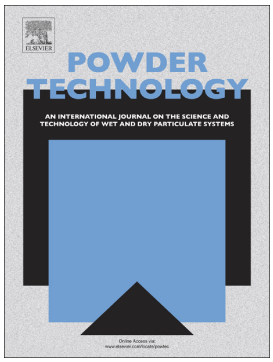

Controllable synthesis of all the anhydrous CaCO3 polymorphs with various morphologies in CaCl2-NH3-CO2 aqueous system

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Controllable synthesis of all the anhydrous $CaCO_3$ polymorphs with various morphologies in $CaCl_2$-NH_3-CO_2 aqueous system

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Abstract: Polymorphism- or morphology-controllable synthesis of $CaCO_3$ is of significance. Usually only calcite $CaCO_3$ can be obtained from the ordinary CO_2-$Ca(OH)_2$ solution route; the very low solubility of $Ca(OH)_2$ also causes many defects with this route. The route by $CaCl_2$ and Na_2CO_3 exhibits some advantages, but the consumption of Na_2CO_3 is a deficiency. Therefore, this work studies the precipitation of $CaCO_3$ with $CaCl_2$ in NH_3-CO_2 aqueous solution, which will make the overall reaction *"$CaCO_3 \rightarrow CaCO_3$"* if tracing the origin of the reactants. A main focus of the present work is to elucidate how to obtain various $CaCO_3$ polymorphs with different morphologies through this synthesis system and the corresponding crystal growth mechanism. The results show that, just by simply regulating the reaction conditions, all three anhydrous $CaCO_3$ polymorphs with various morphologies (e.g., cubic, lamellar, spherical, needle-like and branched) can be obtained in the absence of any additives. The crystal growth process can be well explained based on either Ostwald ripening or dissolution-recrystallization mechanism, depending on the reaction conditions. In addition, the rare phase transition of metastable vaterite to metastable aragonite can also be obtained from the present synthesis system, besides the usual phase transition of vaterite to the most thermodynamically stable calcite. This work provides the essential theoretical support for

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