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Chemistry and Aerosol Model Study of the alpha-Pinene Oxidation by OH, O_3, and NO_3 in the Atmosphere Simulation Chamber SAPHIR

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The 270 m^3 outdoor atmosphere simulation chamber SAPHIR in Jülich was designed to study homogeneous gas phase chemistry at low concentrations that are relevant for atmospheric processes. Recently, analytical instruments for particle characterization have been installed including a water-based condensation particle counter (WCPC), a scanning mobility particle sizer (SMPS), and a quadrupole aerosol mass spectrometer (Q-AMS). The secondary organic aerosol (SOA) lifetime at SAPHIR ($\tau < 27$ h) is dominated by dilution by the experimental gas flow. Thus SAPHIR is a suitable platform for aerosol aging experiments at ambient conditions.

The formation of SOA following the oxidation of 10 ppbV α-pinene by each of the three major oxidants in the troposphere, OH, O_3, and NO_3 was investigated at ambient conditions, approximately 290 K, and at a relative humidity of approximately 50% (rh=0 % for NO_3) for up to two days. The measurements of α-pinene using proton transfer mass spectrometer (PTR-MS) and absolute radical concentrations using differential optical absorption spectroscopy (DOAS) are compared to a model calculation of the gas phase using the Master Chemical Mechanism (MCM v3). Independently, WCPC and SMPS data were compared with a SOA model for the evolution of the particle size distribution.

Measurements of the α-pinene decay and the pinonaldehyde formation agree with MCM model calculations except for the oxidation with NO_3. For the latter, the for-

mation of pinonaldehyde and its consumption differed significantly from the model. At the same time NO_2 was lost compared to the model when the terpene was added, while the evaluation of the AMS data showed the formation of organic nitrate in the particle phase. The measured fractional aerosol yields are 10 % (O_3), $<$ 1 % (OH), and 4 % (NO_3). These values are within the range found in other studies and agree with our SOA model.