

**Vapor pressure studies on silicates.** S. Wetzel<sup>1</sup>, M. Klevenz<sup>1</sup>, M. Trieflo<sup>2</sup>, H.-P. Gail<sup>3</sup> and A. Pucci<sup>1</sup>,  
<sup>1</sup>Kirchhoff-Institut für Physik der Universität Heidelberg, INF 227, 69120 Heidelberg, pucci@kip.uni-heidelberg.de, <sup>2</sup>Institut für Geowissenschaften der Universität Heidelberg, INF 236; 69120 Heidelberg, <sup>3</sup>Institut für Theoretische Astrophysik der Universität Heidelberg, Albert-Ueberle-Str. 2

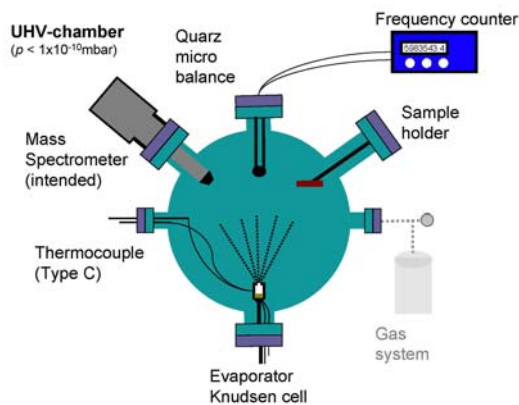
**Introduction:** There are only few groups working on evaporation and condensation processes of silicates. Experimental data primarily exist for the endmembers of olivine and pyroxene (see, e.g. [1-4]), but little is known about Fe-bearing silicates [5] and Ca-Al-bearing minerals, although these phases are expected to be a major component in protoplanetary disks.

We built a setup based on the Knudsen cell method to study the evaporation properties of these minerals. First results on the vapor pressure of SiO will be presented.

**Experimental Setup:** A schematic drawing of the existing setup for thermal evaporation (up to 2200K) of silicates is shown in Fig. 1. It consists of a Knudsen cell for the evaporation of materials under equilibrium conditions and a quartz crystal microbalance (QCM), which is extremely sensitive and can measure mass changes  $\leq 1 \text{ ng cm}^{-2}$ .

A small fraction (typically 0.1%) of the molecules leaving the Knudsen cell condenses on the QCM and from the associated mass change the overall mass change of the Knudsen cell can be determined which is directly related to the vapor pressure within the cell.

Experiments are conducted in ultra high vacuum (UHV) or with a certain partial pressure (available through the intended gas system.).

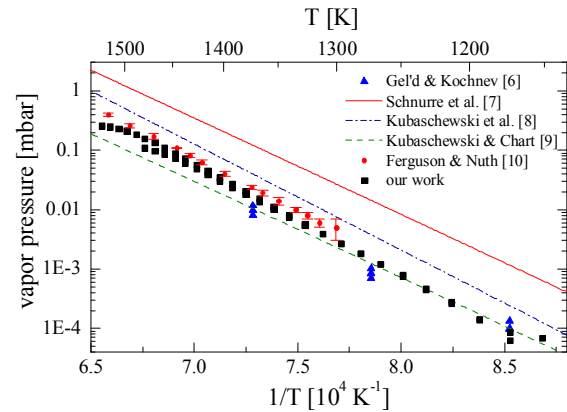


**Figure 1:** Schematic drawing of the existing setup with intended improvements (quadrupole mass Spectrometer and gas system).

**First results and discussion:** The first data obtained on the vapor pressure of silicon monoxide (SiO) are shown in Fig. 2 and compared to literature data.

The discrepancies between the already existing data reflect the difficulties inherent in such

measurements, nevertheless our data are in good agreement with the newest results on the SiO vapor pressure published by Ferguson & Nuth [10] and already exceed their measurement range by two orders of magnitude.



**Figure 2:** Measured vapor pressure of SiO compared to literature data [6-10].

The obtained vapor pressure relation is given by

$$p[\text{mbar}] = \exp\left(-42610 \frac{1}{T} + 26.9\right).$$

**Further work:** With the intended improvements of our setup we will be able to extend the measurement range down to  $10^{-7}$  mbar and the investigation of Fe-bearing silicates and Ca-Al-bearing minerals will be possible in the near future.

**References:** [1] Hashimoto, A. (1990) *Nature*, 347, 53. [2] Tachibana, S. et al. (2002) *Geochimica & Cosmochimica Acta*, 66, 713. [3] Nagahara, H. et al. (1994) *Geochimica & Cosmochimica Acta*, 58, 1951. [4] Wang, J. et al. (1999) *Geochimica & Cosmochimica Acta*, 63, 953. [5] Ozawa, K. and Nagahara, H. *Geochimica & Cosmochimica Acta*, 64, 939. [6] Gel'd, P. V. and Kochnev, M. K. (1948) *Zh. Priklad. Khim*, 21, 1249. [7] Schnurre, S. M. (2006) *Journal of Non-Crystalline Solids*, 336, 1. [8] Kubaschewski, O. (1993) *Materials Thermochemistry*. Pergamon Press Ltd. [9] Kubaschewski, O. and Chart, T. G. (1974) *J. Chem. Thermodyn.*, 6, 467. [10] Ferguson, F. T. and Nuth, J. A. (2008) *Journal of Chemical & Engineering Data*, 53, 2824