

REVIEW

in competition for the academic position of professor
in the professional field 4.4 "Earth Sciences" (Mineralogy and Crystallography)
for the needs of the field " Structural Crystallography and Materials Science "
at the Institute of Mineralogy and Crystallography "Acad. Iv. Kostov" (IMC) - BAS,
Announced in the State Gazette, issue 38/09.05.2025.

Reviewer. Prof. Prof. *Vilma Petkova Stoyanova*, IMC-BAS,
Member of the Scientific Jury under Order No. 394 RD-09/07.07.2025.

Candidate: Dr. Rositsa Hristova Titorenkova, IMC-BAS

1. Information about the competition

The competition for the academic position of Professor in the professional field 4.4 "Earth Sciences" (Mineralogy and Crystallography) is announced for the needs of the field "Structural Crystallography and Materials Science" at the Institute of Mineralogy and Crystallography "Acad. Iv. Within the deadline regulated by the Law on the Development of Academic Staff in the Republic of Bulgaria and the Regulations of the IMC-BAS (in force since 15.05.2025), as the only candidate, has submitted documents Dr. Rositsa Hristova Titorenkova, who is on a basic employment contract in the same field at the IMC-BAS.

The procedure for announcing the competition is based on Article 19 (1) of the PPPRAS of the IMC-BAS and in accordance with the Order № 394 RD-09/07.07.2025 of the Director of the IMC-BAS for the determination of the composition of the NW. Following the first meeting of the JW on 21.07.2025, in accordance with Order No. 394 RD-09/07.07.2025 of the Director of the IMC-BAS, I have been appointed to prepare a review of this competition.

1. Career development and professional qualities of the candidate

1.1 Brief biographical data

Dr. Rositsa Hristova Titorenkova graduated in 1988 at Sofia University "St. Kliment Ohridski", Faculty of Geology and Geography (SU), Sofia. Sofia (Diploma, №111441/08.05.1990) as a Master in the specialty "Geology" with professional qualification "Geologist Chemist". In 2007 he received the educational and scientific degree (PhD) "Doctor" in the scientific specialty "Mineralogy and Crystallography" (Diploma № 31191/01.03.2007, approved by Protocol No 6-04/15.12.2006 of the SAC) after successful defense of his dissertation.

The professional activity of Dr. Titorenkova began in 1996 at the Institute of Applied Mineralogy - BAS as a "Mineralogist - Specialist". In 2013, after a successful competition, she was appointed to the position of "Associate Professor" at the Institute of Mineralogy and Crystallography "Acad. Iv. She is a graduate of the Institute of Crystallography and Crystallography "I. Kostov" - BAS. Since 2013 she has been the Head of the Spectroscopy Laboratory at IPM-BAS, and also Scientific Secretary at the same Institute from 2013 to 2024. Since May 2024 and currently, Dr. Titorenkova is the Head of the Department of Structural Crystallography and Materials Science at IMC-BAS.

1.2. Specialisations and courses

For the professional development of dr. Titorenkova's professional development has been substantially supported by numerous specializations and additional training courses in the field of

Earth Sciences and mastering and application of spectroscopic methods, mainly Infrared and Raman spectroscopy, namely:

- 1996-1997 - at GI-BAS - Specialization "Statistical Methods in Geology", scientific supervisor. Prof. Vasil Vachev (Mathematical Geology);
- August - September 2004 - University of Vienna, Austria, European Mineralogical Union Summer School 6th EMU School " Spectroscopic Methods in Mineralogy";
- September, 2006 - University of Karlsruhe, Germany, ATR infrared spectroscopy with synchrotron radiation;
- March, 2007 - University of Vienna, Workshop: "Vibrational Spectroscopy (Infrared Absorption and Raman): Applications in Geosciences";
- June, 2009 - University of Bilbao, Spain, Crystallography online: International School on the use and application of the Bilbao Crystallographic Server;
- Nov. 28, 2010 - Nov. 28, 2012 - Yamaguchi University, Japan, Postdoctoral Specialization with JSPS (Japan society for promotion of Science) Scholarship;
- September, 2015 - December, 2015 - University of Hamburg, DAAD scholarship (German academic exchange service)

1.3. Compliance of the submitted documents with the requirements for the academic position "professor"

The applicant has submitted the application package for the AD Professor competition within the established deadlines.

