

ATTITUDE OF REVIEWER

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on the materials submitted for participation in the competition for the occupation of the academic position "Associate Professor", announced at the Institute of General and Inorganic Chemistry - BAS, for the needs of the Laboratory "Crystal Chemistry of Composite Materials", in the professional field 4.2 Chemical Sciences (Solid State Chemistry)).

1. General presentation

By order № ПД-09-84 dated 01.07.2019 of the Director of the Institute of General and Inorganic Chemistry (IGIC-BAS) I was appointed as a member of the scientific jury of the competition for occupation of the academic position "Associate Professor" at IGIC-BAS, professional field 4.2. Chemical Sciences (Solid State Chemistry).

The only candidate in the competition for "associate professor" announced in the State Gazette, issue. 36 of 03.05.2019 for the needs of the Laboratory "Crystal Chemistry of Composite Materials" at IGIC-BAS. is Dr. Peter Tsvetanov Tsvetkov from the same institute.

2. Short biography of the applicant

Assistant Professor Dr. Peter Tsvetkov graduated in 2002 with a Master Degree from the Faculty of Geology and Geography at Sofia University "St. Kliment Ohridski ", specialty Mineralogy and Crystallography. He was appointed as a geologist in the X-ray analysis Laboratory of the same Faculty, and since 2006 as a chemist in a Laboratory of Solid state Chemistry at IGIC-BAS, where he holds the position of Assistant Professor from 2010 until now. In 2015, he received a PhD in Solid State Chemistry from IGIC-BAS.

The main topics of scientific interest of Dr. Tsvetkov are related with the determination of certain properties - thermal, optical, catalytic of different groups of compounds - perovskites, tungstates, germanates, layered double hydroxides, carbon materials and glasses. Emphasis is placed on the synthesis, structural characterization of these materials, and the application of the X-ray diffraction method as the main method for studying their structure.

3. Scientific research activities

The results of the research activity of Assistant Professor Dr. Peter Tsvetkov, with whom he participates in the announced competition for the position of associate professor, has been developed within 15 projects with national and 1 international funding and has been described in 23 scientific publications, 19 of which are in ISI journals. Among them are renowned in the field of new materials and catalysis: Carbon (IF 5.23 / 2011, IF 7.466 / 2018), Fuel Processing Technology (IF 3.17 / 2010, IF 4.507 / 2018), Applied Catalysis A: General (IF 3.90 / 2011, IF 4.63 / 2018) .

Selected publications, citations and participation in conferences of Dr. Tsvetkov provide the necessary points that meet the minimal national criteria reflected in the implementing Regulations for the career development of the academic staff in Republic of Bulgaria, as well as in the Regulations for the conditions and order for acquiring scientific degree and occupying academic positions in IGIC-BAS and even exceed them in some of the indicators.

Thematically, the research activity of Assistant Professor Peter Tsvetkov can generally be divided into the following groups:

- Preparation and XRD characterization of aluminum indium tungstates of general formula $Al_{2-x}Me_x(WO_4)_3$, where Me = Y, Sc, In, Al or small ionic lanthanides - Ho, Er, Tm, Yb, Lu.

Solid solution studies between individuals of this structural class have made it possible to obtain tungstates with certain properties, including optical, electrical and thermal, by selecting the appropriate composition of the solid solution. According to the Rietveld method, the specific structural parameters for each of the studied compositions are specified, which makes their potential application in the field of laser optics, sensors and instrumentation more defined.

- Synthesis of olivine-type germanates and transparent glass ceramics containing crystalline germanate phase

A large-scale study was conducted on the synthesis of germanium compounds to replace melting at high temperatures silicates (forsterite, Mg_2SiO_4) and garnet ($Y_3Al_5O_{12}$), used as light-generating media in medical lasers with radiation in the range 1.1 - 1.6 μm . On the one hand, compounds were found to be melting without decomposition and without phase transitions ($LiAlGeO_4$, Zn_2GeO_4 , $Ca_5Ge_3O_{11}$, and $5LiAlGeO_4 \cdot 4Zn_2GeO_4$), and on the other hand, important evidence was obtained that single crystals of these germanium could be grown by own melts.

