ANALYTICAL SEMINAR

Microdroplet Interface Chemistry: Analytical Approaches to Atmospheric Reactivity

Professor Marcelo I. Guzman

Department of Chemistry
University of Kentucky

Understanding chemical transformations at microdroplet interfaces is critical for unraveling the complexity of atmospheric aerosols and their influence on atmospheric processes and air quality. This presentation highlights analytical approaches to investigate oxidative reactions of organic and inorganic compounds at the air–water interface of microdroplets, simulating conditions found in aerosols, fog, and clouds. Comparative studies with thin films under high humidity offer insight into both shared and distinct interfacial reactivity patterns, helping to elucidate the role of environmental conditions in surface-mediated chemical transformations. We use surface-sensitive online electrospray ionization mass spectrometry (OESI-MS) and time-resolved techniques (i.e., FTIR, UV-vis spectroscopy, ion chromatography, and UHPLC-MS) to characterize rapid interfacial reactions involving catechols, phenolic aldehydes, carboxylic acids, and halides with oxidants such as ozone, hydroxyl radicals, and nitrate radicals. Cyclic voltammetry supports mechanistic interpretations. Our findings show that substituted catechols and phenolic aldehydes undergo spontaneous ultrafast oxidation via electron transfer, forming semiquinone radicals, polyphenols, and carboxylic acids that contribute to brown carbon and secondary organic aerosol formation. Halide oxidation yields reactive iodine species, including hypoiodous acid and molecular iodine, that contribute to ozone depletion in marine boundary layers. This work underscores the importance of interfacial chemistry in accelerating transformations inaccessible in bulk or gas phases, offering mechanistic insight into aerosol evolution and atmospheric processes.

Tuesday, November 4, 2025 | **3:30 pm** | **WTHR 172**

PURDUE UNIVERSITY | James Tarpo Jr. and Margaret Tarpo Department of Chemistry