

ATTITUDE OF REVIEWER

from Prof. Zara Cherkezova-Zheleva, Institute of Catalysis - Bulgarian Academy of Sciences (member of the Scientific Jury)

on the competition for occupying the academic position “Associated professor” in the professional field 4.2. "Chemical sciences", scientific specialty 01.05.18 "Solid State Chemistry" for the needs of the Institute of General and Inorganic Chemistry at the Bulgarian Academy of Sciences, Laboratory "Crystal chemistry of composite materials", announced in the State Gazette 36/03.05.2019

According to the Order № ПД-09-84/01.07.2019, issued by the Director of the Institute of General and Inorganic Chemistry– Bulgarian Academy of Sciences (IGIC-BAS), I was appointed as a member of the Scientific Jury for accomplishing the procedure in the competition for occupation of the academic position „Associated professor" in IGIC-BAS in the professional field 4.2 „Chemical Sciences", scientific research area "Solid State Chemistry" for the needs of the Institute of General and Inorganic Chemistry at the Bulgarian Academy of Sciences, Laboratory "Crystal chemistry of composite materials" announced in the State Gazette 36/03.05.2019.

Attitude on the obtained materials

Assistant Professor Dr. Peter Tzvetanov Tzvetkov, Institute of the General and Inorganic Chemistry, BAS is the only candidate, applying for the academic position “Associated Professor” in the competition, announced by the IGIC-BAS for the needs of the Laboratory „Crystal chemistry of composite materials“. He has submitted all the required documents that are listed into the Regulations for the Terms and Procedure for Acquisition of Academic Degrees and for Occupation of Academic Positions in the Institute of General and Inorganic Chemistry, BAS. Dr. Peter Tzvetkov fulfills all the relevant law requirements for occupation of the academic position “Assoc. Professor”. He received academic degree in Master of Sciences“ (MSc) from the Faculty of Geology and Geography at Sofia University “St. Kliment Ohridsky”, in the specialty „Minerology and Crystallography” in year 2002. In 2015 he acquired “Philosophy Doctor“ (PhD) degree in the scientific specialty 01.05.18: „Solid state chemistry”, with PhD Thesis entitled: „Synthesis and investigation of perovskite-type oxides with crystallographic shear planes”, developed under the supervision of Prof. Dr. D. Kovacheva. From 2006 to 2010 he was appointed as a chemist at the IGIC-BAS. Since 2010 after winning a competition, Dr. Tzvetkov has been working as an Assistant Professor at IGIC-BAS. As of 01.07.2019 he has professional experience which is more than required according to the normative documents for participation in the competition for the academic position Assistant Professor at IGIC-BAS.

The set of materials submitted by Dr. Peter Tzvetkov in electronic form is fully in accordance with the requirements of Regulation of the Terms and Procedure for Acquisition of Academic Degrees and for Occupation of Academic Positions in the IGIC, BAS. Based on the submitted summary by applicant it can be clearly seen that he completely fulfil all relevant criteria under Art. 5 of the Regulations on the Terms and Conditions for Acquisition of Academic Degrees and Occupation of Academic Positions at the IGIC, BAS. Dr. Peter Tzvetkov has a sufficient number of points for each of the relevant indicators. For some of the indicators his points exceed the minimal requirements. The applicant participates in the competition with a total score of 564 points, while the relevant required point score is 500.

The total number of scientific publications submitted by Dr. Peter Tzvetkov for participation in the competition is 45. All of them are published in the refereed editions, and 38 are indexed in Scopus. 23 out of 45 papers were written after receiving of PhD degree, so they are object of the present review for current competition. 19 of the discussed 23 articles

are published in journals included in the Scopus database. In addition the applicant has reported his results as one oral and 8 poster presentations at seminar / national forum, 3 oral and 12 posters at National forums with international participation, and 3 oral and 10 posters at International scientific events. He also participated in the work team of 1 scientific project funded by external sources for Bulgaria - Centre of Competence on Multifunctional Materials and New Processes with Environmental Impact (MISSION), 15 National or bilateral scientific projects, and in two other projects: The National Center for New Materials " Center for Advanced Materials " - Union I and Union II. A significant part of his research activities and publications are closely related to the implementation of the discussed projects. Applicant's publications were cited 240 times in total. Particularly he has 187 citates on the articles published after receiving the PhD degree. The Hirsch index based on all candidate publications is 8.