1. **Set of documents (Article 19 (3) of the PPPRAS of the IMC-BAS).** R. Titorenkova has submitted all the documents required for the academic position of professor in accordance with Art. 29, par. 1, items 1-6 of the Law on the Development of Academic Staff in the Republic of Bulgaria (Law on the Development of Academic Staff in the Republic of Bulgaria) (in force from 23.12.2022) and Art. 1, items 1-6 of the Regulations for its Implementation (RAPRAS) (in force from 05.09.2023), as well as Article 19 (3) of the RAPRAS of the IMC-BAS (in force from 15.05.2025) in the established. The Committee for the examination of the documents of the candidate for participation in the competition and the compliance of the documents in the competition for the AD "Professor". The documents were also examined by the scientific jury at the first meeting on 21.07.2025, which decided to admit the candidate Dr. Rositsa Titorenkova to the evaluation for the academic position of "Professor" at IMK-BAS.
2. **Acquisition of the degree of Doctor of Education and Science (Art. 60 item 1 of the PPHRAS).** R. Titorenkova is registered in the NACID (<https://ras.nacid.bg/dissertation-preview/28104>), with the recognized educational and scientific degree "Doctor" on the basis of Diploma No/date: 31191/01.03.2007, approved by Protocol No/date: 6-04 / 15.12.2006, issued by the SAC, city of. No.. "Mineralogical features of zircon from Paleozoic metagranitoids in the Ograjden Mountains, Serbian-Macedonian Massif, SW Bulgaria".
3. According to the submitted Certificate of Work Experience № 483LS05/07.07.2025, issued by IMC-BAS and the professional CV, Dr. Titorenkova has held the academic position of Associate Professor for more than 10 years in the professional field 4.4. Earth Sciences, which satisfies the requirement for more than 5 years of experience in the academic position of "Associate Professor" according to the requirements of Article 29, para. (in force from 23.12.2022).
4. **Published monographic work or equivalent publications in specialised scientific journals (Article 60(3) of the PPHRAS).** The publications submitted for the competition shall not duplicate the publications for the award of the PhD degree and for the post of Associate

Professor and shall comply with the criteria for indicator groups "C" and "D" of the minimum national requirements of Article 1a(2) of the PPHRAS, Article 2(4.4) of the PPHRAS of the BAS and Article 2(5)(3) of the PPHRAS of the IMC-BAS.

5. **Reference for the fulfilment of the minimum national requirements (Article 60, point 5 of the PPHRAS).** The applicant has attached a reference on the fulfilment of the minimum national requirements under Art. 2b, para. 1 and 3 of the RRBA , as well as the enhanced criteria under Art. 2 para. 4.4 of the RRBA and Art. 19 para. 3, item 17 of the PPHRAS (in force from 15.05.2025) of the Institute of Mineralogy and Crystallography "Acad. Iv. Kostov", BAS.
6. **Information on plagiarism (Art. 60 p. 6 of PPHRAS).** Titorenkova for participation in this competition.

2. The evaluation of the scientific production and scientific metrics of Dr. R. Titorenko's scientific work is not included in the competition. Titorenkova

2.1. Characteristics and evaluation of the scientific publication activity

Dr. R. Titorenkova has provided a cumulative list of 82 scientific publications, 40 of them (48.8%) are in refereed and indexed international journals with impact factor (IF- Journal Citation Indicator - Q-JCI) and impact rank (SCR - SCImago Journal Ranking).

