Geophysical Research Abstracts
Vol. 20, EGU2018-8136, 2018
EGU General Assembly 2018

Pressure induced second order phase transition in monohydrated magnesium sulphate (MgSO4·H_2O): A new polymorph potentially occurring on icy satellites

Johannes Meusburger, Martin Ende, Dominik Talla, Ronald Miletich, and Manfred Wildner
Universität Wien, Institut für Mineralogie und Kristallographie, Austria (johannes.meusburger@gmail.com)

The surface of the outer three Galilean moons (Europa, Ganymede, and Calisto) consists mainly of water ice and hydrated minerals, with the majority being hydrated sulphate minerals in different hydration
stages [1]. On Europa these minerals are concentrated on disrupted areas (e.g lineaments, chaos terrain) which indicates an endogenic origin [2].
For this reason, knowledge of the high-pressure behavior of respective mineral phases seems to be crucial to deepen our understanding of the internal structure of icy satellites.
Although the high-pressure behavior of sulphate minerals in higher hydration stages have already been subject to numerous studies (e.g. epsomite [3,4], bloedite [5]), compression data are still scarce for the low-hydrated phases.
In order to fill this gap the high-pressure behavior of MgSO4·H_2O was characterized up to approximately 8 GPa using X-ray diffraction and Raman spectroscopy inside a diamond anvil cell.
The isothermal (T=295 K) equations of state were determined for the low-pressure(α-MS1) as well as for the high-pressure (β-MS1) polymorph by measuring the volume of the reduced unit cell at 21 different pressure points under quasihydrostatic conditions. The obtained data shows a second order phase transition at 2.71(3) GPa.
Since a compound's structural stability does not depend solely on pressure but also largely on other parameters (e.g. temperature, chemical composition), investigations with a variation regarding respective parameters should be carried out in the future to define the stability field of α-MS1 and β-MS1 in the interior of icy satellites.

[1] McCord et al., Hydrated salt minerals on Ganymede's surface: Evidence of an ocean below, Science, Vol. 292, 1523-1525, 2001
[2] McCord et al., Hydrated salt minerals on Europa's surface from the Galileo near-infrared mapping spectrometer (NIMS) investigation, Journal of Geophysical Research, Vol. 104, 11827-11851, 1999
[3] Gromnitskaya et al., The high-pressure phase diagram of synthetic epsomite (MgSO4·7H_2O and MgSO4·7D2O) from ultrasonic and neutron powder diffraction measurements, Phys Chem Minerals, Vol. 40, 271-285, 2013
[4] Nakamura & Ohtani, The high-pressure phase relation of the MgSO4–H_2O system and its implication for the internal structure of Ganymede, Icarus, Vol. 211, 648-654, 2011
[5] Comodi et al., The compression behavior of blödite at low and high temperature up to $\sim$10 GPa: Implications for the stability of hydrous sulfates on icy planetary bodies, Icarus, Vol. 285, 137-144, 2017