REVIEW

on a competition for an academic position "Associate Professor"

in professional direction 4.1. Physical Sciences (General Physics)

for the needs of Sofia University "St.Kliment Ohridski" (SU),
Physical Faculty, announced in SG No. 2015/2009 21 of 15.03.2022

This review was prepared by:

Academician Prof. Dr.Sci.Phys. Alexander Georgiev Petrov, BAS, as a member of the scientific jury in the competition in professional field 4.1. Physical sciences (General Physics) according to Order RD-38-248 / 20. 05. 2022 and modified order RD-38-266/02.06.2022 Rector of Sofia University.

For participation in the announced competition has submitted documents a **single candidate**:

Chief Assistant Dr. ***Gergana Emilova Alexieva***, PF of the SU

(academic position, scientific degree, name, surname, surname, scientific organization)

I. General description of the materials submitted

For all applicants, information on points 1 to 8 shall be given:

1. Application data

The documents submitted in the competition by the applicant comply with the requirements of the ZZRB, the PPPRB and the Rules of Procedure for acquiring scientific degrees and holding academic https://www.uni-sofia.bg/index.php/bul/universitet_t/proceduri_za_nauchni_stepeni_i_akademichni_dl_zhnosti - _blank University (PUPNAZADSU).

To take part in the contest, the candidate chief assist. ***Dr Gergana Emilova Alexieva****, has presented a list of a total of 19 titles, including* 19 *publications in Bulgarian and foreign scientific publications and scientific forums.* NO*, Studies... NO, Monographs... NO, Books... NO, certificates and patents… NO, textbooks and teaching tools...* ***4*** *other documents* (in the form of business notes and certificates from an employer, *project manager, funding organization or project contracting entity,* references and reviews, awards and other relevant evidence) are also presented, according *to* the *applicant's achievements.*

Notes and comments on the documents.

Chief asisst. Dr. Gergana Alexieva is the co-author of 30 scientific publications, of which 25 are referenced in the Scopus database. Some of the results are presented in international and national scientific forums, of which 7 as reports.

In this competition she participates with 19 publications, all are referenced and peer-reviewed, all of them are in magazines. In 7 of them she is a leading author, 4 of which are from Group I. The publications submitted for participation in the competition are in the following quartiles:

- quartile Q1 - 4 pieces [2, 3, 14, 16].
- quartile Q2 - 8 pcs. [1, 6, 8, 10, 11, 15, 18, 19].

- quartile Q3 - 3 pcs. [7, 12, 13].
- quartile Q4 - 4 pcs. [4, 5, 9, 17].

Under this competition, according to the requirements of the law, separate, habilitation work with included publications in referenced international editions with impact factor is presented. Habilitation work is based upon 6 articles [2, 3, 5, 9, 14, 19]. The articles outside the habilitation work are 13: [1, 4, 6–8, 10–13, 15–18].

She has defended her dissertation for educational and scientific degree "Doctor" on "Acoustic properties and applications of polymeric materials" in 2013. All requirements are met and Dr. G. Alexieva is allowed to participate in the competition.

All submitted works are accepted for a review. Reducing articles is not necessary.

G. Alexieva has led one scientific project and participated in five other projects.

The mentioned scientific indicators demonstrate the various scientific capabilities of candidate and fully satisfy the requirements of the PhysFac-SUni for the academic position of "associate professor".

2. Candidate data

Professional and biographical data on a candidate.

Gergana Alexieva graduated from the department of Solid State Physics at the Physical Faculty (PF) of Sofia University (SU) with a Master's degree (10.1992 –11.1997). She started her career as an assistant in the department.

Since 08.2013 she has been promoted to the position of Chief Assistant in the PF of the SU. She is engaged in teaching activities (lectures, seminar and laboratory exercises, etc.); in research activities and activities related to the academic community.

3. General characteristics of the applicant's scientific work and achievements

An assessment of the applicant's scientific performance is given in which scientific fields and on which issues the applicant has worked and continues to work.

The research activities of Dr. G. Alexieva are mainly realized in the Laboratory of Acoustic Waves at the Physical Faculty of "St. Kliment Ohridski" University. and cover scientific and applied tasks from the fields of material science and applied physics. The focus is on the research of acoustic, acoustic-optical and optical properties of bulk materials and thin-layer coatings related to the development of sensor systems applicable in microelectronics, ecology and pharmacy. Much of Dr. G. Alexieva's work is related to the application of the method of direct mass measurement QCM (quartz microbalance method), which is known for its wide applicability for sensory purposes due to its high precision and accuracy.

