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Immersion freezing of aqueous suspensions of K-feldspar

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Recent laboratory measurements showed an increased ice nucleation ability of Kalium-rich feldspar particles in the immersion freezing mode [1]. It was suggested that the proportion of K-feldspar in atmospherically relevant ice nuclei is related to their ice nucleation ability. The importance of K-feldspar is further supported by the field measurements, indicating that it can make a mass fraction of up to 24% in Asian and African mineral dusts [2]. In this contribution we present results of immersion freezing experiments with monodisperse droplets of aqueous suspensions of K-feldspar on a cold stage. We show that the ice nucleation activity strongly depends on i) the particle size distribution (in particular the ice nucleation properties of submicron feldspar particles) ii) the weight concentration of the particles in the aqueous suspension and thus on the total particle surface immersed into the droplets and iii) the age of the particles in an aqueous environment. Further a comparison of different K-feldspars is presented indicating that the origin and the processing methods have a significant impact on the IN activity. The mineralogical composition of feldspar samples is analyzed by means of Raman spectroscopy and a quantification of the particle surface is carried out with environmental scanning electron microscopy (ESEM). The results of freezing experiments are interpreted within the concept of ice nucleation active surface site (INAS) density, which allows a comparison with data obtained with different experimental methods (IN counters, expansion chambers, etc.)

1. Atkinson, J.D., et al., The importance of feldspar for ice nucleation by mineral dust in mixed-phase clouds. Nature, 2013. 498(7454): p. 355-358.
2. Nickovic, S., et al., Technical Note: High-resolution mineralogical database of dust-productive soils for atmospheric dust modeling. Atmospheric Chemistry and Physics, 2012. 12(2): p. 845-855.