Systematic analysis of crystal growth rate and morphology of $CaCO_3$ synthesis through *in situ* optical microscopy combined with microfluidic device and change of the proportion of $CaCO_3$ crystal phase according to functionalized hyperbranched polymer additives

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Biomineralization has been widely studied to control and understand its mechanism in natural-synthetic systems. Calcium carbonate ($CaCO_3$) is one of the most abundant and important biominerals present in the natural environment. Many additives including polymer and protein, are studied for self-assembly of $CaCO_3$ for various morphologies and applications because of their several advantages. Under natural conditions, however, the formation of $CaCO_3$ occurs slowly.

Herein, We designed several functionalized materials based on the hyperbranched polymer (HBP) which affects the formation of $CaCO_3$ crystalline structure. In particular, through an optical microscope combined with a microfluidic device, the pattern and rate of initial stage crystal growth and the morphology of the final crystal phase will be statistically calculated and derived *in situ*. Finally, we have a plan to developing a system that can accelerate $CaCO_3$ formation and systematic analysis.