

***Interactive comment on* “Heterogeneous freezing of single sulphuric acid solution droplets: laboratory experiments utilising an acoustic levitator” by M. Ettner et al.**

Anonymous Referee #3

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The article describes laboratory experiments on homogeneous and heterogeneous freezing of sulfuric acid solution droplets levitated in an acoustic balance. The authors compare the homogeneous freezing temperatures of pure solution droplets to the heterogeneous freezing temperatures of droplets contaminated with graphite, kaolin and montmorillonite powder. As main result they find that the increase in freezing temperature caused by the heterogeneous ice nuclei ranges from about 5°C for graphite particles to about 20°C for montmorillonite KSF. The study is of atmospheric relevance since sulfuric acid aerosol droplets are common in the upper troposphere and lower stratosphere and their homogeneous and heterogeneous freezing effects their optical and microphysical properties. The freezing agents used are good model systems for natural and anthropogenic aerosol particles. Experimental: The experimental tech-

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nique is described clearly and comprehensible and the main conclusion is probably valid. Nevertheless the results are disturbing in some aspects and should receive more attention. My main concern is: The temperatures for homogeneous freezing (red symbols in Figs. 6 and 7) seem consistently higher than observed before (Bertram 1996, Koop 1998, Vortisch 2000) (For better comparison, it would be helpful if the authors would deduce nucleation rates from their data). Even more disturbing is the fact that they scatter by as much as 15° C at any concentration. Given the steep dependence of the nucleation rate on temperature this cannot be explained by the statistical nature of freezing but might indicate some serious experimental problems. Discussion: The authors do not comment on the differences between the three mineral powders used though they exhibit significant differences in their nucleation ability. It would certainly enhance the relevance of the manuscript if the authors could characterize the size and the chemical and physical properties of both substances and relate them to the observed nucleation ability.

Interactive comment on Atmos. Chem. Phys. Discuss., 4, 1887, 2004.

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