



The ir-spectroscopic and thermodynamic properties of HCl/H₂O in the range 170-220K

S. Chiesa and M. J. Rossi

Laboratoire de Pollution Atmosphérique et Sol (LPAS), Ecole Polytechnique Fédérale de Lausanne (EPFL), CH-1015 Lausanne, Suisse (michel.rossi@epfl.ch)

Type II polar stratospheric clouds, composed of pure ice particles, have an important role in the stratospheric chemical processes which finally lead to ozone depletion [1]. In this multidagnostic laboratory study dealing with the simultaneous detection of both the gas as well as the condensed phase [2], we employ ice films grown in a high vacuum chamber as model atmospheric surfaces and studied their interaction with HCl vapor. Transmission FTIR spectroscopy has been employed to assess the molecular structure of the solid phase while mass spectrometry, among others, has been used to study the gas phase products. In addition, reflection-absorption IR spectroscopy (RAIRS) of water ice and ice doped with various amounts of HCl using the SiO₂ sensing element of a quartz crystal microbalance as a cryogenic support will be reported as well.

The conditions for the formation of two different structures, an amorphous HCl/H₂O system and HCl hexahydrate (HCl₆H₂O), will be discussed: the crystalline HCl hexahydrate has been obtained only for temperature of doping with HCl lower than 173 K. Mid-IR spectral characteristics along with numerical values for the IR cross sections of the pure hexahydrate phase will be presented. Water vapor pressure of over HCl₆H₂O in the temperature range 186-193 K will be reported. The stability of the pure hexahydrate phase at temperatures around 195 K will be finally discussed in connection with its possible atmospheric significance.

From our study it will be shown that the pure HCl hexahydrate phase may be of limited relevance for the upper tropospheric-lower stratospheric system, while the amorphous phase may be much more common under atmospheric conditions.