

Early cement hydration kinetics: VSI/AFM/kMC results

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The environmental significance of cement is well known, and attempts to reduce CO₂ and collateral impacts underwrite the need to understand the primary reactions governing the early hydration of cementitious materials. This understanding also facilitates the development and use of inorganic (aluminate, sulfate) and organic additives to control basic properties and performance. However, in comparison to natural silicates such as quartz and feldspar, direct observation of the dissolution of tricalcium silicate, the primary component in Portland cement, and the coupled development of various hydrate phases, is relatively new, and the surface reaction kinetics that orchestrate these complex processes are poorly understood. Here we provide results from ongoing research designed to illuminate the dynamics of Ca₃SiO₅ dissolution using *in situ* surface microscopy (vertical scanning interferometry, fast scanning AFM), and kinetic Monte Carlo simulations (Fig. 1).

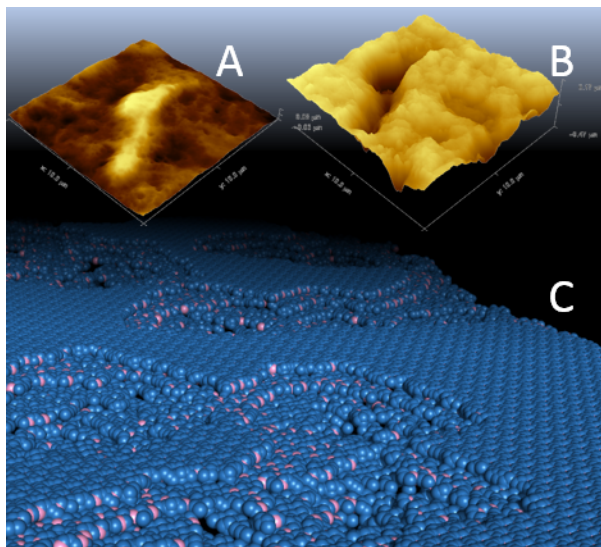


Figure 1: Triclinic Ca₃SiO₅ surface prior to (A) and after 30 m (B) reaction in pure water (TAFM); (C) Evolution of nascent etch pits on Ca₃SiO₅ surface using kMC model.