The number of publications of Dr. Titorenkova for participation in this competition is 36 according to the provided list of publications. I accept all the publications and I will consider mainly those of them (29 pcs.) that protect the minimum requirements adopted by the PMS No. 17/14.03.2025 and published in the State Gazette No. 18/23.03.2025. The detailed scientific-metric reference shows that 18 (62%) of the articles are published in international journals, another 11 (38%) of them - in national journals, 2 of the publications are book chapters in foreign publications. According to the list of publications, Dr. Titorenkova is a co-author in all publications of 29 scientific papers visible in the WoS and Scopus world databases of scientific information. Of these, 21 (72%) papers are in impact factor journals, 3 (10%) in impact rank journals, and 5 (17%) in full-text conference proceedings and non-impact factor journals. The distribution of articles by quartiles of WoS and Scopus journals in which the publications are in is as follows: 10 (34%) articles are in Q1 journals; 5 (17%) - in Q2 journals; 2 (7%) - in Q3 journals and 4 (14%) - in Q4 journals, i.e. more than 60% of the scientific publications have undergone peer review and approval in indexed and refereed international journals. This is an excellent attestation of the quality and level of research involving Dr. Titorenkova. Two of the publications (№ 5 and 6) included in the group on indicator B, Dr. Titorenkova has classified in Q2. They are published in the journal *Materials*, which for 2023 has a section - Metallurgy & Metallurgical, which is Q1. According to the guidelines in the PMC No. 17/14.03.2025 and published in the State Gazette No. 18/23.03.2025, publications No. 5 and No. 6 should be scored with 25 points and the totals should be adjusted to meet the minimum national requirements in professional field 4.4. Earth Sciences.

High-ranking journals include *Journal of Raman Spectroscopy (Q1)*, *Ceramics International (Q1)*, *Journal of biomedical materials research Part A (Q1)*, *Gels (Q1)*, *Materials (Q1)*, *Microporous and Mesoporous Materials (Q1)*.

The data from the publication lists demonstrate the scientific growth of Dr. Titorenkova especially in the last years and the reorientation of her publication activity towards high ranking journals mainly with Q1, in areas corresponding to the objectives of this competition.

In the present competition, the publications with which Dr. Titorenkova participated (36 pcs.) are distributed as follows: in 5 of them she is the first author (in group "C" - no. 2, 10; in group

"D" - no. 12, 17 and 28), in 9 she is the 2nd author (in group "C" - no. 1, in group "D" - no. 11, 13, 14, 16, 27, 30, 31, 33), and in the rest (22 pcs.) she is the third and next co-author. All papers were published in the last 10-12 years after 2011, and the largest number were in 2022 (12 no.), 2019 and 2023 (7 no.).

2.2 Characteristics of citations on publications

The total number of citations noted on Dr. Titorenkova's publications, presented in a separate list, is 442 according to the System for Reporting of Scientific and Expert Activity at BAS - Sonix. Of these, 100 items, refereed and indexed in world-renowned databases of scientific information Scopus and WoS, are submitted for the requirements for the competition for AD "Professor" according to the citation report. This citation is an objective indicator of the quality of Dr. Titorenkova's scientific production and proves the serious international response and interest in the results obtained in her work. The Hirsch index (h) according to Scopus is 9, for the publications of the competition, it is 6. The total number of points from citations in scientific journals refereed and indexed in world-known databases of scientific information Scopus and WoS, presented in the Reference for fulfilling the minimum criteria, is 500. This result exceeds more than 4 times the required 120 points even according to the increased requirements under the BAS and IMC-BAS PPPASRB.

2.3. Characteristics of participation in scientific forums

The scientific results of Dr. Titorenkova's research, obtained after obtaining the academic position of Associate Professor, have been promoted through 40 participations in 31 scientific forums (since 2012), of which 12 in international scientific forums and 19 in national forums. In the programme of these scientific forums, Dr. Titorenkova's participation included 15 oral presentations - reports and lectures, and 25 poster presentations.

