

Attitude of Reviewer

on competition for occupation of the academic position of "professor" in the professional field 4.4. Earth Sciences ("Experimental mineralogy and Crystallography") for the needs of Department "Experimental mineralogy and Crystallography" at the IMC-BAS

announced in SG. 62/ 14.07.2020

Candidate: Assoc. Prof. Vladislav Vladimirov Kostov, PhD – Institute of Mineralogy and Crystallography "Acad. Ivan Kostov" - BAS

Member of the Scientific Jury: Assoc. Prof. Irena Kirilova Mihailova, PhD – University of Chemical Technology and Metalurgy

1. General characteristics of the research and applied research activities of the candidate. Assoc. Prof. Dr. Vladislav Kostov is the author/co-author of 71 scientific papers, which have been published in Bulgarian and foreign specialized journals, in 29 of them he is the first author, and in 7 - the only one. The main thematic area of the scientific and scientific-applied research of the candidate is related to hydrothermal synthesis and crystal chemical characterization of titan-, zircon- and stano-silicates. He has participated in 14 research projects funded by European and national programs, as well as in those related to bilateral international cooperation. He has presented the results of his research activities with reports or posters at 56 international and national scientific forums. 241 citations from his publications have been noted. Assoc. Prof. Kostov has actively participated in scientific councils, scientific expert commissions and juries, for 8 years he has been on the Board of the Bulgarian Crystallographic Society and has contributed to the organization of numerous international scientific forums and schools. He is also a member of the Bulgarian Geological Society.

The candidate participates in the competition for the academic position of "professor" with **32** publications, 1 of which is a sole-author paper, 6 are with two authors, 6 - with three authors and the rest are with more authors. The documents submitted by the candidate Assoc. Prof. Dr. Vladislav Kostov for participation in the competition for the academic position of "professor" show that he fulfills and significantly exceeds the minimum national requirements (Appendix № 1 of PPZRASRB), as well as the requirements of BAS (Appendix № 2 of PPZRASRBAN). The candidate's points are as follows: by group of indicators "A" - **50** points, with the required 50; by group of indicators "B" - **178 points**, with the required 100; by group of indicators "Г" - **233** points, with the required 220; by group of indicators "Д" - **710 points**, with a required 120; by group of indicators "E" - **285** points, with a required 150. (As required are specified the points in accordance with the above-mentioned Appendix № 2, as they are equal to or higher than the other regulatory requirements.)

2. Main scientific and applied scientific contributions. The publications with which Assoc. Prof. Kostov participates in the competition are in the following thematic areas:

- ✓ *Low-temperature hydrothermal synthesis of new functional materials;*
- ✓ *Study of functional properties of materials in view of their rational practical application;*
- ✓ *Powder X-ray diffraction analysis;*
- ✓ *Crystal chemistry and systematics of glazerite type crystal structures;*
- ✓ *Mineral diversity of Bulgaria.*

They are a natural continuation and deepening of his previous research. His personal contribution to the publications is indisputable and they are indicated correctly and in details by the candidate in the submitted documents for the competition.

The main scientific and applied contributions of Assoc. Prof. Kostov are related to new scientific facts and enrichment of existing knowledge and theories in the above topics and can be summarized as follows:

A methodology for the synthesis of the following 13 crystal phases has been developed and optimized, including 4 crystal phases new to science (underlined below):

titanosilicatesETS-4 - $\text{H}_2\text{Ti}_4\text{Si}_{12}\text{O}_{38}(\text{TiO})\text{Na}_{8.8}\cdot 5\text{H}_2\text{O}$ STS (AM-2) – $(\text{K},\text{Na})_2\text{TiSi}_3\text{O}_9\cdot\text{H}_2\text{O}$ sitinakite - $\text{Na}_2\text{Ti}_2\text{O}_3\text{SiO}_4\cdot 2\text{H}_2\text{O}$ AM-4 - $\text{Na}_3(\text{Na},\text{H})\text{Ti}_2\text{O}_2[\text{Si}_2\text{O}_6]_2\cdot 2\text{H}_2\text{O}$ paranatisite - $\text{Na}_8\text{Ti}_{3.5}\text{O}_2(\text{OH})_2(\text{SiO}_4)_4$ **zirconosilicates** $\text{Na}_{3-x}\text{H}_{1+x}\text{ZrSi}_2\text{O}_8\cdot y\text{H}_2\text{O}$, $0 < x < 3$, $0 < y < 1$ **stanosilicates** $\text{Na}_2\text{SnSi}_3\text{O}_9\cdot 2\text{H}_2\text{O}$ (AV-10) $\text{Na}_2\text{SnSi}_2\text{O}_6(\text{OH})_2\cdot \text{H}_2\text{O}$ (Sn-C)*Synthetic kenyaite*

