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Knudsen cell: Investigations about the uptake of important traces gases on ambient airborne mineral dust

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Mineral dust constitutes one of the largest mass fractions of natural aerosol. Its emission is estimated between 800 - 2000 Tg/a]. The dust is emitted through sand and dust storms in the arid regions of our planet, in particular by the great desserts such as the Sahara. The complex chemical composition of mineral dust is similar to crust material, because the dust is produced by soil erosion. The main components of mineral dust are SiO_2 and $Al2O_3$, whereas the active oxides ($Fe2O_3$, TiO_2) show some variety in content due to the dust source region. Mineral dust particles can be transported over several 1000 km and during its transport the surface can be changed by the uptake of water vapor and trace gases. On such modified surfaces homo- and heterogeneous reactions can occur. Trace gas uptakes play an important role in atmospheric chemistry as sinks or sources for several gaseous species. Hence, it is necessary to study these reactions. Among several experimental setups, the Knudsen cell is one of the promising tools to study reactive uptakes from the gas phase and the release of products formed by dust surface-mediated reactions. The Knudsen cell, implemented by Golden et al. in 1975, is a high vacuum flow reactor operating under molecular flow conditions, i.e. gas-wall collisions are highly preferred over gas-gas collisions. Despite several Knudsen cell studies examining the reaction between different traces gases and model dust surfaces constituted of not more than a few components, no measurements utilizing collected ambient mineral dust are done so far. For a better understanding of the chemistry on mineral dust surfaces gas uptake measurements will be done with a Knudsen cell. The first measurements are done with isopropanol on TiO_2. Afterwards there are studies with different substrates like, $Al2O_3$ (α- and γ-phase), FeO_2, Arizona test dust, air collected mineral dust from the Cap Verde islands. In the beginning SO_2, NO_2 and HNO_3 will be used.