

Unlocking Ikaite's Potential: A Novel Approach to Carbon Capture and Transformation into Premium Calcium Carbonate

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Harnessing Nature's Design: Laboratory Advancements in Ikaite Synthesis for Climate Mitigation

Ikaite, a rare and metastable calcium carbonate mineral, forms under very specific micro-environmental conditions, when high pH, carbonate-rich waters mix with cold seawater. A prime example of its natural occurrence is the Ikka Columns in Ikka Fjord, Greenland, which house over a thousand extensive columnar formations. These structures are in a constant state of evolution: while new ikaite material forms, older structures gradually recrystallize into other carbonate minerals as calcite and monohydrocalcite (Pauly 1963, Buchardt et al. 2001). Ikaite has previously been proposed as having a carbon mineral storage potential (Stockmann et al. 2018). Research into this natural ikaite system has revealed its potential as a model for an advanced carbon capture, storage and utilization (CCSU) methodology. Laboratory simulations, combined with extensive optimizations of the ikaite synthesis process, have showcased a method of CO₂ capture characterized by efficiency and low energy consumption, utilizing CO₂ as the primary carbon source. In the face of rising global temperatures, there's a pronounced emphasis on the importance of rigorous scientific and policy measures to combat the effects of anthropogenic climate change. This research underscores a series of carefully controlled reactions that involve ikaite synthesis via specialized membranes. These reactions effectively capture CO₂, whether sourced from flue gas or purer CO₂ forms, with the carbon securely embedded within the molecular lattice, leading to the formation of carbon-negative Calcium Carbonate. By harnessing green energy, technological advancements, and the inherent scalability of this method, it holds promise as a pivotal strategy in climate change mitigation, especially for major CO₂ emitters. The ultimate outcome is the capture of CO₂ and its conversion into premium-grade Calcium Carbonate, suitable for a wide array of industries and products.

References

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