

# **Self-organization of brucite [Mg(OH)<sub>2</sub>] crystal morphology and orientation during periclase [MgO] hydration**

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Hydration of periclase [MgO] is a volume-expansive reaction, which leads to the formation of brucite [Mg(OH)<sub>2</sub>]. From a technological perspective, this hydration reaction is either a desirable process for brucite synthesis and thermochemical energy storage or an undesirable phenomenon in the use of MgO as a refractory material. Although numerous studies have attempted to understand the key aspects affecting the MgO hydration mechanisms and the related formation pathways for the distinct brucite crystal morphologies, the kinetic and thermodynamic controls on pre-defining form, size, shape and orientation of the documented brucite are still debated. Therefore, experiments were conducted to monitor and assess the evolution of the reactive solution, the MgO-Mg(OH)<sub>2</sub> conversion and the morphological development of the hydration products. It was found that the reactive surface area of the MgO raw material is the main controlling factor on the overall hydration progress and is almost independent on the degree of its purity (e.g., MgO content). However, the ongoing and immediate dissolution of product impurities (CaO, CaCO<sub>3</sub>, Ca-Mg-Fe silicates, etc.) is strongly affecting the self-adjusting pH during hydration. The pH and the associated charge distribution of the MgO surface and its hydration products are suggested to have distinct control over the individual morphology, orientation and self-organization of the newly formed brucite crystals. This contribution may shed light on the complex interplay between surface-dominated versus bulk fluid processes and will help to optimize and tailor brucite synthesis.