DEPARTMENT OF CHEMISTRY AND ENVIRONMENTAL SCIENCE

SPRING 2018 GRAD SEMINAR SERIES

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GUEST SPEAKER

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TOPIC

Measurements of Atmospheric New Particle Formation in Urban Shanghai

ABSTRACT

Atmospheric nucleation of gas-phase precursors to clusters and then further to nanoparticles is the largest source of atmospheric aerosol particles. According to both observation and theoretical arguments, new particle formation usually requires a relatively high H2SO4 concentration to promote the formation of new particles and a low pre-existing aerosol loading to minimize the sink of new particles. Here, we investigated new particle formation by measuring the number size distributions of atmospheric aerosol particles down to 1.5 nm and the chemical composition of key gas-phase precursors and clusters in urban Shanghai, where the concentration of pre-existing particles is at the high end around the world. We were able to observe both precursor vapors (H2SO4) and initial clusters at a molecular level. High new particle formation rates were observed to coincide with several familiar markers suggestive of H2SO4-dimethylamine (DMA)-H2O nucleation, including sulfuric acid dimers and H2SO4-DMA clusters. The initial growth up to around 3 nm could be explained qualitatively by H2SO4 and neutralizing bases under the very high urban condensation sink, whereas the subsequent faster growth rate above this size is believed to result from the added contribution of condensing organic species. In addition, we present the development of a high-resolution time-of-flight chemical ionization mass spectrometer (HR-ToF-CIMS) method, utilizing protonated ethanol as reagent ions to simultaneously detect atmospheric gaseous amines (C1 to C6) and amides (C1 to C6) that are highly related to atmospheric new particle formation. These findings will help to understand urban new particle formation and its air quality and climate impact as well as to formulate policies to mitigate secondary particle formation in China.

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