2.4. Characteristics of participation in scientific projects

Dr. R. D. Titorenkova has an impressive participation in the project activities of IMC-BAS. She has actively participated in 23 national and international scientific projects, being a participant in 18 projects and a leader of 5. Of all the projects, 4 are international in bilateral cooperation between the academies of BAS and other related academies in the Czech Republic and Romania, and one is with Germany (DAAD German Academic Exchange Service), of which she is also the leader. The applicant does not provide evidence of project participation in the package, but only a list of project names and roles. There is also no reference to the funds involved in the projects.

2.5 Expertise and teaching activities

Along with her research activities, Dr. Titorenkova is also active as a lecturer in the course on Infrared Spectroscopy and Accessory Minerals Indicators at the Central Research Centre of the Bulgarian Academy of Sciences. She has taught students of the University of St. Kl. Ohridski" in the course "Vibrational spectroscopy in mineralogy" in 2014-2016.

Dr. Titorenkova is a scientific supervisor of 1 PhD student at IMC - D. "Structural characteristics of dental enamel studied by vibrational (micro-infrared and Raman) spectroscopy", who was discharged with the right to defense.

Dr. Titorenkova is the supervisor of student G. Markov from Sofia University "St. Kliment Ohridski" during the period 2016-2017 under the program "Student Practices".

Dr. Titorenkova is also a lecturer in the course on Raman spectroscopy -International summer school, Centre of Applied Spectroscopy, Instrumental analysis, 15-21.07. 2013, Sofia

2.6. Assessment of the fulfilment of the minimum national requirements for the scientific field 4.4. 4.4 Earth Sciences according to the PPHRAS of BAS and IMC-BAS

From the made reference it is established that the scientific production of Dr. Titorenkova is on the topic of the competition. The analysis of the submitted materials shows that it meets, and in some indicators exceeds, the national requirements (ЗПАЧРБ *), as well as the increased criteria of the Bulgarian Academy of Sciences and the Institute of Mineralogy and Crystallography "Acad. Iv. Kostov" (Bulgarian Academy of Sciences/IMC**) for the position of "professor" in the professional field 4.4. Earth Sciences.

The fulfilment of the minimum national requirements in professional field 4.4. Earth Sciences by points

Indicators by group	Indicators	Doctor		Required points for AD "Professor" by group for 4.4. Earth Sciences		Points achieved by the candidate
		Min. requirements	Points achieved	HAZARD*	BAS/IMC**	BAS/IMC**
A	1. Dissertation for the award of the degree of Doctor of Education and Science	50	50	50	50	50 ¹
B	3. Habilitation work - scientific publications in publications that are refereed and indexed in WoS and Scopus			100	100	240 ²
Г	7. Scientific publications in journals that are refereed and indexed in WoS and Scopus, outside the habilitation thesis	30	50	200	220	266
Д	11. Citations in scientific publications, monographs, collective volumes and patents, refereed and indexed in WoS and Scopus			100	120	500
E	12. Sum of indicators 12 to the end			150	150	350
	Total	80	100	600	640	1406

* The Law on the Development of Academic Staff in the Republic of Bulgaria

** Regulations on the conditions and procedure for the acquisition of scientific degrees and for the filling of academic positions in the Bulgarian Academy of Sciences / Regulations on the conditions and procedure for the acquisition of scientific degrees and for the filling of academic positions in the IMC-BAS

1 - Points missed by the applicant under criterion A

2 - Incorrectly calculated points for two of the publications (No. 5 and No. 6) due to incorrect quartile determined by the candidate under criterion B

The review reveals that the scientific production of Dr. Titorenkova defends and exceeds in all indicators the increased requirements of BAS/IMC in the individual groups of indicators for scientific field 4.4. Earth Sciences, as specified in the BAS-PRASRB and the IMK-BAS-PRASRB. These data prove that Dr. Titorenkova is an eminent scientist in the field with a proven international prestige of research in the field of spectroscopic studies and characterization of physico-chemical and crystal-chemical properties of materials.