[4, 7, 9, 10, 17, 19]

ETS-10 - $(\text{Na},\text{K})_2\text{Si}_5\text{TiO}_{13}\cdot x\text{H}_2\text{O}$ GTS-1 - $\text{HM}_3\text{Ti}_4\text{O}_4(\text{SiO}_4)_3\cdot 4\text{H}_2\text{O}$, (M = Na,K)AM-1 (JDF-L1) - $\text{Na}_4\text{Ti}_2\text{Si}_8\text{O}_{22}\cdot 4\text{H}_2\text{O}$ natisite - $\text{Na}_2(\text{TiO})(\text{SiO}_4)$

[1, 5, 6, 12]

 $\text{Na}_2\text{ZrSi}_2\text{O}_7\cdot \text{H}_2\text{O}$ $\text{Na}_2\text{Zr}_7\text{Si}_{2.5}\text{O}_{20}\cdot 3\text{H}_2\text{O}$

[28]

 $\text{Na}_3\text{HSnSi}_4\text{O}_{12}\cdot 2\text{H}_2\text{O}$ (Sn-B) $\text{Na}_5\text{Sn}_3(\text{Si}_2\text{O}_7)_2(\text{OH},\text{Cl})\text{O}_2\cdot 4\text{H}_2\text{O}$

[2, 3]

The influence of a number of physicochemical factors on the phase composition and the microstructure of the synthesized materials has been studied, which achieves control and opportunity for preliminary setting of the quantity, size and morphology of the phases.

The crystal structures of the two new crystal phases - zircon silicates - were determined by the Rietveld method.

For 8 of the crystal phases, better X-ray diffraction data were obtained from the respective standards in the ICDD database until 2015, and for 4 phases, respectively - structural data in the ICSD until 2010.

A number of properties (thermal evolution and resistance, dehydration, rehydration, cation exchange, sorption characteristics) of the synthesized zircon- and titan-silicates have been determined, which outline the guidelines for their possible applications [2, 3, 5, 8, 10, 14, 17, 23 24, 25]. The obtained results are thoroughly interpreted from a crystal chemical point of view and dependences of the type composition - structure - properties have been established.

A number of crystal structures have been successfully identified and refined using the Rietveld method and specialized software for interpretation of powder X-ray diffraction data - GSAS, FullProf, TOPAS, PowderCell and others. [6, 8, 12, 13, 18, 20, 22, 23, 32]. Quantitative and microstructural phase analysis of materials has been successfully performed using the above software packages [9, 14, 20, 21].

3. Impact of the scientific publications of the candidate in the Bulgarian and foreign literature. The response of scientific publications is adequately measured by quoting them in the scientific literature. The candidate Assoc. Prof. Dr. Vladislav Kostov participated in the competition with 241 citations of his publications, (142 found according to Scopus and Web of Science), which collects in this group of indicators many times more points than required. I believe that this citation of the candidate's scientific publications in prestigious specialized scientific journals is a recognition of their relevance and high quality.

4. Critical remarks and recommendations to the scientific works of the candidate. I have no critical remarks on the candidate's scientific works. I would recommend him to prepare a monograph or review articles in which to present in a summary the main results and established patterns related to the synthesis and properties of new functional materials.

CONCLUSION My acquaintance with the materials submitted for participation in the competition, the topicality and importance of research topics, the level of research, coverage and exceeding the minimum scientometric indicators provided by law, give me reason to confidently give a positive assessment. As a member of the Scientific Jury, I propose the candidate Assoc. Prof. Dr. Vladislav Vladimirov Kostov to take the academic position of "professor" in the professional field 4.4. "Earth Sciences" ("Experimental Mineralogy and Crystallography").

04. Nov. 2020

Member of the Scientific Jury:

/ Assoc. Prof., PhD, eng. Irena Mihailova/