Appendix 12c

REVIEW
to occupy the academic position:

''Professor''	
''Associate Professor''	X
	one of the academic positions indicated shall be marked with the sign "X"

Candidates to occupy the position:

1	Assist. Professor	PhD	Tina	Radmilova	Tasheva	UCTM
№	academic position	scientific degree	name	middle name	last name	workplace

Scientific area:

5	Technical sciences
code	name

Professional area:

5.6	Materials and Materials Science
code	name

Scientific specialty:

Silicate Materials

The competition has been announced:

64	05.08.2025	Silicate Technology	Metallurgy and Materials Science
in SG issue	date	for the needs of the Department	Faculty

The review was written by:

Prof.	PhD	Reni	Stoilova	Iordanova	IGIC-BAS
academic position	scientific degree	name	middle name	last name	workplace

1. Review for the candidate:

Assist. Prof.	PhD	Tina	Radmilova	Tasheva	UCTM
academic position	scientific degree	name	middle name	last name	worplace

1.1. Completion of the provided documents:

A) The competition documents are in full compliance with the Regulations	3 points	**X**

B) The documents are complete but do not fully comply with the requirements of the Regulations	2 points	
C) The documents are not completed in accordance with the requirements of the Regulations	0 points	
		one of the answers given is marked with the sign "X"

Missing documents and violated requirements must be described if response C is marked.

1.2. Meeting the minimum requirements under the Regulations:

A) The candidate meets the minimum requirements	20 points	X
B) The candidate doesn't meet the minimum requirements	0 points	
		one of the answers given is marked with the sign "X"

It must be filled in if answer B is marked. The publication activity of the candidate is analyzed. The response of the results achieved (quoted) is analyzed.
According to the report on the fulfillment of the minimum required points for the academic position of Associate Professor in Professional Direction 5.6 Materials and Materials Science at the UCTM, in all groups of indicators the candidate exceeds the minimum required points. In the group of indicators "B", indicator 4 - Habilitation work, in the form of scientific publications (not less than 10) which are referenced and indexed in scientific data bases, with a required 100 points, assist. prof. Tasheva has presented 162.24 points. In the group of indicators "G", indicator 7 - Scientific publications which are referenced and indexed in scientific data bases, with a required 200 points, the candidate presents 208 points. The habilitation report includes 10 articles, most of which are in specialized glass journals with a high impact factor (above 2.5) - an indicator that indicates the significance of the published research. 8 other original research articles outside the habilitation thesis were also presented. Therefore, in the competition for associate professor Tina Tasheva participated with 18 scientific publications that are on the topic of the current competition. The pressented publications do not repeat those for the acquisition of the educational and scientific degree "doctor." In 10 of the publications, she is the first author. The total number of citations of the scientific production submitted for the competition is 17, which according to the Regulations carry 170 points, which exceeds the required 50 points several times, which is indicative of the relevance of the topic developed by the candidate and the quality of the scientific publications. According to the regulations for holding the academic position of "associate professor", no leadership or participation in projects is required. However, the candidate presents an impressive list of participation in project development. Assist. Prof. Tasheva was the leader of 2 projects under the Competition for Funding of Fundamental Research for Young Scientists and Postdoctoral Fellows at the National Science Fund (2022 and 2018) and the leader of 2 projects under the National Program Young Scientists and Postdoctoral Fellows (2020 and 2019) at the Ministry of Education, and Science. She is a participant in 2 projects under the National Science Found and projects under the Operational Program "Science and Education for Smart Growth", as well as in a project under the National Recovery and Sustainability Plan. She has published a textbook – "Guide to Exercises in Structural Analysis". Thus, the total

number of points in Indicator E is 171. The required number of points for the position of associate professor is 400. Assistant prof. Tasheva presents 761.24.

