

Abstract of the doctoral thesis entitled

“Preparation and investigation of spectroscopic properties of $YXZO_4$, where X and Z - P^{5+} , V^{5+} , As^{5+} , doped with rare-earth ions and co-doped with s^2 type ions”

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Researchers in the field of spectroscopy are constantly looking for luminophores with the best possible luminescent properties, in particular high quantum efficiency. The yttrium orthovanadates and yttrium orthophosphates are thoroughly researched for their structural and spectroscopic properties due to good chemical, physical and mechanical properties. Therefore, they find applications in many branches of science. However, some aspects are still unresolved and unsystematised. These compounds belong to the group of materials with the general formula $REXO_4$. This group of compounds also includes yttrium orthoarsenate. The scientific interest concerning yttrium orthoarsenate was the highest between 1960 and 1990. Since then, no more than ten scientific publications have been published, and less than half of them focus on $YAsO_4$ as a luminescent material. The materials crystallize in the same crystal system, space and point group. The difference between these materials becomes apparent in the size of the elementary cell. Therefore, it is possible to obtain a continuous solid solution, for example, from $YAsO_4$ to YVO_4 . The physicochemical properties of such solid solutions are not known to the extent that their components are, for example, yttrium orthophosphate.

In this dissertation, with the special attention structural and spectroscopic properties of $YXZO_4$ solid solutions, doped rare earth ions and s^2 -type ions were analysed. In each article, to synthesise the materials, the co-precipitation was used. Employing measurement techniques such as XRD, SEM, TEM, and ICP-OES allowed the crystallographic structure, morphology, and elemental composition to be determined. The spectroscopic measurements allowed for the precise determination of the occurring mechanisms, the influence of the matrix composition and the synthesis conditions on the luminescence properties at room and low temperatures.

The dissertation includes four scientific publications. Designed and conducted studies provide information on the processes and dependencies occurring in solid solutions of $YXZO_4$ -type materials doped with RE^{3+} (Eu^{3+} , Tb^{3+} , Er^{3+} , Yb^{3+} , Tm^{3+}) and s^2 -type (Bi^{3+}) ions. An additional aim of the papers presented in the thesis is to respond to the challenges of science and to provoke further research theses in the area of $YXZO_4$ -type compounds.

