

Interactive comment on “Ice condensation on sulfuric acid tetrahydrate: implications for polar stratospheric ice clouds” by T. J. Fortin et al.

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Received and published: 27 March 2003

General Comments:

This paper describes an experimental study of ice nucleation on sulfuric acid tetrahydrate (SAT) surfaces. SAT films were prepared by depositing SO₃ and H₂O vapors followed by a cooling and warming cycle. The transmission FTIR spectroscopy technique was used to characterize the condensed phases. Ice formation was observed to occur at a saturation ratio of 1.03 to 1.3. A microphysical model was then employed to assess type II PSC formation and dehydration, on the basis of the present experimental finding. The present results are important for understanding polar ozone depletion processes. The paper is well written.

Specific Comments

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My main comment concerns with the preparation of SAT films used in their experimental studies, which may have important implications on their conclusions. As described in the experimental section 2.1, the SAT film was formed by freezing a liquid sulfuric acid film and then warming the frozen film to 215 K. Freezing of a liquid sulfuric acid solution always produced a mixture of several crystalline forms. Hence their initially frozen sulfuric acid film contained both SAT and ice. Although a subsequent procedure was taken to evaporate ice by warming the film up to 215 K, it is highly likely that the SAT formed in their experiments was preactivated. A preactivated surface would be prone to subsequent nucleation, which may explain their observed low supersaturation for ice nucleation on SAT. This is an important point that should be clearly assessed and explained in the paper. Preactivated ice nucleation has been well documented in the literature, as discussed by Pruppacher and Klett. Preactivated nucleation of nitric acid trihydrate (NAT) on SAT has also been suggested previously (Zhang et al., GRL, 23, 1667, 1996). On the other hand, their procedure to produce the SAT film do resemble that of SAT particle formation in the stratosphere, and hence their final conclusions are entirely compatible to the stratosphere. The bottom line is that their experimental finding can be interpreted either as that (a) SAT is a good nucleation substance for ice formation or (b) a preactivated SAT surface nucleates ice efficiently. Their final conclusion that SAT particles serve efficiently as ice nuclei under the stratospheric conditions, however, remains unaffected.

Interactive comment on Atmos. Chem. Phys. Discuss., 3, 867, 2003.

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