The scientific results achieved by Dr. G. Alexieva are carried out in solving a number of experimental, methodological, engineering and technological tasks, in cooperation and collaboration with other scientists.

Scientific contributions and related publications, depending on the purpose, object, and method of research, may be systematised into two interrelated groups:

I.Exploring the capabilities of various materials for sensory and pharmaceutical applications

II. Characterisation of the structure and properties of materials by acoustic, acoustic-optical and optical methods

I. Exploring the possibilities of various materials for sensory and pharmaceutical applications

I.1.Study of polymeric and metal-oxide nanostructured layers for sensory applications [2, 3, 4, 5, 17, 19].

I.1.1. Sensitivity study of uretanimid polymer films for sensory applications: The study demonstrates the potential of this polymer to be used in the development of a sensor for the detection and measurement of highly toxic gases HMI and pyridine. measurement of gas permeability of different polymer matrices. **Contribution of G. Alexieva: essential.**

I.1.2. Study of metal-oxide nanostructured materials for sensory applications: High sensory sensitivity and selectivity to analytes ammonia and acetic acid, as well as to pyridine and hexamethylenemine. **Contribution of Dr. Gergana Alexieva: leader.** High sensory sensitivity and selectivity to analytes ammonia and acetic acid, as well as to pyridine and hexamethylenemine. **Contribution of Dr. Gergana Alexieva – corresponding author.** It was established by SEM and AFM that the surface morphology of the nanostructured layers of ZnO depends on the roughness of the quartz plate. **Contributions of Dr. G. Alexieva: Participation in the concept and analysis.** A study on the sensitivity of electrochemically deposited layers of zirconium dioxide (ZrO_2) and ZnO for three gas analytes (methanol, ethanol and ammonia) is presented in the stat [17]. The results confirm the strong influence of surface topography and layer morphology on their sensory capabilities. **Contributions of Dr. G. Alexieva - Participation in the concept, measurements, processing and analysis of experimental data, and the preparation of the publication.** In [19] layers of ZnO, dosed with aluminum (Al), were studied. Original morphology of the surface and its dependence on the amount of the doping agent $Al_2(SO_4)_3$ and for the presence of a structural transition from nano-sticks to nano-walls have been obtained. Comparative measurements (QCM) of the sensory sensitivity of the layers to ammonia vapour and ethanol have been shown. obtained by electrochemical deposition can be successfully applied in the manufacture of precise sensory devices for the detection and measurement of ammonia vapour. **Contributions of Dr. G. Alexieva: Initiator of the study. Participation in the concept and methodology, conduct of sensor measurements, participation in the processing and analysis of experimental data, as well as in the preparation of the publication.**

I.2.Applications of the quartz microbalance method in development of drug carrier structures [9, 14]

I.2.1. Manufacture and characterization of a drug carrier by bio-polyelctrolytes

In [9] the results of the construction of a medium representing a multilayer system of two polyelectrolytes – chitozan and xanthan are presented. For the first time this system was implemented using a built-in microfluidic platform quartz resonator (10 MHz, AT-cut). The results were interpreted taking into account the physico-chemical properties of the two polyelectrolyps (oppositely electrically charged) and the presence of diffusion of their free parts. The optimal conditions for successful construction of the carrier have been established. **Contributions of Dr. G. Alexieva: Conducting the experiments on obtaining multilayer structures from polyelectrolytic materials, participation in the concept and methodology, processing and analysis of experimental data, writing the publication.**

I.2.2. Development of a method for quantitative evaluation of medicinal content in polymeric microparticles. [14] For the first time, it was proposed to use the QCM method to quantify the drug content in microparticles. UV-Vis spectral method. The proposed method is also validated by statistical analysis of the results obtained. **Contributions of Dr. G. Alexieva: Participation in the methodology and analysis of the results obtained.**

II. Characterization of the structure and properties of materials by acoustic, acoustic-optical and optical methods

II.1. Pulse echo methods when analyzing the acoustic properties of materials [10, 13]

In [10] and [13] measurements of acoustic speeds were carried out in crystals of iron-dosed strongite (Bi12SiO20:Fe) and in ag4SSe.2PbTe solid solution. Thebasis ofthe measured acoustic speeds and the analysis carried out confirms the isotropicity of these materials. In [13] the results of the studies on the acoustic and optical properties of Ag4SSe.2PbTe (solid solution of two narrow-gap semiconductors) were published. the applicability of this material for piezoelectric delay lines and in IC acoustics. **Dr. G. Alexieva's contributions:** Participation in the methodology and measurement of acoustic speeds.

