2021-2022 ANALYTICAL CHEMISTRY SEMINAR SERIES

Droplet like it's hot

How chemistry changes in tiny volumes

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How is chemical reactivity different in sub-microliter volumes compared to bulk, continuous phases? For centuries, chemists have assumed that chemical reactivity is similar in the ocean as it is in a lysosome despite volume differences spanning nearly 40 orders of magnitude. While measurement science techniques exist to probe reactivity in small volumes, they suffer in their ability to characterize femtoliter (1E-15 L) or smaller nanodroplets, one at a time. This talk will detail our group's efforts in developing nanoelectrochemical methods to study reactivity in water micro- and nanodroplets. We will demonstrate the heterogeneous growth of a new phase does not depend on the water nanodroplet size, but the heterogeneous nucleation kinetics can be enhanced in such complex environments due to localized surface concentration supersaturation.

Due to rapid mass transfer within nanodroplets, we will demonstrate the possibility of electrosynthesizing high entropy alloy nanoparticles at room temperature. Finally, we will demonstrate that homogeneous enzymatic reaction rates are accelerated in water nanodroplets and that the rate is inversely proportional to the nanodroplet size. The talk will end with a future outlook on the role such experiments can play in understanding how nature takes advantage of nanoconfinement in the genesis and propagation of life.

SEPTEMBER 13, NOON - 1:00PM

CHAPMAN 125 + ZOOM