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Synthesis of macroporous calcium hydroxide salt xerogels in the presence of malonic acid through an epoxide-mediated alkalization reaction

Calcium hydroxide-based materials are essential in CO_2 absorbents[1], and thermochemical energy storage materials[2]. To promote these applications, introducing pores into calcium hydroxide-based materials and precisely controlling their morphology are promising approaches. In this study, macroporous calcium hydroxide salt xerogels were synthesized in the presence of malonic acid (MA) through an epoxide-mediated alkalization reaction induced by propylene oxide. The precise control of porous morphology was successfully achieved.

Fig. 1 shows SEM images and appearance of dried samples prepared without and with MA. The sample prepared without MA resulted in white precipitates and showed 10 μm rod-shaped crystals (Fig. 1a). Meanwhile, the sample prepared with MA formed monolithic gels with a three-dimensionally interconnected macroporous structure (Fig. 1b). These results suggest that MA acts as a crystal growth inhibitor, preventing bulk crystal precipitation and allowing for the formation of monolithic and porous gels. In addition, we found that this synthetic route enables dynamic control over the structure size by simply adjusting the aging time of the wet gels.

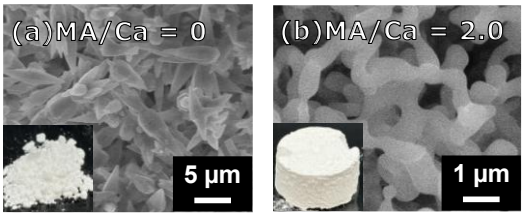

Fig. 1 SEM images and appearance of dried samples prepared at
(a) MA/Ca = 0 and (b) MA/Ca = 2.0.

1) H. Zhang, R. Liu, T. Ning, R. Lal, *Environ. Chem. Lett, 16*, 1095-1100, (2018).
2) A. Shkatulov, Y. Aristov, *Energy*, 85, 667-676, (2015).