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Laboratory investigations of the photochemical decay of alkylbromides trapped in ice

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Photochemical reactions of atmospheric trace gases taking place at the surface of atmospheric ice particles and in bulk ice are important in tropospheric chemistry but also in polar and alpine snowpack chemistry. Consequently, the understanding of the uptake und incorporation of tropospheric trace gases in water ice as well as their interactions with water molecules is very important for the understanding of processes which occur in ice particles and at the air/ice interface. Reactive atmospheric trace gases trapped in ice are subject of photochemical reactions when irradiated with solar UV radiation. Among such compounds bromine species are highly interesting due to their potential of depleting ozone both in the stratosphere and troposphere. Methyl bromide (CH3Br) is the largest bromine carrier to the stratosphere. It has both natural and anthropogenic sources.

In this contribution we will present the results of our laboratory studies of alkyl bromides (methyl bromide (CH3Br), methyl dibromide (CH2Br2), n-propyl bromide (C3H7Br), 1,2-dibromoethane C2H4Br2)), trapped in water ice. We have simulated the UV photochemistry of these brominated alkanes isolated in ice films kept at 16 K and for comparison in solid argon matrices. The photoproducts formed in the ice have been identified by means of FTIR spectroscopy. Reflection absorption infrared spectroscopy (RAIRS) is especially useful to study nascent ice surfaces, kinetics of adsorption/decomposition, and heterogeneous catalysis. Among the observed photoproducts we could identify carbon monoxide and carbon dioxide for each alkyl bromide studied. The photoproduct HBr is dissociated in the bulk ice. Based on the experimental observations possible reaction mechanisms will be discussed.