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Alpha-Pinene Oxidation in the Presence of Seed Aerosol: Estimates of Particle Nucleation and Growth Rates, Aerosol Yield and Saturation Vapour Pressure

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A recently developed inverse modelling procedure has been applied to smog chamber measurements of particle nucleation and growth following á-pinene and SO2 oxidation. Using only the measured aerosol size distributions as input, highly time-resolved particle growth rates are obtained by regression analysis of the General Dynamic Equation (GDE). This allows the growth rate to be determined with a higher time-resolution than can be deduced from inspecting contour plots ("banana-plots"). These empirical growth rates are then used to estimate the time of formation of recently nucleated particles. The nucleation rate is determined by taking into account the particle losses that have occurred between time of nucleation and time of measurement due to coagulation and deposition to the chamber walls. An aerosol yield for á-pinene of 6% is obtained, for an initial concentration of 14 ppbv. The time dependence of the yield is shown to be at least partly due to the time needed for condensation. The presence of seed aerosol that had been exposed to á-pinene oxidation, together with an accurately known particle growth rate, enabled the estimation of the effective saturation vapor pressure of its condensable products at 1 pptv.