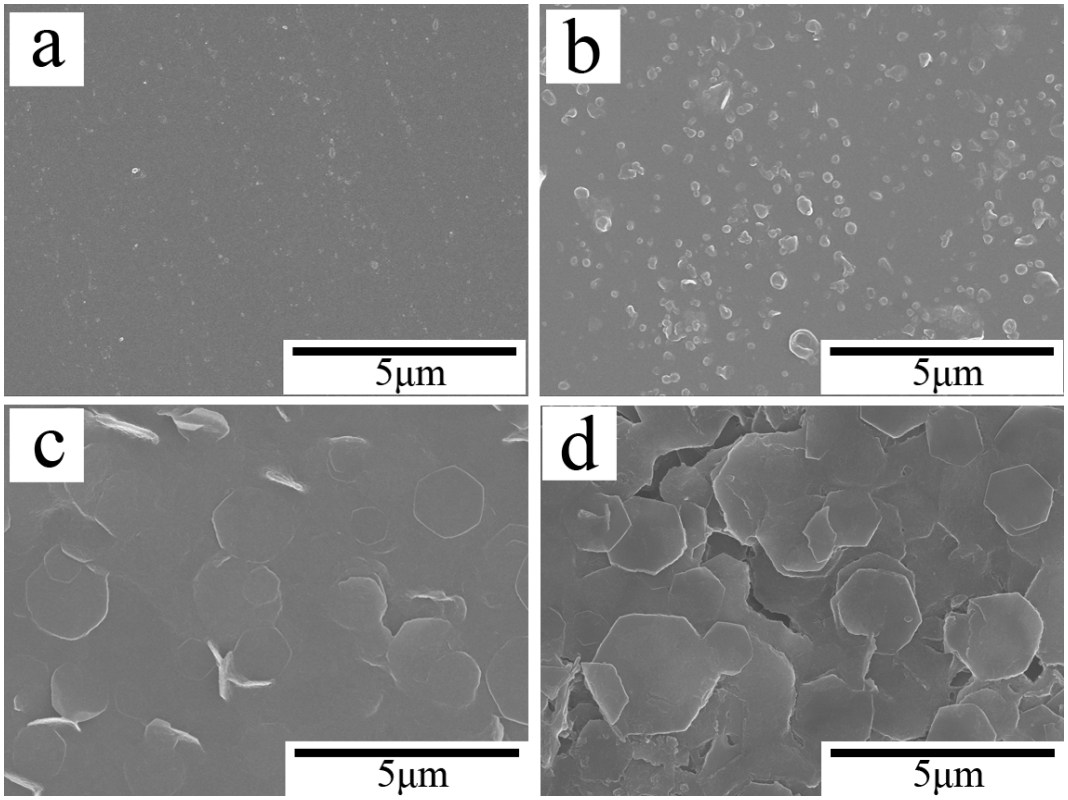

Fig. S3 SEM images of (a) the PVA modified substrate and the PLDH-film prepared with different reaction times: (b) 3 h, (c) 6 h and (d) 9 h.

