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CCN properties of coated soot particles

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The goal of the LExNo campaign, which was conducted November 2005 at the ACCENT site Leipzig Aerosol Cloud Interaction Simulator (LACIS), was to get further inside in the activation properties of wood burning aerosol particles. For this experiment, wood burning aerosol particles were imitated by spark generated soot (pure or compacted with propanol) coated with ammonium sulfate (AS) and/or levoglucosan (LG) using two tube furnaces. The gained particles were analyzed using two AMS, a HTDMA, two CCNC (Wyoming B-100), a continuous flow CCNC, and LACIS.

For the experiments discussed in the following, soot particles with a diameter of 100 nm were selected by a first DMA, coated with AS or LG and from the resulting size distribution particles with a diameter of 84.4 nm were selected for analysis. Each new experiment was performed with particles coated at different furnace temperatures. The critical supersaturation of particles coated with AS ranged between 0.35 and 0.55% for the different experiments, corresponding to a different mass of salt per particle caused by the varying furnace temperatures. Critical supersaturation for not compacted soot coated with LG are in the range between 0.54 and 0.78%, for a comparable mass of soluble material per particle, and they are thereby harder to activate than the AS coated soot of the same size and pure LG particles with Sc = 0.36%. Particles compacted before coating showed a similar behavior as not compacted particles suggesting that coating already leads to a compaction of the particles. A comparison between hygroscopic growth and the critical super-saturation for the activation of the investigated particles shows a clear relationship between these two properties. It was found that a larger equilibrium diameter (at a fixed RH, e.g. 98%) corresponds to a lower critical supersaturation of the particles. First tests show that the relationship can be described via a simple form of the Köhler theory.