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Environmental scanning electron microscopy (ESEM) as a new technique to determine the ice nucleation capability of individual atmospheric aerosol particles

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Heterogeneous ice nucleation on synthetic silver iodide, natural kaolinite and montmorillonite particles via condensation freezing and deposition mode was studied by environmental scanning electron microscopy (ESEM) in the temperature range of 250 – 270 K. By increasing the H_2O pressure in the sample chamber at constant temperature, ice formation can be studied in-situ and can be related to the chemical composition of the particles that can be determined simultaneously. For silver iodide and kaolinite, supersaturation values of first ice formation are in good agreement (1 – 2 % absolute) with diffusion chamber experiments. For both substances, threshold temperatures for the condensation freezing and deposition mode are also in good agreement (within 2 K) with previous literature data. For montmorillonite, ESEM results for the supersaturation value of first ice formation and for threshold temperatures of condensation freezing and deposition mode lie within the large range reported in the literature.