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Laboratory studies of ice formation pathways from ammonium sulfate particles

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Abstract. Cirrus clouds are composed of ice particles and their formation pathways have been studied extensively in the laboratory. The ability of ammonium sulfate particles to act as nuclei for cirrus clouds has been of particular importance because of their ubiquitous presence in the upper troposphere. The results of past laboratory experiments of homogeneous ice nucleation from ammonium sulfate particles show a wide range of freezing conditions. In the present study, a flow tube apparatus equipped with Fourier transform infrared spectroscopy was used to reexamine these discrepancies. It was found that when ammonium sulfate particles were preconditioned at 100% relative humidity (RH) prior to experimentation, the particles began to freeze at conditions predicted by the homogeneous ice nucleation model developed by Koop et al. (2000). If the particles were not preconditioned at 100% RH, some froze at warmer temperatures and lower ice saturation ratios than predicted by Koop et al. (2000). It is hypothesized that a population of effloresced particles affected freezing conditions for particles that were not preconditioned at 100% RH.

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