

## Controlled OH radical induced aerosol ageing in the ADIA simulation chamber

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OH radicals are the most important agents for oxidation of atmospheric pollutants. Furthermore they play an important role in formation and ageing of atmospheric aerosol particles e.g. like secondary organic aerosols (SOA). Since the influence of temperature on aerosol formation and ageing is one of the major uncertainties for understanding aerosol transformations (Tsigaridis et al., 2005) it seems useful to have an OH radical source in the large temperature controlled but dark AIDA aerosol chamber (Saathoff et al., 2008).

Therefore we employed controlled ozonolysis of 2,3-dimethyl-2-butene (TME) to generate OH radicals in a similar way as described by Lambe et al., (2007). Since no direct measurement of OH radicals was available the OH radical concentrations generated in the simulation chamber were calculated from the measured depletion of the OH tracer 3-pentanol. Once characterised the dark OH source was used in ageing experiments on SOA material formed by ozonolysis of  $\alpha$ -pinene and limonene under simulated tropospheric conditions in the large aerosol & cloud chamber AIDA on time scales of up to 30 hours and at temperatures between 253 and 313 K. The organic aerosol was generated by controlled oxidation with an excess of ozone and the aerosol mass concentrations were calculated from size distributions measured with differential mobility analysers (SMPS, TSI, 3071). Various instruments were used to measure the time evolutions of hydrocarbons (PTR-MS, FTIR), ozone (UV-absorption), aerosol mass & size (TOF-AMS, SMPS), number concentrations (CPC), and volatility (VTDMA). The experimental results were analysed using the aerosol behaviour code COSIMA (Naumann, 2003), supplemented by a recently developed SOA module.

According to the model analysis the OH radical levels in the AIDA chamber from ozonolysis of TME have been around some times  $10^6 \text{ cm}^{-3}$  depending on the experimental conditions. Generating the OH radicals this way in the presence of SOA from ozonolysis of  $\alpha$ -pinene and limonene resulted in additional formation of SOA mass in the order of 10-20% within two hours or less, in agreement with the predictions of numerical simulations. The additional mass formed is smaller for lower temperatures.

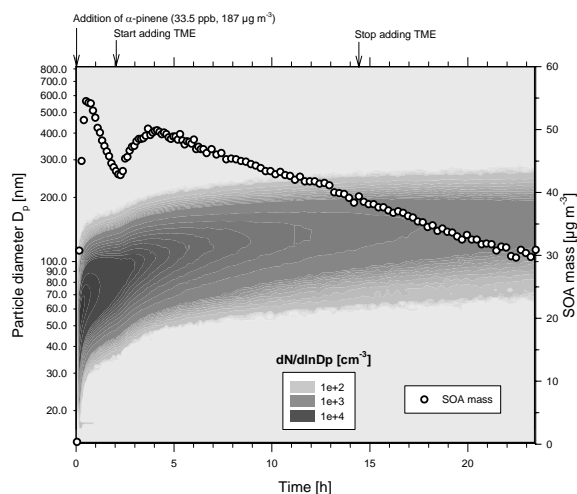


Figure 1. Evolution of size distribution and mass concentration of SOA formed by ozonolysis of  $\alpha$ -pinene and aged with OH radicals from TME oxidation at 293.4 K.

For an experiment with SOA from  $\alpha$ -pinene ozonolysis Figure 1 shows the evolution of the particle size distribution measured (SMPS) and the particle mass concentration calculated by integration of the volume size distribution using a particle density of  $1.25 \text{ g cm}^{-3}$ . Arrows indicate the start and end of OH radical generation by TME ozonolysis with an excess of 500 ppb of ozone. Please note that already during ozonolysis of the terpene OH radicals are formed which strongly influence yield and properties of the SOA particles.

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