3. Main scientific and/or applied contributions

The contribution of the publications with which the candidate participates in the competition (36 items) has been considered in the two main categories of material according to the requirements of Article 2b(2) and (3) of the HACCP: criterion "C" - Habilitation Author's Statement on the Contribution of the Publications, which are included in the Habilitation thesis and category "D" - Author's Statement on the Contribution of the Publications by Indicator. The candidate Dr. R. Titorenkova has presented her contributions on the publications jointly for the groups of indicators "C" and "D" in one general reference. In defence of the requirements for indicator "C", Dr. Titorenkova includes 10 publications (Nos. 1-10) which have been published in refereed and indexed world-renowned databases of scientific information, 8 of them being in quartile Q1 and 2 publications with Q2. For the group of indicators "D", 17 publications are included in subgroup D.7 - Refereed publications (Nos. 11-27), 7 publications in subgroup D.8 - Non-refereed publications (Nos. 28-34) and in subgroup D.9 - 2 book chapters (Nos. 35, 36).

4.1. Summary of the submitted publications

The scientific activity of Dr. Titorenkova is related to research in several scientific areas of synthesis and characterization of structural-phase and physicochemical properties of natural, synthetic and modified groups of materials such as 1. Biominerals and synthetic biomaterials; 2. Synthetic heteropolyhedral, porous materials; 3. Ceramics and ceramic pigments; 4. Synthetic materials; 5. Natural minerals and natural pigments; 6. Spectrophotometric methods.

4.2 Scientific contributions

The main scientific contributions in Dr. Titorenkova's publications can be presented in several categories:

- Obtaining new data on the chemical and phase composition, occurrence of isomorphic substitutions, structural and crystal-chemical characteristics and properties of biological, synthetic and natural minerals;
- Application of local vibrational spectroscopy methods in mineralogy to the study of biological, synthetic and natural minerals and materials;
- Establish relationships between structural characteristics, isomorphic substitution, defects and properties of minerals and materials.

The scientific contributions of Dr. Titorenkova in these studies are briefly presented within the defined thematic groups.

4.2.1. Research on biological minerals and synthetic biomaterials (B1, 2, 3, 4, 5, 6; D28 and D35)

The publications in this group deal with the synthesis of various calcium phosphates with applications in dentistry (B2, 3, 6 and D35), the influence of conditions, pH of the medium (B3, B6, D35), methods of influence and intensification on phase composition (B2) and phase

transformations in simulated media to study the degree of influence on the final products or modification of their structure (B1-6, D28, D35).

The preparation of synthetic Ca-phosphates was investigated by a biomimetic approach, i.e. in a simulated medium of tissue fluids (SBF), which differed in HCO_3^- , Cl^- ions and amino acid (glycine) content in order to mimic the biological mineralization of solid tissues. These syntheses yield amorphous dicalcium phosphate dihydrate (an analogue of the mineral brushite), which is considered to be a precursor of biological apatite that makes up mineralized tissues. Depending on the composition of the system, pH and Ca/P ratio, and residence time in different tissue fluids, dicalcium phosphate dihydrate is transformed into octacalcium phosphate (intermediate phase) and ultimately B -type carbonate-apatite at different rates (B3).

The effect of amino acid additions of glycine, alanine and valine on the biomimetic precipitation of amorphous, Mg- and Zn-doped, double-doped calcium phosphates, which after calcination are transformed into Mg, Zn- β -tricalcium phosphate (β -TCP; an analogue of the mineral vitlocite), was investigated. The influence of amino acid type and concentration on the extent of magnesium and zinc incorporation into the solid phases formed was refined by a suite of methods. Mg^{2+} and Zn^{2+} have been shown to substitute for Ca^{2+} only at the octahedral positions in the tricalcium phosphate (β -TCP) structure, and the resulting isomorphically substituted Mg,Zn- β -TCP can serve as a reservoir for magnesium and zinc ions, in biomaterials for solid tissue remodeling (B6).