Contributions of the research activities of the candidate

The major scientific contributions of Dr. Peter Tsvetkov are related to research on the preparation and investigation of practically important materials with new and improved properties. The author's contributions are significant and correctly presented. They follow the logically obtained results of research in two thematic directions: synthesis of new high-tech materials by selecting of different preparative methods and treatment conditions; characterization of materials by registration and analysis of X-ray diffraction patterns, application of different methods for structure refinement and structure parameters calculation – mainly by Rietveld method of the studied compositions. The candidate's scientific papers submitted for participation in the competition are entirely in the field of solid state chemistry, and a significant part of them - in the thematic area "Crystal Chemistry of Composite Materials". Contributions can be grouped in several thematic areas:

1.) Important practical results were obtained for the exact conditions of solid-phase synthesis and growth of single crystals of solid solutions of aluminum-indium tungstates $Al_{2-x}In_x(WO_4)_3$ with application in laser technology such as sensors and as special ceramics in different instruments. For a first time are synthesized nanosized solid solutions with formula $Al_{2-x}In_xCr_y(WO_4)_2$ ($x = 0-2$, $y = 0.02-0.1$). It is established that at room temperature the solid solutions $Al_{2-x}In_x(WO_4)_2$ at x value between 0 and 1.1 are orthorhombic and for x value between 1.1 and 2.0 are monoclinic. The orthorhombic modification is built of MeO_6 octahedra, connected with WO_4 tetrahedra in such a manner that they form a pseudo-layered structure with a large tunnel size, which allows sufficient mobility of Me^{3+} ions. The wide range of solid solutions between compositions of this structural class makes it possible to obtain tungstates with certain properties by selecting a suitable solid solution composition. High-temperature powder X-ray diffraction determines the phase transition temperatures for different x values. The detailed structural characterization of these materials allows the investigation and interpretation of their optical properties for their practical application in the field of laser optics.

2.) Thermal behavior of germanates, mainly olivine-type structures with Mg, Ca, Li, Zn, Sc and their combinations was studied. Analysis of the obtained data is important for the appropriate choice of synthesis method and growth conditions of growing single crystals as matrices doped with Cr^{4+} for lasers. By means of X-ray and DTA/TG analysis data are obtained about the melting temperatures, type of melting (with or without decomposition), the substances during melting with decomposition, as well as the temperatures of the polymorphic transitions for some of the germanates. Most of the data reported in this topic are novel. It is found that owing to the rather high melting temperatures and the decomposition or polymorphic transitions during the melting, the germanates with olivine structure do not allow single crystal growth from their own melts, but the flux method from appropriate high-temperature solutions should be applied. A broad-band of emission in the range of 1000–

1600 nm was established which is important for satisfying the requirements for application of these materials in medicine as an alternative to the widely used single crystal laser arrays. A series of alkaline borates and molybdates have been investigated as potential solvents for the growth of germaniate single crystals. Suitable conditions have been found for the production of glass and transparent glass ceramics containing crystalline nanoscale germanium phase, which is of potential use as a solid state matrix for tunable lasers.

3.) Dr. Tsvetkov's scientific activities also include an original scientific contributions of significant importance for structural characterization of catalyst materials, perovskites and carbon materials using X-ray diffraction method. Structural transformations of layered double hydroxides (LDHs) of hydroalcite-type were monitored as a result of change of their chemical composition and treatment temperature. LDHs are catalyst precursors for CO₂ removal by methanation, fat hydration, etc. Mo- and W-containing catalysts supported on diatomite or silica gel were investigated. Crystal structure determination and calculation of the structure parameters of perovskites reveal the important dependences for the relationship between chemical composition and unit cell parameters, octahedra deformations and stability of the resulted structures. X-ray diffraction study determines the degree of graphitization and the crystallite size of the obtained nanoporous carbon foams with an anisotropic texture and high mechanical strength.

The educational and expert activities were not mentioned by the applicant in the submitted documents. However Dr. P. Tsvetkov teaches doctoral students, graduates and young scientists at the schools of Introduction to powder X-ray diffraction, organized by the Bulgarian Crystallographic Society.

Based on the review of the submitted documents for the announced competition and my personal opinion, it can be concluded that the scientific contributions of Dr. Peter Tsvetkov are significant and correctly presented. They logically follow the obtained results. The scientific and innovative contributions of his work are related to preparation and characterization of new innovative materials and to registration and evaluation of X-ray diffractograms, as well as structure refinement. He is a young and active scientist with great potential for systematic research and in-depth investigations, whose competence is very much appreciated. The Applicant's scientific papers submitted for participation in the competition are completely in the field of thematic area "Solid state chemistry" and in particular are fully in line with the thematic area " Crystal chemistry of composite materials ".

CONCLUSION: Documents and materials presented by Assist. Prof. Dr. Peter Tsvetkov meet all the requirements of the Law for the Development of the Academic Staff in the Republic of Bulgaria, the Regulations for its implementation and the corresponding rules for the implementation of the law in the IGIC - BAS. The candidate submitted a sufficient number of scientific papers, published after receiving the PhD degree. The obtained results based on the research activity of Dr. Peter Tsvetkov are original and have significant scientific contribution to the studied area. They completely fulfilled the relevant requirements of IGIC for occupation of the academic position "Associate Professor" in the field of competition and are fare above them. I strongly support the application and also recommend to the members of the Scientific Jury and to the Scientific Council of the Institute of General and Inorganic Chemistry to award to the Assist. Prof. Dr. Peter Tsvetkov the academic position "Associated Professor" under the direction 4.2. Chemical Sciences, 01.05.18 "Solid State Chemistry".

08/21/2019
Sofia

Reviewer:

(Prof. Dr. Z. Cherkesova-Zheleva,
Member of the Scientific Jury)