



# CEE595AG Seminar

Department of Civil and Environmental Engineering

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## A Semi-Automated Multi-Endpoint ROS (Reactive oxygen species) Analyzer (SAMERA)

The oxidative potential (OP) of ambient particulate matter (PM), i.e. the ability to generate reactive oxygen species (ROS) in the presence of a biological reductant, has been investigated for a long period of time. Both dithiothreitol (DTT) and surrogate lung fluid (SLF) are widely adopted as the probes to determine OP. A semi-automated system was built based on these two antioxidant probes. Five endpoints out from the two probes, including the consumption of DTT, ascorbic acid (AA) and glutathione (GSH), as well as the generation of hydroxyl radical ( $\bullet\text{OH}$ ) in DTT and SLF, were used as OP indicators. An automated Kloehn control pump system with sample injection valve was used to automate the protocol. A liquid wavelength capillary cell (LWCC) and a Horiba spectrofluorometer were used for the measurement of five endpoints. The system was calibrated with pure substances (i.e. Cu, Fe, phenanthraquinone and 5-hydroxy-1,4-naphthoquinone) as the positive controls, and was then tested for its performance with the real ambient PM samples collected from an urban site. The detection limit and precision of the system were evaluated. We anticipate that system can be coupled to a PM sampling device to monitor the oxidative potential of ambient PM in real-time.

Josue Lopez

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## Tailoring calcite growth through an amorphous precursor in a hydrogel environment

The precipitation of calcium carbonate in hydrogel-like environments is a widely used strategy by marine organisms to build functional mineral-organic composite structures. Here, we investigate a pathway for calcium carbonate mineralization in agarose hydrogels with a wide range of polymer networks. The experimental investigation demonstrates that the formation and the dissolution of ACC within the agarose hydrogels are diffusion-limited processes, and therefore, they are affected by the supersaturation of the solution and by the hydrogel network. In contrast, both the inclusion of the polymer into the calcite crystals and their morphology as well as the rate of crystal growth are quite unaffected by the supersaturation, demonstrating that the precipitation of ACC affords a tight control of calcium carbonate mineralization in the hydrogel over a wide range of calcium carbonate and agarose concentrations. The results of this work not only reveal an important mechanism underlying (bio)mineralization but it can also inspire a new avenue to craft biomimetic materials with a high degree of precision.

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