Main result is also that for all germanium with olivine type structure with the participation of Mg, Ca, Li, Zn, Sc, as well as their combinations, the only possible way to obtain single crystals is by the method of growth from high-temperature solutions (flux method). Conditions were found for the growth of a single crystal of Ca_2GeO_4 at a temperature of 1150°C, instead of the one cited in the literature of 1350°C.

The glassy phases of the systems: $CaO-GeO_2-B_2O_3$, $CaO-GeO_2-Na_2B_4O_7$ and $CaO-GeO_2-LiBO_2$ were also obtained and investigated. Suitable conditions for glass and glass ceramics preparation were also found and crystalline nanophase was proved by X-ray diffraction.

- X-ray characterization of catalytic and carbon materials.

The studies relate to several types of catalytic systems, among which - based on layered double hydroxides type containing Ca, Mg, Ni, Zn and Co; W and Mo containing catalysts on supports of Al_2O_3 and TiO_2 and Ni-Mg / diatomite catalysts, modified with Ag. Thermal transformations, phase stability in the catalytic systems, as well as the phase composition of the freshly prepared and worked catalysts and the crystallite size were followed and registered.

The degree of graphitization and the crystallite size of synthetic nanoporous coals obtained by polymerization of mixtures containing coal tar and furfural, as well as carbon foam with anisotropic texture and high mechanical strength obtained using precursors after thermal oxidation treatment of commercial coal tar with H_2SO_4 and HNO_3 are determined by X-ray diffraction method.

- Structural characterization of perovskites

The results presented in 6 publications are on synthesis by solution combustion method, structural study and morphology of complex perovskites of general formula $GdCo_{1-x}Cr_xO_3$, $PrCo_{1-x}Cr_xO_3$, with different element ratios, and of $YCo_{0.5}Fe_{0.5}O_3$, $LaCu_{0.5}Mn_{0.5}O_3$, $LaCu_{0.45}Pd_{0.05}Mn_{0.5}O_3$, $Pb_{1.33}Ba_{0.67}Fe_2O_5$, $Pb_{1.33}Sr_{0.67}Fe_2O_5$, and $Pb_{1.33}Ba_{0.33}Sr_{0.33}Fe_2O_5$. Some structural parameters of the perovskites were determined and the degree of deformation and stability of the structure, as well as their thermal stability were investigated. Correlations between these properties and the content of a certain type of ions in the composition of the Perovskites have been found.

For the studies in the first two groups, the applicant has presented for his participation in the competition a reference for original scientific contributions.

The citations obtained from other authors in international scientific literature testify to the significance of the results.

4. Educational and pedagogical activity

As I personally know the applicant and part of his scientific activity, I would like to point out here that he is one of the main organizers and lecturers of the two National schools (Introduction in XRD method – parts I and II) dedicated to the method of X-ray diffraction, held in 2017 and 2019, respectively under the auspices of Bulgarian Crystallographic Society.

During these events, attended by many graduated and PhD students, postdocs and young scientists from the institutes of BAS, some universities in Bulgaria and abroad, as well as private companies, Dr. Tsvetkov demonstrated in-depth knowledge in the field of materials science, crystallography, solid state chemistry and X-ray diffraction, as well as excellent skills to pass on your experience and knowledge and teach young people.

CONCLUSION

Submitted by the candidate in the competition, Assistant Professor Dr. Peter Tsvetanov Tsvetkov documents and materials fully comply with the Law on the Development of the Academic Staff in the Republic of Bulgaria, the Regulations for its implementation and the corresponding Regulations of IGIC-BAS and the topic of the announced competition for "Associate Professor".

I am fully convinced of the positive evaluation of the scientific papers and activities presented in the competition and I recommend to the honorable members of the Scientific Jury to prepare a report proposal to the Scientific Council of IGIC-BAS, Assistant Professor Dr. Peter Tsvetanov Tsvetkov to be elected to the academic position of Assistant Professor at IGIC-BAS, in the professional field 4.2. Chemical Sciences (Solid State Chemistry).

Date: 30.08.2019

Reviewer:
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