

Study on experiment and a mechanism of utilization of calcite in phosphor removal from eutrophic water

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Experiment of Dephosphorization of Calcite

Experiment reagents and minerals : $K_2HPO_4 \cdot 3H_2O$, NaF, $CaCl_2$, Calcite (#160-#200). Firstly, we analyze the P-bearing solution at room temperature in order to study whether calcite has the function of dephosphorization or not, and its effect. Each group is same in concentration but different in additional material kinds. Compared with results of all groups, we can found that P concentration of solution in these groups that had added calcite crystal seed declined significantly. The P concentration could be dropped down to below 2.7mg/l and the lowest value is 0.247mg/l ; However, there is no change in P concentration of solution in the group1-1, 1-2 without addition of calcite. It is obviously that the addition of calcite crystal seed is beneficial to P precipitation in solution. Therefore, results of experiment show that calcite can promote the decrease of P concentration in water bodies. Attenuation rates of P concentration of solution is different: 88.48%, 69.94%, 12.68% when the initial P concentration of solution is 5mg/l, 3mg/l and 1mg/l respectively.

Discussion and Results

The experimental results conducted by Dietfried Donnert and Manfred Saleker [1] or Li Zuyin, Lv Jialong [2] indicate that calcite can induce the precipitation of phosphorus high P concentration (≥ 20 mg/l or 20-500 mg/l). In above mentioned experiment, initial phosphorus concentration is only 5.26mg/l, far below the P concentration in those dephosphorization experiments. This indicates that calcite still has dephosphorization in a low P concentration of solution. The result of TEM shows that the Ca-P precipitation of experiments is not crystalline and no phosphor precipitation occurs at the surface of calcite.

[1] Donnert & Saleker (1999) *Wat. Sci. Tech.* **40**, 195-202.

[2] Li & Lv (1995) *Soil* **6**,304-310 (in Chinese).

Nano-minerals: Size-dependent crystal structure, shape and chemical reactivity changes

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Nano-phase minerals (or nano-minerals) are common in the earth environments, especially in the critical zone where the fluids meet the solid earth. The behaviors of nano-minerals are different from their macroscopic crystals. The size-dependent property of the nano-minerals is important for us to better understand geochemical processes in the earth system. Integrated experimental study and computer modeling will help us to know nano-crystals' properties and their formation processes. Both shape and size of nano-crystals will affect their stability and reactivity. In CdS (greenockite) nano-crystal system, aspect ratio of the stable crystal shape increases as the crystal size decreases [1]. Growth of the crystals through oriented attachment nano-crystals will result in very long 1-D crystal (nano-fiber) and 2-D nanoplate. In the zirconia system, thermodynamically unstable tetragonal phase becomes stable when the crystal size becomes small (< 13 nm). The sized-dependent phase transition between the tetragonal and monoclinic (baddeleyite) structure also depends on crystal shapes [2].

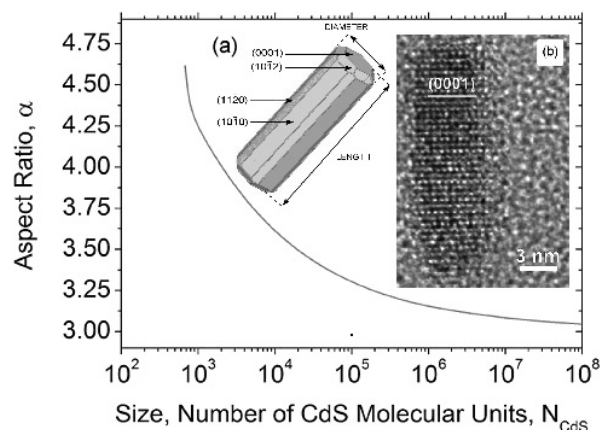


Figure 1: HRTEM image and DFT calculation showing the calculated crystal shape and aspect ratio of CdS as function of size.

[1] Barnard & Xu (2007) *Journal of Physical Chemistry* **111**, 18112-18117. [2] Barnard *et al.* (2006) *Nanotechnology* **17**, 3039-3047.