1.3. Relevance of scientific and / or applied research:

A) The research is relevant. Part of the research is pioneering (no results are known on the topic by other authors)	7 points	
B) Research is relevant. Results from other authors are known for each of the topics and / or applications studied.	5 points	X
C) Most of the research is relevant, but also some results are presented that have no scientific and / or applied value	3 points	
D) The smaller part of the research is relevant	2 points	
E) Research is not relevant	0 points	
		one of the answers given is marked with the sign "X"

The evaluation of the relevance of the research must be substantiated.
The study of the optical properties of glasses is of essential importance for the development of modern photonic and optical technologies. The determination of parameters such as the refractive index, electronic oxygen polarizability, linear and nonlinear optical characteristics and optical basicity allows for a deeper understanding of the structure and behavior of the material when interacting with light. The results obtained would have direct application in the development of optical fibers, laser media, nonlinear-optical elements and functional glasses for sensors and photonic devices. Therefore, the study of these properties is relevant and of high scientific and applied value. The relevance of bioactive glasses in materials science and biomedicine is undeniable. They have a strong scientific basis, active development and potential for clinical applications.

1.4. Knowledge of the problems subject of research:

A) The candidate knows in detail the achievements of other authors on the researched topics and/or applications	6 points	X
B) The candidate is partially familiar with the achieved results on the researched topics and / or applications	4 points	
C) The candidate has no prior knowledge of the status of the researched problems	0 points	
		one of the answers given is marked with the sign "X"

The evaluation must be substantiated if answer C is marked.

1.5. Type of research:

A) Theoretical	4 points	X
B) Applied	4 points	
C) Theoretical with application elements	4 points	
D) It does not correspond to the level specified in the Act for the Development of the Academic Staff in the Republic of Bulgaria and the Regulations	0 points	
		one of the answers given is marked with the sign "X"

The level of research must be substantiated if answer D is marked.

1.6. Objectives of the research:

A) Realistic and of scientific and / or applied interest	8 points	X
B) Realistic, but not of scientific and / or applied interest	4 points	
C) Unattainable (unrealistic)	0 points	
		one of the answers given is marked with the sign "X"

Objectives must be specified. The type of the set objectives must be justified.
The fundamental research conducted by Assist. Prof. Tasheva has an applied focus and is dedicated to: 1. Synthesis of traditional and non-traditional glasses and obtaining glass-ceramics based on them, in order to develop materials with potential application in optics and biomedicine. 2. Structural characterization of the synthesized glasses: short and medium order, oxidation state of transition metals; phase composition of glass-ceramics; 3. Study of optical characteristics and bioactive properties - important characteristics of the obtained materials for their application; 4. Establishment of the composition-structure-property relationship

1.7. Methods of research:

A) Adequate to research and set scientific objectives and /or applications	8 points	X
B) Partially appropriate, enabling part of the scientific objectives and / or applications to be achieved	4 points	
C) Inappropriate methods	0 points	

		one of the answers given is marked with the sign "X"

Methods must be specified. The type of methods used is justified.
1. melt quenching method for glass synthesis; 2. characterization of the obtained samples by X-ray diffraction, DTA, infrared and Raman spectroscopies, Mössbauer spectroscopy, optical microscopy, XPS, scanning electron microscopy; 3. computational methods for determining optical characteristics, average single bond strength, interionic interaction parameter – Lorentz-Lorenz equation, Duffy and Ingram, Dimitrov – Komatsu, Miller's rule, Beck's method;

1.8. Candidate research contributions:

A) With lasting scientific and / or applied response, they form the basis for new research and applications	20 points	
B) They are of significant scientific and / or applied interest, complete and / or summarize previous research	16 points	
C) They are of scientific and / or applied interest	12 points	X
D) Lack of significant contributions	8 points	
E) Lack of contributions	0 points	
		one of the answers given is marked with the sign "X"

