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# View Abstract

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**ABSTRACT SYMPOSIUM NAME:** WISE: Women in Environmental Science & Engineering (Invited)

**ABSTRACT SYMPOSIUM PROGRAM AREA NAME:** ENVR

**CONTROL ID:** 3579127

**PRESENTATION TYPE:** Oral Only : Do not consider for Sci-Mix

**TITLE:** Nucleation and Nanoscale Interfacial Processes for Resilient and Sustainable Water-Energy Systems

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**ABSTRACT BODY:**

**Abstract:** Our potable water resources are increasingly stressed by climate change and rapid socioeconomic development. Development demands more energy and electricity, whose production also consumes clean water, aggravating the stress. The resiliency and sustainability of these co-dependent water-energy systems are affected by calcium carbonate (CaCO<sub>3</sub>) formation, commonly found in carbon dioxide utilization and mineralization processes, pipeline scaling, water purification membrane processes, and energy-related subsurface operations. In this talk, I will discuss new experimental ways to quantify the interfacial energy of CaCO<sub>3</sub>-on-quartz substrates *in situ* and to explore its roles in CaCO<sub>3</sub> nucleation in environmental systems. To investigate the size and total particle volume of heterogeneously formed CaCO<sub>3</sub> nanoparticles *in situ* and in real-time, we utilized grazing incidence small-angle X-ray scattering (GISAXS) along with atomic force microscopy (AFM) and other surface-sensitive techniques. Using these techniques and classical nucleation theory, we determined, for the first time, the apparent activation energy and the pre-exponential kinetic factor of heterogeneous calcium carbonate nucleation on quartz at different salinities and temperatures. We also examined the impacts of environmentally-abundant sulfate ions on CaCO<sub>3</sub> heterogeneous nucleation. The thermodynamic and kinetic information obtained in this study can be used to improve reactive transport models and to more accurately predict the fate and transport of contaminants and nutrients in the environment. The results could also aid in controlling scale formation in pipelines and on desalination membranes.

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