Monoterpene Gas-Phase Oxidation and Secondary Organic Aerosol Formation: New Insights into RO2 Autoxidation and Chemical Composition

**Abstract:**

Atmospheric secondary organic aerosols (SOA) play a crucial but poorly understood role in affecting air quality, the Earth’s radiative balance, and human health. Therefore, an accurate understanding of the gas-phase oxidation mechanism leading to SOA formation is crucial to elucidate the SOA composition and hence their environmental impacts. Monoterpenes are a class of volatile organic compounds (VOC) that are substantially emitted from biogenic sources. In forested regions such as the southeastern United States and the boreal forests, it has been reported that almost half of the total OA mass could come from monoterpene oxidation. In recent years, gas-phase peroxy radical (RO2) autoxidation from monoterpene oxidation has been suggested to account for a major fraction of RO2 fates under atmospheric conditions, but key gaps still exist regarding the autoxidation rate constants and products. In this seminar, two representative monoterpene oxidation systems will be presented: -pinene ozonolysis and limonene + nitrate radical oxidation. In both systems, the gas-phase RO2 autoxidation mechanisms were probed using an iodide-adduct chemical ionization mass spectrometer, where direct RO2 measurement was achieved. Through the chemical analysis coupling with kinetic simulations, the RO2 autoxidation rate constants were constrained. The SOA chemical composition from the two monoterpene oxidation systems were characterized with an ion-mobility spectrometry mass spectrometer to achieve isomer separation. The analyses provide new insights into the monoterpene RO2 autoxidation chemistry and SOA formation pathways.

**Biography:**

Professor Haofei Zhang obtained his bachelor’s degree from Shanghai Jiaotong University in 2008, and his PhD from the Department of Environmental Sciences at UNC Chapel Hill, in 2012, under the guidance of Professors Richard Kamens and Jason Surratt. Haofei was Rich’s last PhD student and Jason’s first PhD student. After his PhD, Haofei joined Lawrence Berkeley National Laboratory and UC Berkeley as a Dreyfus Environmental Chemistry postdoc fellow, before starting his tenure-track professor appointment at the Department of Chemistry of UC Riverside in 2017. In Haofei’s past academic career, he has focused on understanding the chemical mechanisms that lead to atmospheric oxidation of volatile organic compounds, formation of secondary organic aerosols, and the chemical evolution of organic aerosols. Haofei’s research uses various types of mass spectrometry techniques in atmospheric chemistry studies. His recent research interests include nighttime oxidation of biomass burning-derived volatile organic compounds and brown carbon formation, phase state of isoprene-derived secondary organic aerosol, and organic aerosol interfacial peroxy radical dynamics during multiphase aging. These projects are currently supported by multiple NSF grants.