JURY MEMBER'S REPORT

by Prof. PhD. Eng. Sasho Vassilev, Institute of Electrochemistry and Energy Systems - BAS, with respect to the competition for occupying the academic position of Assistant Professor at the IGIC - BAS in the professional field 4.2 "Chemical Sciences", (Solid State Chemistry), Announced in the State Gazette, issue 36, 03.05.2019 for the needs of the Laboratory "Crystal Chemistry of Composite Materials"

The only candidate who has submitted documents for the announced competition is PhD Petar Tzvetanov Tzvetkov. The documents comply with the requirements of the Academic Staff Development Act and the Regulations for its implementation, as well as the Regulations of BAS and IGIC-BAS. The candidate has a degree in Mineralogy and Crystallography from the Faculty of Geology and Geography at Sofia University "St. Kliment Ohridski ". He defended his doctoral dissertation in 2015 at the Institute of General and Inorganic Chemistry - with the theme of his thesis: "Synthesis and study of oxides with perovskite type structure and crystallographic planes of shear" under the scientific guidance of Prof. Daniela Kovacheva.

From 2002 to 2006, P. Tsvetkov worked at the Faculty of Geology and Geography at Sofia University "Kliment Ohridski" - in the Laboratory for X-ray Structural Analysis. From 2006 to 2010 he worked at IGIC-BAS, Laboratory of Solid State Chemistry, and from 2010 at the Laboratory of Crystal Chemistry of Composite Materials at the same institute. In 2010 he was selected as an assistant.

The competition documents present 23 scientific publications for the period 2005 - 2018 of which 20 are in abstract journals with impact factor. Seven of the publications are categorized in quartiles Q1, seven in Q4, four in Q2 and three in Q3. PhD Tzvetkov has 37 participation in international and national scientific conferences and symposia. A list of the noted quotations is presented - a total of 187 so far. One of his works has 47 citations, three works have between 22 and 45 citations. The candidate's Hirsch index (h-index) of Scopus is 8.

The main contributions of Assistant Professor Peter Tzvetkov are scientific and scientifically applied. However, in all the works, the fundamental physicochemical focus of studies related to structure data, properties and synthesis predominates. They cover a large area of material science and are summarized in four directions in the publication reference.

The first area covers works related to the synthesis and testing of application materials for solid-state lasers.

- For the first time, the conditions for solid-phase synthesis as well as suitable high-temperature solvents and conditions for the growth of single crystals of solid solutions of the general formula $Al_{2-x}In_x (WO_4)_3$ have been thoroughly investigated. The materials are suitable for sensor elements and laser optics.

- It has been found that for all germanates with olivine-type structures, the only possible way to obtain single crystals is by the method of growth from high-temperature solutions (flux method).
- For the first time, important evidence has been obtained that single crystals of $LiAlGeO_4$, Zn_2GeO_4, $Ca_5Ge_3O_{11}$, and $5LiAlGeO_4.4Zn2GeO_4$ single crystals could be grown from their own melt.
- A method for obtaining glass and glass ceramics from the systems: $CaO-GeO_2-B_2O_3$, $CaO-GeO_2-Na_2B_4O_7$ and $CaO-GeO_2-LiBO_2$ doped with Cr_2O_3 has been developed. Appropriate conditions for glass and glass ceramics were found, and after X-ray diffraction detection of the nanophase, glass ceramics were tested for absorption and emission in the range 1.1 - 1.6 μm. -The potential of the obtained glass ceramics to be used as a solid-state matrix for tunable lasers has been proved.

The second area is radiographic research of a number of oxide systems for practical application for catalysts.
- A number of oxide systems with a layered structure for catalytic oxidation of CO have been studied, and Mo-catalysts for the conversion of CO with water vapor deposited on Al_2O_3 and TiO_2 carriers obtained by the sol-gel method have been investigated.
- The effect of cobalt content in mixed Co-Al layered double hydroxides (LDH) as precursors for catalytic oxidation of CO was monitored. Precursors with a ratio of Co^{2+} / Al^{3+} = 0.5, 1.5 and 3.0 are characterized.
- The activity of a catalyst of the formula (K_2O) (NiO) $WO_3/\gamma-Al_2O_3$ used to study the catalytic properties for the conversion of CO to water vapor in the presence of sulfur has been demonstrated. X-ray analysis revealed that all tested samples were X-ray amorphous and WO_3 phase was not detected, despite the high tungsten content.

The third strand includes works related to the structural characterization of perovskites.
- Perovskite phases were obtained from the $GdCo_{1-x}Cr_xO_3$ systems (x = 0, 0.33, 0.5, 0.67, 1), $PrCo_{1-x}Cr_xO_3$ (x = 0, 0.33, 0.5, 0.67, and 1). A structural study was conducted and structural parameters were calculated for the $GdCo_{1-x}Cr_xO_3$ series (x = 0, 0.33, 0.5, 0.67, 1). From a crystal-chemical point of view, $PrCo_{0.5}Cr_{0.5}O_3$ has been found to be the most stable structure.
- The effect of partial substitution of Y^{3+} by Ca^{2+} in the structure of $YCo_{0.5}Fe_{0.5}O_3$ on the crystal-chemical and electrocatalytic properties was investigated. The crystal structure was determined and the crystal-chemical parameters of the perovskites of the $YCo_{1-x}Fe_xO_3$ system were calculated (x = 0, 0.33, 0.5, 0.67 and 1).
- Substitution of Cu with Pd in the crystal structure of the perovskite phase $LaCu_{0.5}Mn_{0.5}O_3$ type ($LaCu_{0.45}Pd_{0.05}Mn_{0.5}O_3$) has been found to result in material with higher thermal stability and improved catalytic properties.
- In addition to powder X-ray diffraction and the Rietveld method, Mössbauer spectroscopy was used for the structural characterization of the materials. In such a study, the proportional counter is replaced by a solid silicon detector (SDD). As a result, a significant increase in the resolution of the spectrum has been achieved.

The fourth area concerns the radiographic characterization of carbon materials.
- Synthesis and study of nanoporous carbon materials and structures.
- Production of carbon foam for fuel cells and battery electrodes.

Assistant Proffesor Peter Tsvetkov has participated in a number of projects (16), including: The Centre of Competence on Multifunctional Materials and New Processes with Environmental. Impact (MISSION), funded by the European Commission (Contract EC-

INCO-CT-2005-016414); 2005-2008, Young Scientists Project, in the Operational Science and Education for Intelligent Growth Program - "Establishment and development of centers of excellence, has conducted research activities on joint tasks with Macedonia and Israel, as well as in 5 NSF projects.

He is a member of the board of directors of the Bulgarian Crystallographic Society, where he regularly gives lectures to organized schools for doctoral students and young researchers in the field of X-ray structural analysis.

I have no critical comments or questions on the submitted materials for the competition.

Conclusion

The submitted documents, publications and quotes meet the requirements of the Law on the Development of Academic Staff in the Republic of Bulgaria (LDASRB), the Regulations of BAS and cover the additional requirements for the indicators for occupation of the academic position " Associate Professor " of the Regulations of the IGIC - BAS.

I give a positive assessment and strongly recommend that the Scientific Council of IGIC award the academic position "Associate Professor" in the professional field 4.2 "Chemical Sciences" (Solid State Chemistry) to Peter Tsvetanov.Tsvetkov.

August 22, 2019 Member of the Scientific Jury:

Sofia / Prof. PhD Sasho Vassilev /