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Heterogeneous nucleation and growth of water vapor on meteoric smoke particle analogues at mesospheric conditions

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Sub 2 nm meteoric smoke particles (MSP) produced from the ablation and recondensation of meteoric material are believed to be the major kind of nuclei causing the formation of water ice particles in the mesopause of Earth at heights of 80-90 km. These so called noctiLucent clouds (NLC) are frequently detected during polar summer, whereas the microphysical nucleation process and subsequent growth on such small particles are understood only poorly. Parameterizing these processes results in large uncertainties especially due to a lack of experimental data on desorption energies and critical saturation for the activation of nucleation under realistic mesospheric conditions, which states the need of laboratory measurements.
We produce charged nanometer sized (2-3 nm) MSP analogues in a microwave plasma particle source and transfer them to a novel linear ion trap which allows us to trap the particles under typical mesospheric temperatures and H_2O concentrations. The adsorption of H_2O molecules on the particles surface followed by nucleation and growth can be examined by analyzing the mass distribution of the particles with a time-of-flight mass spectrometer as function of the residence time under supersaturated conditions. In this contribution we present such measurements for single positively as well as negatively charged particles which allow us to determine the desorption energy of water vapor on the investigated nanoparticles as well as the critical saturation needed to activate nucleation and subsequent growth.