Contributions must be specified. The type of results achieved must be justified.
The review of the achieved results assigned to the Habilitation thesis (in the form of scientific publications) shows that important results for inorganic materials science have been achieved, which can be summarized as fundamental with an applied focus. The research is dedicated to obtaining new theoretical and experimental data on the electronic polarizability and optical basicity of simple oxides and oxide glasses, establishing the composition-structure-properties relationship, by applying the polarization approach. New silicate and multicomponent glasses containing classical and conventional glass formers, as well as modifying oxides, have been synthesized and structurally characterized. The influence of the components on the structure, physicochemical, physicomechanical and optical properties of the obtained glasses has been studied. New glassy, glass-ceramic and ceramic materials with potential for dental and biomedical applications have been developed. 1. **Electronic polarizability and optical basicity of simple oxides and oxide glasses, establishing the composition-structure-properties relationship by applying the polarization approach**. New data have been obtained on the electronic polarizability and optical basicity of simple oxides (SiO_2, Al_2O_3, TiO_2) and oxide glasses with the participation of Bi_2O_3, Nb_2O_5, GeO_2, B_2O_3, TeO_2 and their influence on the structure and properties has been studied. A comparative analysis of the electronic polarizability in glasses based on Bi_2O_3 has been carried out, with the participation of classical glass formers SiO_2, P_2O_5, GeO_2, B_2O_3, conditional glass former TeO_2, modifying oxides Li_2O, ZnO, as well as PbO, Ga_2O_3 and RE_2O_3. For these systems, the

optical basicity, $\Lambda(n_0)$ and the interionic interaction parameter, $A(n_0)$, were calculated using equations based on the Lorentz–Lorenz formula and the Yamashita–Kurosawa theory. A strong dependence of these parameters on the Bi_2O_3 content was found. Comparison with other glasses not containing Bi_2O_3 (such as B_2O_3-SiO_2, $Li_2O/Na_2O/ZnO$-$B_2O_3/SiO_2/P_2O_5$, Li_2O/Na_2O-GeO_2 and $Li_2O/Na_2O/ZnO$-TeO_2) shows that the bismuthate glasses have extremely high basicity ($\Lambda(n_0) \sim 1.15$) and very weak chemical bonding ($A(n_0) \sim 0.01$ Å-3). The obtained results explain some properties of bismuthate glasses: low glass transition temperatures (Tg ~ 232°C), brittleness and low phonon energies, high values of nonlinear optical susceptibility, possibility of forming functional crystals doped with RE^{3+} ions.

The optical basicity, $\Lambda(n_0)$, of some binary and ternary silicate glasses has been determined by the Lorentz-Lorenz formula, based on the refractive index. A new, more correct value of the optical basicity has been proposed for a number of oxides (SiO_2, Al_2O_3, TiO_2). The relationship between the optical basicity and the structural units building the silicate networks has been established. The comparison between the experimentally determined optical basicity Λ_{exp} and the theoretically calculated Λ_{th} is an effective method for quantitatively determining the electronic polarizability in glasses.

The structural role of Nb_2O_5 in a number of multicomponent glasses has been determined. It has been proven that deformed NbO_6 octahedra, with low phonon energy (600 cm^{-1}), form clusters, as a result of which the electronic polarizability of the glass increases and the optical properties of rare-earth ions added to the glasses improve. The results obtained are the basis for the design of new functional oxide glasses and glass-ceramics containing Nb_2O_5, with improved electrical and optical properties.

A correlation has been established between the structure and optical basicity of tellurite glasses in the TeO_2-V_2O_5-MoO_3 system. With increasing V_2O_5 content, the free volume in the amorphous network and the number of non-bridging oxygens increase. It has been found that MoO_3 is the better glass former, as it contributes to the formation of a better cross-linked three-dimensional structure with the participation of bridging bonds: Te–O–V, V–O–V, Mo–O–Mo and Te–O–Te. The synthesized tellurite glasses are characterized by high values of electronic polarizability (2.560 - 2.657 $Å^3$), high optical basicity (1.018 - 1.042), high values of the refractive index of light (2.100 - 2.281), and nonlinear optical susceptibility. The obtained low values of the interionic interaction parameter (0.048 - 0.055 $Å^{-3}$) and the strength of the single chemical bond (294–334 kJ/mol) indicate the formation of weak interionic bonds in the amorphous networks.

