## Abstract Submitted for the MAR13 Meeting of The American Physical Society

Reaction-diffusion controlled growth of complex structures<sup>1</sup> WILLEM NOORDUIN, Harvard University, School of Engineering and Applied Sciences, L. MAHADEVAN, Harvard University, School of Engineering and Applied Sciences, Wyss Institute for Biologically Inspired Engineering, JOANNA AIZEN-BERG, Harvard University, School of Engineering and Applied Sciences, Wyss Institute for Biologically Inspired Engineering, Department of Chemistry — Understanding how the emergence of complex forms and shapes in biominerals came about is both of fundamental and practical interest. Although biomineralization processes and organization strategies to give higher order architectures have been studied extensively, synthetic approaches to mimic these self-assembled structures are highly complex and have been difficult to emulate, let alone replicate. The emergence of solution patterns has been found in reaction-diffusion systems such as Turing patterns and the BZ reaction. Intrigued by this spontaneous formation of complexity we explored if similar processes can lead to patterns in the solid state. We here identify a reaction-diffusion system in which the shape of the solidified products is a direct readout of the environmental conditions. Based on insights in the underlying mechanism, we developed a toolbox of engineering strategies to deterministically sculpt patterns and shapes, and combine different morphologies to create a landscape of hierarchical multi scale-complex tectonic architectures with unprecedented levels of complexity. These findings may hold profound implications for understanding, mimicking and ultimately expanding upon nature's morphogenesis strategies, allowing the synthesis of advanced highly complex microscale materials and devices.

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