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PROPERTIES OF RARE-EARTH ORTHOVANADATES UNDER HIGH PRESSURE

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RVO$_4$, (R = Y, Sc, Pr – Lu) orthovanadates, crystallizing in $I4_1/amd$ space group (zircon type structure), exhibit physical properties that may lead to various applications. One of well known examples is the Nd doped YVO$_4$, a laser material. Some of compounds of this family are considered as being suitable for birefringent lasers, optical waveguides and polarizers, they can be used for remote thermometry, as catalysts for oxidative dehydrogenation, and are candidates for advanced bio-imaging phosphors and as components of toughened ceramic composites. For example, EuVO$_4$, is considered as both, a potential phosphor (the metastable scheelite phase) [1,2] and a potential ionic conductor (the stable zircon phase) [2].

RVO$_4$ compounds belong to a large family of AXO$_4$ compounds that most frequently adopt the structures of zircon, scheelite, fergusonite, monazite, wolframite, CrVO$_4$, ZnSO$_4$ and rutile types [3-5]. Phase relationships in this family observed as a function of pressure have been systematized in Refs. [4,6] (for all possible AXO$_4$ compounds), and in Refs. [5] for RXO$_4$ compounds (X = P, As, V). For RVO$_4$, R = Ce to Lu, the most stable ambient pressure structure is of zircon type, space group $I4_1/amd$, this structure can be also obtained for R = La using special preparation methods.

A number of studies have been performed by means of various experimental techniques and theoretical approaches, yielding the limited information on the equations of state and on zircon-scheelite pressure transitions. For the given compound, the discrepancies in bulk modulus between different experimental and theoretical datasets attain 20 GPa. Moreover, the phase-transition point and the range of pressures where both phases coexist, show a considerable scatter. Understanding of these discrepancies may be useful for further studies of these or similar compounds.

In this talk, existing data for compressibility and zircon-scheelite phase transition in RVO$_4$ is are reviewed. The importance of using hydrostatic-compression conditions is emphasised. Systematic trends for the bulk modulus and phase transition pressure are revealed within the RVO$_4$ family and connected with the lanthanide contraction effect. Differences between the elastic properties reported by various author for the given compound will be discussed.

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