Based on spectral studies with infrared spectroscopy, structural models describing the network of the synthesized glasses have been developed. The short-range order in the amorphous networks has been clarified: VO_5 trigonal bipyramids connected in $(VO_4)_n$ and $(V_2O_8)_n$ chains, MoO_5 units forming $[Mo_2O_8]$ complexes, as well as deformed TeO_4 and TeO_{3+1} bipyramids combined with TeO_3 trigonal pyramids.

As a result of the conducted research, new data were obtained on the electronic polarizability, optical basicity and chemical structure of the synthesized tellurite glasses. The composition-structure-property relationship was established, which is the basis for the development of new glasses with desired optical properties.

Another group of synthesized glasses are vanadate glasses in the V_2O_5-BaO-TeO_2 system.

With the help of IR spectroscopy, the influence of individual components on network formation has been studied. The main structural units and the bonds formed between them have been determined. Replacing BaO with V_2O_5 leads to the formation of a better cross-linked structure, built up of bridging bonds: Te–O–V, Te–O–Te and V–O–V. The glasses are characterized by high values of electronic polarizability and optical basicity, which is a result of the presence of weakly polarized cations – Te^{4+} and Ba^{2+}.

The studies conducted on the glass formation, structure and optical characteristics of tellurite and vanadate glasses show that by appropriate change in the composition, the structure and hence the optical characteristics of the glasses can be modified.

2. Synthesis of multicomponent silicate glasses in the systems Na_2O-CaO-SiO_2-Fe_2O_3 and Na_2O-Ba-ZrO_2-TiO_2-SiO_2-B_2O_3-Al_2O_3 and study of the influence of modifiers on the structure and properties of the glasses.

In this group of glasses, the candidate has contributed to the structural characterization, determination of some physicochemical parameters and prediction of the refractive index of light.

The role of the individual components in the formation of amorphous networks and their influence on some physical and optical parameters has been determined. Fe_2O_3 is incorporated into the glass network as FeO_4 and FeO_6 structural units and plays the role of both a network former and a modifier. Fe_2O_3 leads to an increase in density, molar volume and refractive index, as well as to changes in oxygen density. When introduced into the composition of glass, it causes structural depolymerization and loosening of the silicate network.

The presence of ZrO_2 in the obtained silicate glasses in the system Na_2O-Ba-ZrO_2-TiO_2-SiO_2-B_2O_3-Al_2O_3 causes an increase in density, oxygen density and refractive index, accompanied by a decrease in molar volume. An increase in hardness, elastic modulus and crystallization temperature is observed, which is due to the formation of a stronger and more stable three-dimensional structure with the participation of Zr^{4+} in octahedral coordination.

The results obtained show the possibility of regulating the structural, optical and mechanical properties of oxide glasses by controlled introduction of various modifying oxides.

3. Synthesis and characterization of bioactive glasses and glass-ceramics.

Another area to which the candidate has directed her research interests is the preparation and structural characterization of new glasses for application as glaze layers in dental medicine, new glass-ceramics and ceramics for application in dental and regenerative medicine.

Bioactive silicate and borosilicate glass compositions were synthesized, which were applied as glaze on a zirconium base. SEM analyses show the formation of a homogeneous layer without cracks and without the presence of pores, with excellent adhesion. The glass with the highest content of alkali oxides has a CTE value closest to that of dental zirconium ceramics, high transparency and good fluidity, which makes it a suitable material for dental applications.

