ELASTIC PROPERTIES OF PRASEODYMIUM ORTHOVANADATE

O.N. Ermakova[1,2*], **R. Minikayev**[1], **H. Dabkowska**[3], **C. Lathe**[4,5], **J. de Groot**[6], **and W. Paszkowicz**[1]

[1] *Institute of Physics, Polish Academy of Sciences, Al. Lotnikow 32/46, 02–668 Warsaw, Poland*
[2] *Institute of Solid State Chemistry, Russian Academy of Sciences, Pervomayskaya 91, 620990 Ekaterinburg, Russia*
[3] *Department of Physics, McMaster University, Hamilton, Ontario, L8S 4M1 Canada*
[4] *HASYLAB am DESY, Notkestrasse85, D–22603 Hamburg, Germany*
[5] *Helmholtz Centre Potsdam, GFZ German Research Centre for Geosciences, Telegrafenberg, 14473 Potsdam, Germany*
[6] *Institut für Festkörperforschung, JCNS, and JARA-FIT, Forschungszentrum Jülich GmbH, 52425 Jülich, Germany*

Keywords: synchrotron radiation, rare-earth orthovanadates, bulk modulus, equation of state
* *e-mail*: Ermak@ifpan.edu.pl

Rare-earth orthovanadates (RVO_4) are known to be applicable as laser materials. Their physical properties lead to applications in other optical devices, gas sensors, phosphors, polarizers, etc.; they are also useful in catalysis [1]-[6]. At ambient conditions RVO_4 adopt the zircon structure (space group $I4_1/amd$), except for $LaVO_4$ exhibiting polymorphism depending on preparation conditions. In the 5 – 10 GPa pressure range these materials undergo a phase transition from zircon to scheelite-type structure.

The aim of the present investigation was to determine the elastic properties of $PrVO_4$ at pressures from ambient up to 5 GPa, using the synchrotron beam, and to verify whether the zircon-scheelite phase transition occurs at the applied conditions. For this purpose, energy dispersive data at high-pressure conditions were collected using white synchrotron radiation at the F2.1 beamline Hasylab/DESY (Hamburg, Germany). The in-situ powder-diffraction experiments were carried out using the MAX80 X-ray diffraction press. The data were collected using a germanium solid-state detector. The diffraction angle was fixed at angle 3.793°. For calibration of the applied pressure NaCl powder was used. Unit cell parameters for $PrVO_4$ were refined using the Le Bail method. Bulk modulus was calculated from fitting of the second order Birch-Murnaghan equation of state.

The studied needle-shaped single crystal was grown by slow cooling of the molten PbO/PbF_2 flux. For high-pressure powder diffraction experiment, this crystal was finely ground in an agate mortar. In order to reduce strains in the diffraction experiment, the obtained powder was mixed with vaseline in volume proportion 1:1.

At ambient conditions, the lattice parameters of the studied zircon-type $PrVO_4$ crystal are in good agreement with literature data. In pressure range from ambient up to 5 GPa, the observed lattice parameters smoothly decrease with increasing pressure; the total decrease of the unit-cell volume is at the level of 4.5%. Phase transition to scheelite structure is not observed within the studied pressure range.

Acknowledgments: The measurements performed at Hasylab have received funding from the 7th Framework Programme (FP7/2007 – 2013) of European Community under ELISA grant agreement No. 226716.

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