Publication B35 (book chapter) is devoted to the biomimetic precipitation and transformation of calcium ortho-phosphates. The work reviews the classification of calcium ortho-phosphates, their crystal structure, degree of solubility, review of composition, pH of electrolyte systems and their advantages. Results of biomimetic precipitation in modified SBF of different compositions, biomimetic precipitation and transformation of amorphous calcium phosphate and dicalcium phosphate dihydrate, high temperature modification of ion-modified amorphous calcium phosphate into apatite are presented.

In Publication B1, the changes of dental apatite treated with different parameters of a dental pulsed Er-YAG laser ($\lambda = 2940 \text{ nm}$) were investigated. The structural changes were determined by micro-infrared spectroscopy in reflection mode and Raman spectroscopy with an ultraviolet source of the excitation radiation (325 nm). Based on statistical analysis of spectral parameters (position, width, integral intensity of peaks due to different atomic groups (PO_4 , CO_3 , OH and amino groups)) it was found that the effect of dental laser was strongest on organic molecules and carbonate groups at dental laser power of 8W. The contribution of these studies is the determination of safe parameters for dental laser operation, at which there is no disruption of the structural state of biological apatite, mobilization of carbonate and amino groups (B1).

Publications C4 and B5 present results of testing new materials for remineralization of dental apatite. The feasibility of using microgels of polymers PDMAEMA/Carbomer 940 (C4) and in the presence of polycarboxybetaine (PCB) or polysulfobetaine (PSB) (B5) to form a thin surface layer on laboratory demineralized enamel surfaces is investigated. The results demonstrate that the polymer forms spherical particles around which calcium phosphates are deposited in-situ, as demonstrated by micro-infrared, Raman spectroscopy and NMR analyses.

I will not review publication B2 as I am a member of the author collective.

4.2.2 Synthetic heteropolyhedral porous materials - publications from group C7, 8, 9 and from group D19

In this group of publications, results of preparation and characterization of new, synthetic heteropolyhedral porous silicates are presented. The heteropolyhedral compounds have a crystalline structure composed of silicon-oxygen tetrahedra linked by coordination polyhedra

(octahedra) formed from other metals (copper, iron, titanium, zircon, etc.). Their skeletal structure resembles zeolites and zeolite-like minerals. Paper B7 presents the results of the synthesis and characterization of a new, iron, microporous silicate (MS-1 - $\text{Na}_{6.7}\text{Ca}_{1.3}\text{FeSi}_{(6)}\text{O}_{18}$) with a three-dimensional structure, an analogue of the mineral imundrite of the lovozerite group; paper B8 characterizes a new, indium analogue (MS-2) of the mineral imundrite ($\text{Na}_6\text{Ca}_{1.5}\text{FeSi}_{(6)}\text{O}_{18}$) of the lovozerite group, which instead of iron has a skeleton composed of $[\text{InO}_6]$ indium octahedra connected by 6-membered rings of $[\text{Si}_{(6)}\text{O}_{18}]$ tetrahedra; in B9 results are presented from the preparation and study of three copper heteropolyhedral silicates: $\text{Na}_{(0.17)}\text{K}_{(0.)}8[\text{Na}_4\text{Cu}_2\text{Si}_{(12)}\text{O}_{(28)}(\text{OH})(\text{H}_{(2)}\text{O})_{(2)} \cdot 4\text{H}_2\text{O}$ (MS-3A), $\text{Na}_{(1.08)}\text{K}_{1.14}\text{Cu}_2\text{Si}_{(12)}\text{O}_{(29)}(\text{H}_{(2)}\text{O})_{(2)} \cdot 3.5\text{H}_2\text{O}$ (MS-3B) and $\text{Na}_{(1.43)}[\text{Na}_4\text{Cu}_2\text{Si}_{(12)}\text{O}_{(29)}(\text{H}_{(2)}\text{O})_{(2.3)} \cdot 9\text{H}_2\text{O}$ (MS-3C) and the exchanged forms Cs-MS-3A, Sr-MS-3A by hydrothermal synthesis. The materials have been studied by a complex of methods and the crystal structure, chemical composition, thermal properties have been determined. Publication D19 presents results of hydrothermal synthesis of another heteropolyhedral microporous material, the titanosilicate Na-GTS ($\text{Na}_4\text{Ti}_{(4)}\text{O}_{(4)}(\text{SiO}_4)_3 \cdot 6\text{H}_{(2)}\text{O}$), which is a structural analogue of the mineral pharmacosiderite. Its ion exchange capacity when exchanged with cobalt was investigated, and the experiments were conducted at Yamaguchi University, Japan.

