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New Instrument INKA for Ice Nucleation and Growth Experiments

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Microphysical processes in clouds, such as the formation and growth of ice crystals, significantly influence the weather and the climate. Particularly the transition from the supercooled water to the solid ice phase is of great relevance since ice formation initiates the formation of precipitation and thereby strongly affects the cloud structure and life time. However, the formulation and parameterization of these processes and further laboratory studies are needed to obtain quantitative information on the ice activity of various atmospheric aerosol species. Therefore, we have constructed and built a new continuous flow diffusion chamber (CFDC) called INKA (Ice Nucleation Instrument of the KArlsruhe Institut of Technology) to be used both in the AIDA laboratory for detailed studies of ice nucleation and growth processes and in field applications for measuring the temperature-dependent abundance of ice nucleating particles (INPs). The CFDC design was originally developed and theoretically described by Rogers et al. (1988). The main part of the new INKA instrument, the chamber, consists of two vertically-oriented, concentric tubes with a total length of 150 cm. Together with particle-free, dry sheath air, the sampled aerosol particles flow through the annular space between these two cylinders. The wall temperatures of the cylinders can be adjusted and the walls of the annular gap are coated with thin ice layers. The bottom part (about 50 cm) of the outer cylinder of INKA is separately cooled, which allows operation in two different modes: In the ice nucleation mode, the CFDC is operated with a nucleation and growth section, covering the upper 100 cm of its length, which exposes the aerosol particles to a defined temperature and supersaturation. The bottom part is the so called droplet evaporation section which allows the ice particles to grow to a detectable size on the expense of present droplets. In the ice growth mode, the full length of the cylinders is operated as one large nucleation and growth section. Since the wall temperatures can be reduced to values as low as -80 °C, ice nucleation and growth of both mixed-phase and cirrus clouds can be investigated under well controlled temperature and humidity conditions. In this contribution, we will present the setup of INKA and show first measurements.