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Heterogeneous freezing of super cooled water droplets in micrometre range- freezing on a chip

Thomas Häusler (1), Lorenz Witek (2), Laura Felgitsch (1), Regina Hitzenberger (2), and Hinrich Grothe (1)

(1) Institute of Materials Chemistry, TU Wien, Vienna, Austria (thomas.haeusler@tuwien.ac.at), (2) Institute of Aerosol Physics & Environmental Physics, University of Vienna, Vienna, Austria

A new setup to analyse the freezing behaviour of ice nucleation particles (INPs) dispersed in aqueous droplets has been developed with the aim to analyse ensembles of droplets with sizes in the micrometre range, in which INPs are immersed. Major disadvantages of conventional drop-freezing experiments like varying drop sizes or interactions between the water- oil mixture and the INP, were solved by introducing a unique freezing- chip consisting of an etched and sputtered 15x15x1 mm gold-plated silicon or pure gold film (Pummer et al., 2012; Zolles et al., 2015). Using this chip, isolated micrometre-sized droplets can be generated with sizes similar to droplets in real world clouds. The experimental set-up for drop-freezing experiments was revised and improved by establishing automated process control and image evaluation. We were able to show the efficiency and accuracy of our setup by comparing measured freezing temperatures of different INPs (Snomax®, K- feldspar, birch pollen (*Betula pendula*) washing water, juniper pollen suspension (*Juniperus communis*) and ultrapure water) with already published results (Atkinson et al., 2013; Augustin et al., 2013; Pruppacher and Klett, 1997; Pummer et al., 2012; Wex et al., 2015; Zolles et al., 2015). Comparison of our measurements with literature data show the important impact of droplet size, INP concentration and number of active sites on the T_{50} values. Here, the new set-up exhibits its strength in reproducibility and accuracy which is due to the defined and isolated droplets. Finally, it opens a temperature window down to -37˚C for freezing experiments which was not accessible with former traditional approaches

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