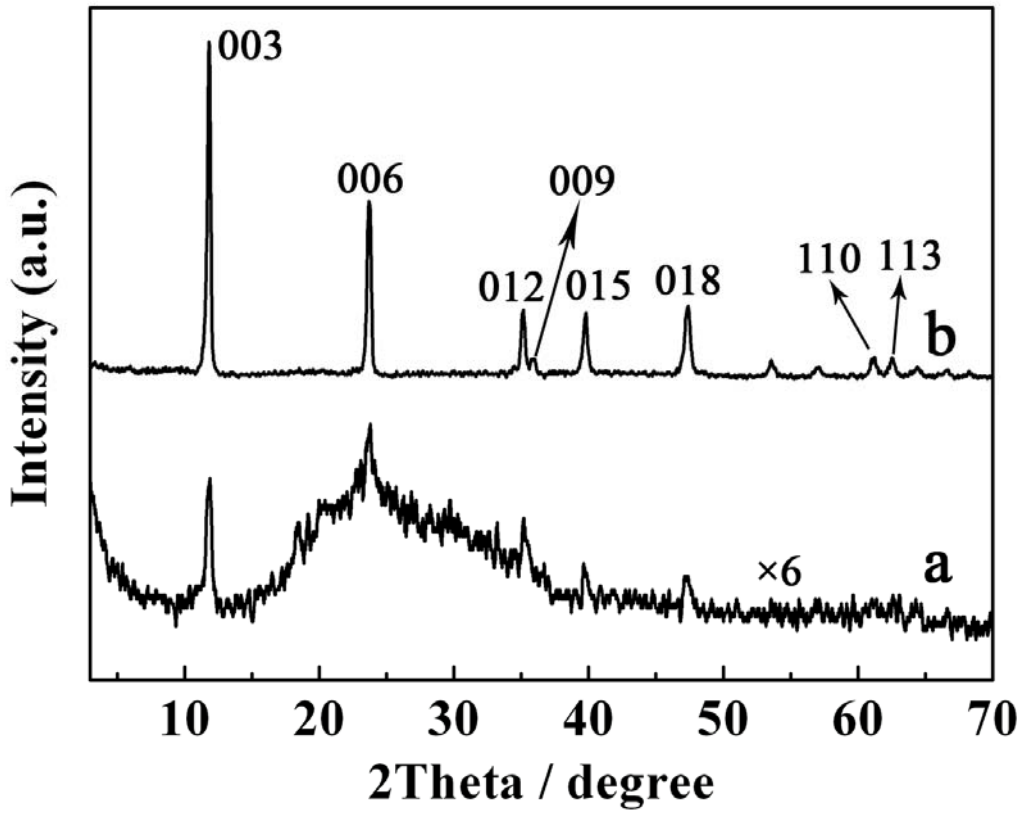

Fig. S4 The XRD pattern of (a) the powder scraped from the PLDH-film and (b) the LDH obtained under the same hydrothermal conditions (reaction at 90 °C for 9 h) in the absence of the substrate.

From Fig. S4a, we could notice that the XRD pattern of the powder scraped from PLDH-film exhibited the characteristic reflections of the LDH structure, which confirms the formation of the LDH film on the PVA-modified glass substrate. Figure S4b shows the XRD pattern of the LDH obtained under the same hydrothermal conditions in the absence of the substrate. A series of LDH peaks appearing as symmetric, strong lines can be observed which proves that LDH can be fabricated under the same hydrothermal conditions in the absence of the substrate.