4.2.3. Ceramic pigments - publications from group B10 and group D11, 12, 13, 14, 15, 29-33

In this group of publications, research has been carried out on the preparation and characterization of ceramics and ceramic pigments as part of a topic developed jointly with the University of Rousse Branch in Razgrad and aimed at the preparation of ceramic pigments for use in sanitary ceramics. The aim of these studies is the synthesis of colored ceramics based on pyroxene matrix (mainly from the series of solid solutions diopside-hedenbergite, diopside-enstatite and augite), by incorporating transition elements-chromophores (Co^{2+} , Mn^{2+} , $\text{Cr}^{(3+)}$, Fe^{2+} , $\text{Fe}^{(3+)}$, V^{5+} , REE^{3+}) into the structure of pyroxenes. The colour of the materials is associated with the presence of transition metals incorporated in the crystal structure, which have unfilled d- or f-electron orbitals defining the electronic transition under the action of light. The syntheses were carried out by two methods: by solid-phase high-temperature synthesis and by sol-gel method and subsequent heating at high temperatures.

The scientific contribution in these publications is related to the establishment of the compositions and synthesis parameters at which the formation of ceramics, mainly from pyroxene, is expected so as to establish the influence of isomorphic substitution on the phase, structural and optical characteristics and on the colour of the ceramics.

4.2.4. Other synthetic materials - Group D publications 16, 17, 18, 20, 21

This group of publications presents research on other synthetic materials with different potential applications.

In publication D16, experiments were carried out to produce a "geopolymer" by activating waste slag from the Aurubis plant (Pirdop, Bulgaria) with a phosphoric acid solution.

In Publication 17, glass in a new quaternary tellurite system TeO_2 - $\text{Bi}_{(2)}\text{O}_3$ - GeO_2 - $\text{Li}_{(2)}\text{O}$ was obtained. Raman spectroscopy was used to evaluate the contributions of the different TeO_n structural units. The spectra in different polarization differ, which is an indication of the presence of unbound oxygen atoms.

Nanosized TiO_2 materials with added Ag silver are promising photocatalysts. In publication D18, results of preparation of TiO_2 nanosized sheets and TiO_2 thin films decorated with Ag nanoparticles by cryoliophilization and ArF laser ablation methods are presented. These materials are mainly characterized by TEM.

Publication D20 presents results of synthesis, crystal structure determination, thermal and spectral characterization of three Mg(II) perrhenate complexes: $\text{Mg}(\text{H}_{(2)}\text{O})_{(2)}(\text{ReO}_4)_{(2)}(1)$ and two new ionic complexes with urea ($\text{OC}(\text{NH}_2)_2$, (U)), $[\text{Mg}(\text{H}_{(2)}\text{O})_{(2)}(\text{U})_{(4)}](\text{ReO}_4)_{(2)}(2)$ and $[\text{Mg}(\text{U})_{(6)}](\text{ReO}_4)_{(2)}(3)$. A detailed analysis of the vibrational and optical spectra is presented, and the density of states is performed with theoretical, periodic PAW/PBE calculations.

In publication D21, the crystal structures of three complex compounds, magnesium iodides with urea, are determined. The studied compounds were found to crystallize in the same $\text{P2}_1/\text{c}$ space group and exhibit a structure isotypic of the corresponding chlorides and bromides. The complexes were characterized by experimental IR spectroscopic and TG-DTA analyses and DFT/B3LYP theoretical calculations of the free energy and vibrational states at the molecular level.