II.2.Acoustic characterisation of the piezoelectric properties of polymers [1]. Studies have been published in [1] on several composites obtained with different types of nanoparticles, as well as for samples of PVDF and P(VDF-TrFE) of different thicknesses, Acustooptic measurements were carried out for two composite P(VDF-TrFE) materials, co-administered with iron iodate nanoparticles (IF) and sylanated ZnO. For the first composite, two diffraction maximums corresponding to longitudinal and transverse wave were recorded.

Contributions of Dr. G. Alexieva: Conducting acoustic-optical measurements, working with master student Petya Angelova, data processing and their analysis.

II.3. Characterization of materials by optical methods [6, 7, 8, 11, 12, 13, 15, 16, 18]

II.3.1. Examination of optical properties of glass panes. In [12] the optical absorption of new Cr-dosed glasses (80-x) Sb_2O 3-20K2O-xPbO was studied in the spectral region 2,75-3,35 eV at room temperature. In [7], [8] and [11], optical properties of samples from the three-component halcogenide As2Se3-Ag4SSe-PbTe system (with different parts content) were studied in the UV, VIS, NIR and FIR. A correlation relationship has been established between the optical parameters tested and the composition of the glasses. The established "transparency window" in the area 6600-3600 cm-1 due to the As_2Se_3 glass matrix, combined with the significant values obtained for the refractive indicator in this range, is promising for photon applications. **Contributions of Dr. G. Alexieva: Participation in the methodology of research, analysis of experimental data and production of the publishing material. Author for correspondence in [12].**

II.3.2. Investigation of metal oxide nanostructured layers. In [15] The influence of the deposition temperature was investigated and in [16] the influence of the pad on the structural and optical properties of electrochemically deposited layers ZnO and ZrO_2. In [15] ZnO layers are deposited on glass pads covered with tin dioxide (SnO_2). It is established that mean grain size is weakly temperature-dependent, while morphology (by SEM) varies from grains to nano-wall and nano-rods at 50 °C, through nano-walls at 60° and 70°C to hexagonal nanosticks at 80°C. In [16], the ZrO_2 layers were found to be in different crystalline directions. (ITO) due to the slower formation of grains in this type of pad. In [6], based on spectral data in the 720-1750 nm area and the effective oscillator model, basic optical parameters of ZnO films dosed with chromium (Cr) and cobalt (Co) were evaluated and analysed. The results obtained for the properties of films are relevant for their use in the development of light-capture structures in optoelectronic and thin-layer devices. **Contributions of Dr. G. Alexieva: Participation in the methodology of the studies and in the analysis of the results obtained.**

II.3.3. Polymorphic analysis of a drug by IR spectroscopy. In [18] a new experimental approach was proposed for the analysis of polymorphism in medicinal materials. Extensive studies (IR-spectroscopy, XRD and DSC) have been carried out to characterise the molecular structure and phase features of Nitrofural crystals grown on a halcogenide glass carrier (As_2Se_3). **Contributions of Dr. G. Alexieva: Participation in the methodology and analysis of experimental data.**

IN CONCLUSION:

a) The reviewer considers that the scientific work of Dr. Gergana Alexieva fully meets the minimum national requirements (under Art. 2b, para 2 and 3 of the IRASRB) and respectively the additional requirements of "St. Kliment Ohridski" University of Bulgaria. for the academic position "Associate Professor" in the scientific field and professional direction of the competition.

(b)Scientific papers do not repeat those of previous procedures for obtaining a scientific title and academic position.

c) Not proven by the statutory order plagiarism in the scientific papers presented in the competition.

4. Characteristic and evaluation of the teaching activity on a candidate

Assessment of the educational and pedagogical activity of the applicant meets the minimum national requirements and additional requirements of the PF of SU.