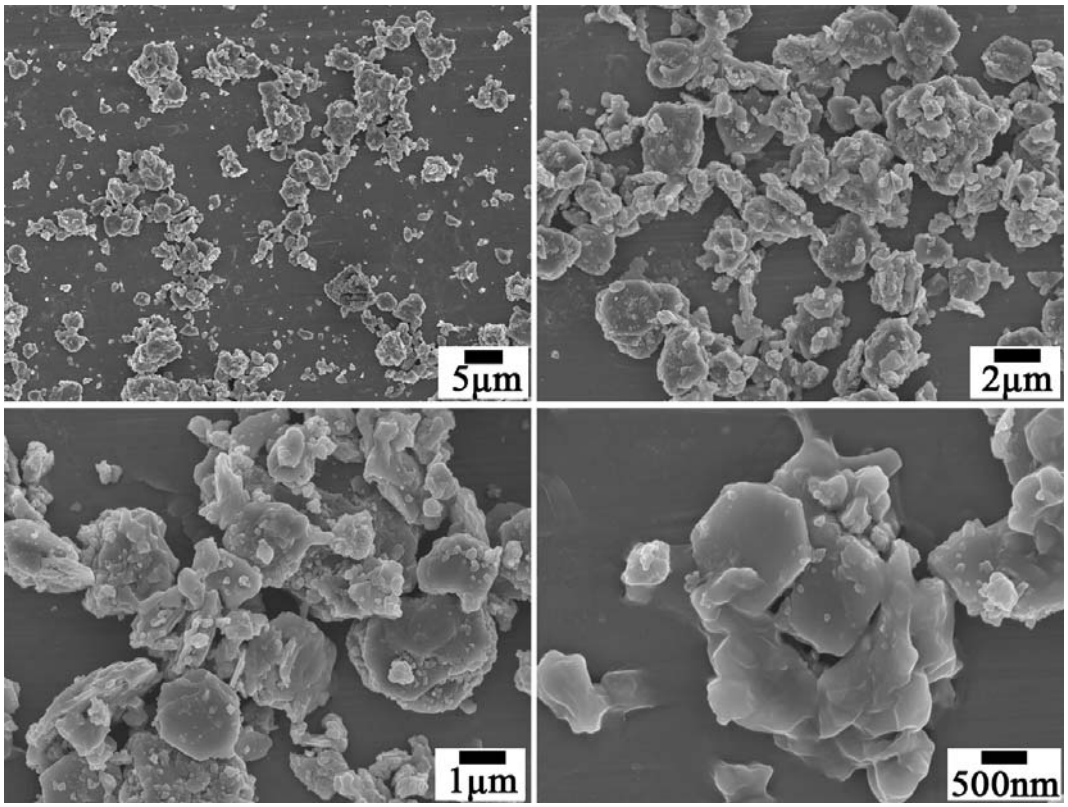

Fig. S5 SEM images of the LDH obtained under the same hydrothermal conditions (reaction at 90 °C for 9 h) in the absence of the substrate.

Fig. S5 shows the images of the LDH obtained under the same hydrothermal conditions in the absence of the substrate. The hexagonal shape and size of the LDH crystals are similar to, but not as uniform as, those in the PLDH-film.

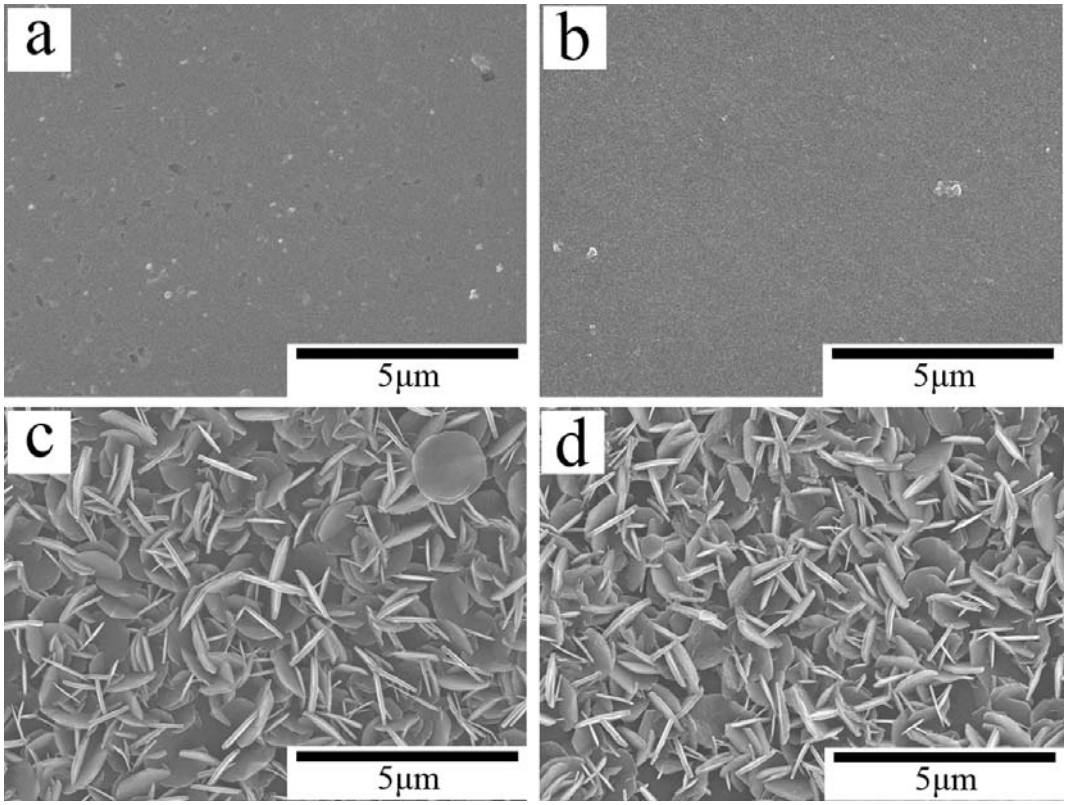

Fig. S6 SEM images of (a) the substrate and the OLDH-film prepared with different reaction times: (b) 3 h, (c) 6 h and (d) 9 h.