A new bioactive glass-ceramic material based on biogenic hydroxyapatite (BHA) synthesized from Rapana venosa shells in combination with monocalcium phosphate monohydrate was obtained. Dense ceramic samples with 25 wt.% glass (B_2O_3-SiO_2-Al_2O_3-Na_2O) containing a crystalline phase of hydroxyapatite ($Ca_{10}(PO_4)_6(OH)_2$) and a new bioactive crystalline phase $Na_3Ca_6(PO_4)_5$ were sintered. Tests in simulated body fluid (SBF) demonstrated the ability of the material to form an apatite layer, which confirmed its bioactive potential.

Studies showed good adhesion, compatibility and bioactivity, necessary for dental and biomedical applications.

Outside the habilitation thesis, other scientific contributions were prsented:

1. Structural characterization of borate oxide glasses with application in medicine

In recent years, there has been increased interest in boron-containing bioactive glasses, as they have faster bioactivity/dissolution and good results in bone and wound regeneration. Bioactive borate glasses (BBG) have demonstrated significant potential in a number of biomedical applications.

Assist. Prof. Tasheva has focused on studying the structural features of borate glasses from the B_2O_3-Na_2O-CaO-P_2O_5 system and studying the influence of synthesis conditions - such as cooling rate and the type of crusibles used - on the phase formation and the type of samples obtained - amorphous, crystalline or glassy.

The dependence of the structure of the glasses on the type of added modifiers has been established. The glasses were modified with ZnO and MgO, a decrease in density, an increase in molar volume and a decrease in oxygen density were found, respectively an increase in the free volume and the number of non-bridging oxygens, resulting in partial depolymerization of the amorphous network.

2. Study of the influence of structure on the optical and dielectric characteristics of multicomponent oxide glasses

Different glass compositions in the BaO-TeO_2-Bi_2O_3-B_2O_3 system were synthesized and studied. To characterize the amorphous network, basic structural parameters such as interionic interaction, oxygen density and single bond strength were determined. The structure of the obtained glasses was described by infrared and Raman spectroscopy. The relationship between the structure

and optical properties was analyzed. The experimentally measured refractive indices of light are in good agreement with the theoretical values determined by the polarization approach, which is the basis for the development of new glasses with potential for optical applications.

Borate glasses with low Bi_2O_3 content, as well as borobismutate glasses, were synthesized. The electronic oxygen polarizability (from 1.545 to 2.457 Å³) and optical basicity (from 0.589 to 0.990) of the synthesized glasses were determined. The high values of the nonlinear optical susceptibility χ(3), which is in the range 0.90 - 2.42×10^{-13} esu, make them potential candidates for application in nonlinear optics. The formation of weak chemical bonds in the structure of glasses with high Bi_2O_3 content was established. They are characterized by low values of the interionic interaction parameter (0.224 - 0.051 $Å^{-3}$) and of the chemical bond strength (377 - 198 kJ/mol). The observed optical properties are explained by the structural features of the glasses – networks with low Bi_2O_3 content are built up of pyro- and orthoborate units, while networks with high Bi_2O_3 content contain mainly orthoborate groups.

Tellurite glasses in the V_2O_5-BaO-TeO_2 system have been synthesized. The glasses are characterized by high values of electronic polarizability, optical basicity, high values of the refractive index (n_0) and significant nonlinear optical susceptibility of the third order χ(3). It has been established that the addition of V_2O_5 leads to a better cross-linked amorphous structure of ionic and covalent bonds. The observed structural transformations induced by V_2O_5 affect the optical characteristics of the materials.

The dielectric properties of vanadate glasses containing TeO_2 and BaO have been studied and the possibility of controlling these properties by replacing BaO with TeO_2 has been demonstrated. The obtained results reveal possibilities for developing new functional materials with potential applications in various fields.

The dielectric permittivity, dielectric loss and frequency-dependent conductivity, which is in the range 100 Hz - 1 MHz at room temperature, have been measured.