Teaching experience: from 05.2003 to present read the following courses: Initial computer knowledge - practicum; Condensed Matter Physics - Seminar; Crystallography and Crystal physics - seminar; Polymers in microelectronics - practicum; Acoustic and optical waves in a solid body - practicum; Electricity and magnetism - practicum; Optics - practicum; Physics – practicum; Programming and computational physics - practicum; Modern experimental methods - practicum; Introduction to programming - practicum; Physics of wave processes – lectures and seminar; Basics of acoustics – lectures; Computer methods of data processing – practicum; Geometric optics – practicum; Medical statistics – practicum; Medical statistics. Data processing - practicum; Introduction to astronomical optics – practicum; Computer modeling in optics - practicum; lectures in Physics at the Physics and Biophysics course for specialty Pharmacy; Physics – lectures (specialty Biology); She is the author of the exercise directions: 1. Acoustic-optical diffraction (to the course in "Modern Experimental Methods") 2. Deposition of thin layers by the centrifugation method (to the course on "Physical foundations of corpuscula and photon microtechnologies") 3. Piezoelectric res-

onators (to the course in "Physical Electronics 2-Solid State Electronics"). In the last 5 school years there have been 2888 hours of teaching employment and 2553 hours of audience occupancy. **She is a supervisor of two Master theses:** Acoustic Gas Sensors, SU, the thesis of Maria Galcina (2013); Transverse piezoelectric effect in nanocomposities based on PVDF, SU, the thesis of Petya Minkova Angelova (2002).

5. Meaningful analysis of the applicant's scientific and scientific and applied achievements contained in the competition materials

A detailed analysis of the scientific and applied contributions of the candidate presented in the competition is carried out and the results of the candidate in the works of other authors are clearly stated. 2015

Analysis of publications with respect to goals, tasks and contributions is given above. The reviewer shall maintain the contributions made (mainly experimental) and consider that they are of the following nature:

New theories, hypotheses, methods, etc.: **contribution group II.1**

Enrichment of existing knowledge: **contribution groups I.1, II.2, II.3**

Application of scientific advances in practice: **contribution groups I.1, I.2**

All the papers are collective. The number of co-authors is between 2 and 8, average number 5. The candidate's own contribution is correctly marked after each publication: decisive, leading, corresponding author, involved in the staging of the task, in the methodology, in the preparation of the samples, in the measurements, in the analysis of the literature, in the writing of the publication, in the supervising of graduates from the team.

It is clearly concluded that Dr. Alexieva appears in this competition with a sufficient number of contributions in several new areas of solid-state physics, acoustoelectronics, optics and sensorics.

Chief Assist. Dr. Gergana Alexieva is the co-author of 30 scientific publications, of which 25 are referred in the Scopus database. The total number of independent quotes of these articles is 52. Hirsch's h-index is 5. Some of the results are presented in international and national scientific forums, of which 7 as oral reports.

6. Critical notes and recommendations

I don't have any particular critical notes.

7. Personal impressions of candidate

My impressions are very positive. Dr. Gergana Alexieva is an established scientist and university lecturer with in-depth knowledge of the theory and experiment. She has established working collaborations with a significant number, including leading scientists at home and abroad, and a pronounced ability for a teamwork. There are useful specializations in prestigious European scientific centers and successful participations in international scientific events. We have to evaluate a mature scientist, with her own prospective scientific and applied direction, in which she is able to attract and motivate new young colleagues.

8. Conclusion of the application

Having become acquainted with the materials and scientific papers presented in the competition and on the basis of the analysis of their significance and the scientific and applied contributions contained therein, I confirm that the scientific achievements meet the requirements of the IARB, its Implementing Regulations and the respective Regulations of “St.Kliment Ohridski" University for the position of associate professor in the scientific field and professional direction of the competition. In particular, the applicant satisfies the minimum national requirements in the professional field and plagiarism has not been established in the scientific papers submitted under the competition.

I give my **positive** assessment of the candidacy.

II. GENERAL CONCLUSION

Based on the above, I am recommending to the scientific jury to propose to the competent body of election of the Physical Faculty at “St. Kliment Ohridski" Universiy to elect Dr. Gergana Emilova Alexieva to take the academic position "Associate Professor" in professional field 4.1. Physical sciences (General Physics).

24.06.2022 The review prepared by: …….....
(acad. DScPhys Alexander Georgiev Petrov)