2.046 New insight into the role of H2SO4 seeds in SOA formation from toluene and isoprene.

Presenting Author:

Yongfu XU, State Key Laboratory of Atmospheric Boundary Layer Physics and Atmospheric Chemistry, Institute of Atmospheric Physics, Chinese Academy of Sciences, Beijing 100029, China, xyf@mail.iap.ac.cn

Co-Authors:

Long Jia, State Key Laboratory of Atmospheric Boundary Layer Physics and Atmospheric Chemistry, Institute of Atmospheric Physics, Chinese Academy of Sciences, Beijing 100029, China

Abstract:

In general, it is difficult to generate SOA through homogenous mechanisms. Preexisting seeds play a vital role in SOA formation. Chamber experiments have been used to demonstrate how background H_2SO_4 seeds affect SOA formation in toluene-NO_2 and isoprene-NO_2 irradiations. H_2SO_4 is generally formed from the gas-phase oxidation of SO_2 by OH. In toluene-NO_2 irradiations, the burst time of particles was delayed by 3 (2) hours in ultra-pure background air in which SO_2 concentrations were well below the SO_2 analyzer detection limit of 50 ppt as compared to that in background air in which SO_2 concentrations were around 1 ppb under dry (humid) conditions. The maximum number concentrations of particles were only 10^2/cm^3 in ultra-pure background air, compared to 10^4 /cm^3 in background air. In addition, the maximum mass concentrations of SOA in ultra-pure background air were only about 8 μg/m^3 under both dry and humid conditions after 6 hours of reaction, compared to the concentrations of about 75 μg/m^3 (dry) and 165 μg/m^3 (humid) in background air. In isoprene-NO_2 irradiations, both OH and O_3 are important oxidants. In isoprene-OH irradiations, background SO_2 had a great positive effect on SOA formation, which is similar to toluene-NO_2 irradiations. However, in the ozonolysis of isoprene particles were mainly formed by self-nucleation of organic products. It is concluded that background H_2SO_4 particlesare the major seeds in the OH oxidation channel of toluene and isoprene, which enhance SOA formation through the acid-catalyzed particle-phase reactions, while theyhave little effect on the O_3 channel oxidation of isoprene due to self-nucleation of the stabilized Criegee intermediates-related products.