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Characterization of the formaldehyde-H2O system using combined spectroscopic and mass spectrometry approaches

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The atmosphere is a multiphase reactor in which physical exchange processes, heterogeneous reactions and photochemical reactions take place. The oxygenated organics (formaldehyde, ethanol, acetone etc.) present at trace concentrations into the atmosphere are known to play an important role in atmospheric chemistry due for example to their contribution in the production of HO_x radicals, which largely determine the lifetime of pollutants [1]. Further, it has been shown that the interaction of oxygenated organics with ice particles in the atmosphere has the potential to promote heterogeneous chemistry [2]. In the polar lower troposphere, formaldehyde (H_2CO) was measured in concentrations that are much higher that those predicted by chemistry models [3]. The mechanism at the origin of the formaldehyde production remains however controversial as the incorporation / partitioning of H_2CO in ice crystal has to be determined first. Incorporation of formaldehyde into ice can take place according to several different physical mechanisms like co-condensation, riming, adsorption/desorption. The partitioning of formaldehyde between the gas phase, the liquid and the solid phases is an important parameter that leads to a better understanding of the incorporation mechanisms. In our work, different experimental approaches are used to characterize the partitioning between the different phases in which the H_2O-H_2CO system exists.

Recently, we investigated by mass spectrometry and infrared diode laser spectroscopy the vapor liquid equilibrium (VLE) of formaldehyde aqueous solutions of different concentrations at room temperature. From the data collected on the vapor pressures at atmospherically relevant formaldehyde concentrations, we derived the Henry's coefficients at 295 K [4].

In this study we present first results on the solubility of formaldehyde in ice. This allows a better characterization of the partitioning of formaldehyde vapors above supercooled droplets and/or ice at low temperatures (233-283K) and low dissolved fraction of formaldehyde. Also presented is the thermal evolution of thin structured films of condensed H_2CO/H_2O or H_2CO/acid-doped (HNO_3)-ice layers. This is examined using temperature programmed desorption (TPD) experiments and Raman spectroscopy. The results are compared with those obtained on co-condensed H_2CO/H_2O mixtures [5].

[1] Atkinson R., *Atmospheric Environment*, 2000, **34**: 2063

[2] Abbatt J.P.D., *Chem.Rev.* 2003, **103**: 4783

[3] Dominé F., Shepson P.B., *Science*, 2002, **297**: 1506

[4] Oancea A. et al. *Environ. Sci. Technol.* in press

[5] Chazallon B. et al. , *Phys.Chem.Chem.Phys.*, 2008, **10:** 702