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HIGH-PRESSURE DIFFRACTION STUDY OF $SmVO_4$: COMPRESSIBILITY AND ZIRCON-SCHEELITE PHASE TRANSITION

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$SmVO_4$, is considered as a catalytic material suitable for oxidative dehydrogenation of butane [1] and propane [2]. It belongs to the family of RVO_4, (R = Y, Sc, Pr – Lu) orthovanadates, of wakefieldite mineral name, crystallizing in $I4_1/amd$ space group. Some of compounds of this family are considered as being suitable for optical waveguides and polarizers, they can be used for remote thermometry, as laser components, as catalysts for oxidative dehydrogenation and are candidates for advanced bio-imaging phosphors and as components of toughened ceramic composites. In this work the elastic properties and structural changes under pressure of $SmVO_4$ are determined experimentally and compared with literature data of some other RVO_4 compounds.

The $SmVO_4$ single crystal was grown from PbO/PbF_2 flux by the slow cooling method. The *in-situ* high-pressure measurements were conducted at I711 beamline (MAXlab, Lund, Sweden) using a membrane-driven diamond-anvil cell. A methanol-ethanol-water mixture was applied as pressure transmitting medium.

The experiments performed at room temperature at hydrostatic pressures show that $EuVO_4$ undergoes a zircon–scheelite phase transition which starts at 7 GPa and ends at about 9 GPa. Fitting the Birch-Murnaghan equation of state gave the bulk modulus of the zircon-type phase of 118 GPa. The above values differ from those found in a recent study [3] for the $EuVO_4$ compound being a close neighbor of $SmVO_4$ in the RVO_4 series. The possible reasons for the similarities and differences in respect to $EuVO_4$ and other members of the RVO_4 family will be discussed.

References

[1] D. Patel, P.J. Andersen, H.H. Kung, "Oxidative dehydrogenation of butane over orthovanadate", *J. Catal.* **125** (1990) 132–142.

[2] C.T. Au, W.D. Zhang, H.L. Wan, "Preparation and characterization of rare earth orthovanadates for propane oxidative dehydrogenation", *J. Catal. Lett.*. **37** (1996) 241–246.

[3] D. Errandonea, R. Lacomba-Perales, J. Ruiz-Fuertes, A. Segura, S.N. Achary, A.K. Tyagi, "High-pressure structural investigation of several zircon-type orthovanadates", *Phys. Rev. B* **79** (2009) 184104.