It has been proven that electron transfer in vanadate chains plays an important role in these properties. The introduction of TeO_2 leads to important structural changes in the amorphous vanadate network, which affect the dielectric properties. At low TeO_2 content < 10 mol %, Ba^{2+} ions occupy intermediate positions in the amorphous network without disturbing the structure of the glasses and they interact directly with the isolated V=O bonds (Ba^{2+}…O=V). Te^{4+} ions break the vanadate chains forming O=V-O-Te, without directly affecting the V=O double bonds. The important conclusion is that the formation of Te-O-V bonds, when replacing BaO with TeO_2, reduces the dielectric losses.

A comparative analysis of the electronic polarizability for different compositions of two- and three-component oxide glasses (borate, silicate, germanate, tellurite and glasses containing heavy metal oxides) has been conducted. It has been shown that the increase in optical basicity is accompanied by a decrease in the strength of the single chemical bond and an increase in the polarizability of the oxide ions.

1.9. Participation of the candidate in the achievement of the presented results:

A) The candidate has at least an equal participation in the submitted papers	8 points	X
B) The candidate has at least an equal participation in most of the submitted papers	7 points	
C) The candidate has a secondary participation in most of the submitted papers	4 points	
D) The candidate participation is unnoticeable	0 points	
		one of the answers given is marked with the sign "X"

Critical notes must be provided if one of the items C or D is marked.

1.10. Pedagogical activity:

A) The candidate has effective and sufficient pedagogical activity at the university. The textbooks issued are modern and useful (they meet the requirements of the Regulations). The work with undergraduate and doctoral students is at a high professional level.	8 points	
B) The candidate has sufficient pedagogical activity at the university. The textbooks issued satisfy the requirements of the Regulations.	6 points	X
C) The pedagogical activity and / or textbooks issued are insufficient (do not meet the requirements of the Regulations)	0 points	
		one of the answers given is marked with the sign "X"

Critical notes must be provided if one of the items B or C is marked.
Assist. Prof. Tasheva shows active pedagogical activity. Over the past 3 academic years, she has taught bachelors and masters - "Structural Analysis", "Methods for Obtaining Nanoparticles and Nanostructured Materials", "Characterization and Properties of Nanostructures and Nanomaterials", "Characterization and Properties of Building Materials", "Instrumental Analysis of Raw Materials and Products in Silicate Production", "Materials Science", "Introduction to the Specialty".

1.11. Critical notes:

A) Lack of critical notes	8 points	X
B) Critical notes of a technical nature	7 points	
C) Critical notes that would partially improve the results achieved in a small part of the research	5 points	
D) Critical notes that would partially improve the results achieved in most of the research	3 points	
E) Significant critical notes	0 points	
		one of the answers given is marked with the sign "X"

Critical notes must be provided if one of the answers C, D or E is marked.

1.12. Conclusion

A) The evaluation of the candidate's activity is **POSITIVE**	This evaluation is assigned to a total number of at least 65 points	X
B) The evaluation of the candidate's activity is **NEGATIVE**	This evaluation is assigned to a total number below 65 points	
		one of the answers given is marked with the sign "X"

To be filled in if requested by the reviewer
The review of the presented scientific and research activity of the candidate in the competition clearly shows that she is an established scientist in the field of glass - synthesis, structural characterization, optical parameters. She has accumulated sufficient experience and knowledge to be a stable basis for achieving new future successes and significant achievements. The documents and materials presented by Assistant Professor Dr. Tina Tasheva meet all the requirements of the Act on the Development of the Academic Staff in the Republic of Bulgaria, the Regulations for its implementation and the Regulations of the UCTM for the acquisition of the academic position of "associate professor". The topic and level of the research as well as the originality of the results cover all the criteria for the requested academic position. On this basis, I give my positive assessment of the overall scientific and research and teaching activity and with conviction I recommend to the Scientific Jury that the academic position of "Associate Professor" be awarded to Assistant Professor Dr. Tina Tasheva in Professional Direction 5.6 Materials and Materials Science.

	The review was written by:	
date	Prof.PhD Reni Stoilova Iordanova	signature