Engineered peptoids mimic protein-induced $CaCO_3$ mineralization for CO_2 sequestration

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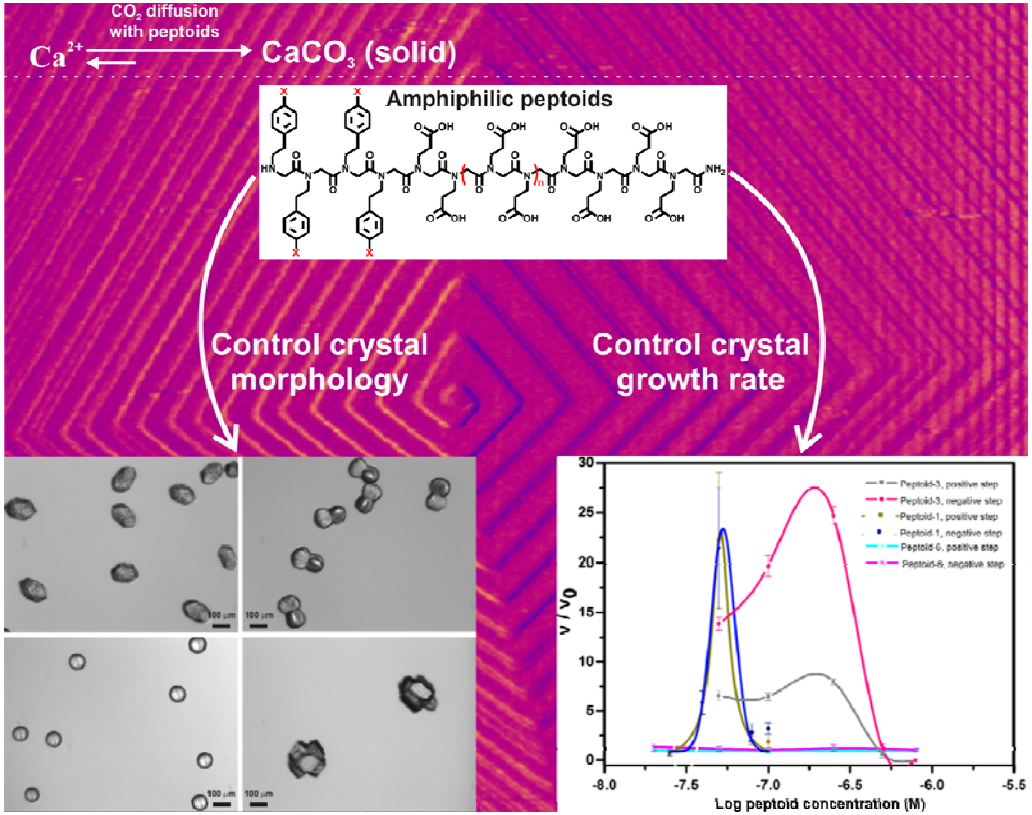

Engineered non-natural polymers (peptoids) direct $CaCO_3$ crystal morphology (left) and dramatically accelerate growth (right) as determined by measurement of step speed in the presence of peptoid (v) relative to pure system (v_0).

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- CO_2 emission is the single largest anthropogenic source of global warming. One promising option for reducing CO_2 emissions is to capture the gas and store it permanently by converting it to thermodynamically stable carbonate minerals in underground geological reservoirs.
- Properly designed synthetic molecules that mimic natural protein induced mineralization of $CaCO_3$, but are much more stable against high pressures, temperature, acidic conditions and protease digestion might enable a technology that is broadly applicable to industrial crystallization, including CO_2 sequestration.
- This study shows that sequence-specific and highly stable non-natural polymers (peptoids) dramatically impact $CaCO_3$ mineralization by controlling crystal morphology and giving unprecedented 20-fold rate enhancements at only 50 nM (Figure).
- Both morphology and rate control were observed to depend on peptoid sequence, side chain chemistry, chain length and concentration.
- Available data suggest that a suite of peptoids can be developed to direct the timing and rate of carbonate crystallization.