Abstract Submitted
for the MAR15 Meeting of
The American Physical Society

Growth Mechanism of Pumpkin-Shaped Vaterite Hierarchical Structures[1] GUOBIN MA, YIFEI XU, MU WANG, National Laboratory of Solid State Microstructures, and School of Physics, Nanjing University, Nanjing 210093 — $CaCO_3$-based biominerals possess sophisticated hierarchical structures and promising mechanical properties. Recent researches imply that vaterite may play an important role in formation of $CaCO_3$-based biominerals. However, as a less common polymorph of $CaCO_3$, the growth mechanism of vaterite remains not very clear. Here we report the growth of a pumpkin-shaped vaterite hierarchical structure with a six-fold symmetrical axis and lamellar microstructure. We demonstrate that the growth is controlled by supersaturation and the intrinsic crystallographic anisotropy of vaterite. For the scenario of high supersaturation, the nucleation rate is higher than the lateral extension rate, favoring the "double-leaf" spherulitic growth. Meanwhile, nucleation occurs preferentially in $< 11\bar{2}0 >$ as determined by the crystalline structure of vaterite, modulating the grown products with a hexagonal symmetry. The results are beneficial for an in-depth understanding of the biomineralization of $CaCO_3$. The growth mechanism may also be applicable to interpret the formation of similar hierarchical structures of other materials.

[1]The authors gratefully acknowledge the financial support from National Science Foundation of China (Grant Nos. 51172104 and 50972057) and National Key Basic Research Program of China (Grant No. 2010CB630705).

Guobin Ma
National Laboratory of Solid State Microstructures, and
School of Physics, Nanjing University, Nanjing 210093

Date submitted: 15 Nov 2014 Electronic form version 1.4