Dr. Titorenkova's contribution to these studies is in the characterization of the materials and obtaining new information on the structural characteristics of the materials.

4.2.5. Natural Minerals and Natural Pigments and Spectrophotometric Methods - Group Publications D22, 23, 24, 25; 34, 36

Contributions to natural mineral research include the results of the description and characterization of new mineral occurrences of fluoravellite $\text{G22 Al}_{(2.90)}(\text{PO}_4)_{(2)}(\text{OH})_2.[\text{F}_{(0.88)}(\text{OH})_{(0.12)}]_5\text{H}_2\text{O} (+0.1\text{H}^+)$ from the Balkan Peninsula (Northern Macedonia) and Libetenite - $\text{G23 Cu}_{(2)}(\text{PO}_4)(\text{OH})$, from the Kladenche deposit, Rosen ore field, Eastern Middle Norway. Results include mineralogical description and data on crystal morphology, chemical composition, crystal structure and infrared spectra.

Publications D24, D25 and D34 present results of mineralogical characterization of ancient plasters and pigments from the Early Hellenistic tomb of Dokumaci (4-3 BC), located near the town of Mangalia, Romania. The phase compositions of the plasters and pigments used for decoration were determined by optical microscopy, electron microscopy, powder X-ray phase analysis, infrared and Raman spectroscopy. In paper D36 spectral characteristics from micro-infrared and Raman spectroscopy of natural minerals used as pigments for red, black, yellow and green colour in some selected Thracian tombs in Bulgaria are presented in a summarized form. Contributions include spectroscopic data to specify the composition and features of the ancient, natural pigments used.

4. Personal impressions

I know Dr. R. I have excellent impressions of her as a dedicated scientist and researcher, with high expertise in spectroscopic methods, organizational skills and experience in project initiatives. This has allowed me to build a good personal and professional relationship with Dr. Titorenkova, whom I consider to be a warm and helpful colleague.

5. Evaluation of the personal contribution of dr. Prof. R. Titorenkova's contribution to the AD "Professor" competition.

The thorough review of the presented scientific papers and scientific documentation gives me reason to assume that the personal contribution of Dr. Titorenkova consistently covers all stages of scientific activity - from participation in the planning of the syntheses of various natural and synthetic samples, successively through the conduct of the analytical measurements by powder X-ray diffraction, infrared spectroscopy, Raman, optical spectroscopy and other analytical methods, interpretation of the results and formulation of publications. The active publication activity, citation rate, national and international project activity are reflected in the values of the scientific metrics, which significantly exceed the minimum national requirements of the Law on

Research and Development and of the Regulations on Research and Development in the Institute of Medical Sciences-BAS for obtaining the AD "Professor" in the professional field 4.4. Earth Sciences.

6. Critical comments and recommendations

I have no critical remarks and recommendations.

7. Conclusion

The documentation submitted by Dr. Rositsa Hristova Titorenkova for participation in the competition for the position of AD "Professor" meets the requirements of the Law on the Protection of Human Rights and Fundamental Freedoms of the IMC-BAS. The supporting material meets 1406 points and exceeds the minimum requirements of the regulatory documents.

I positively evaluate the materials submitted in the competition and recommend the Scientific Jury to propose to the Scientific Council of IMC-BAS that the candidate Dr. Rositsa Hristova Titorenkova be elected to the academic position of Professor at IMC-BAS in the professional field 4.4. Earth Sciences (Mineralogy and Crystallography) for the "Structural Crystallography and Materials Science" at the Institute of Mineralogy and Crystallography "Acad. Iv. Kostov (IMC) - BAS.

Sofia

04.09.2025

Reviewer:

Заличено съгласно
чл. 2 от ЗЗЛД

(Prof. Dr. V. Petkova)