

REVIEW

on a competition for the academic position of "associate professor" in professional direction
4. 1. Physical sciences, specialty "Electrical, magnetic and optical properties of condensed matter" announced in the State Gazette no. 35 of 10 May 2022

Member of the scientific jury: Prof. Nikolay Nedyalkov Nedyalkov, Institute of Electronics, BAS

The only candidate for the mentioned competition is Dr. Velichka Strijkova-Kenderova, assistant professor at the Acad. J. Malinovski Institute of Optical Materials and Technologies - BAS, (IOMT) "Optical Materials" department. She completed her master's degree at Sofia University "St. Kl. Ohridski", Faculty of Physics, specialty "Optics and Spectroscopy". She also has a second specialty - physics teacher, from Physics faculty of Sofia University "St. Kl. Ohridski" In 2014 she successfully completed his doctoral studies at the Institute of Optical Materials and Technologies - BAS. Since 1998, she has been working at the Institute of Optical Materials and Technologies, successively holding scientific degrees up to assistant professor, as she has been since 2011. The main direction of her scientific interests is related to the deposition and research of thin organic layers, nanocomposite materials and nanotechnologies, spectrophotometric measurements. In recent years, her main activity has been related to the study of the properties of various materials using atomic force microscopy.

The submitted documents for the competition and their content provide an opportunity for a clear assessment and analysis of Dr. Strijkova's scientific, applied and organizational activities. 19 scientific publications are presented, of which 16 were published in journals with an impact factor, and 3 of the publications were in journals with an impact rank. All the publications presented are post-doctoral and have been published within the last 5 years, which is a clear indication of active work at this stage of her career. As examples of the quality of her work, publications in Int. J. Mol. Sci. 2022, IF = 5.924, Q1, Nanomaterials, IF = 5.076, Q1 could be mentioned. For participation in the competition, 50 citations of works in which she is a co-author are submitted. All quotes are from the last five years, which demonstrates the relevance of the topics she works on. She has participated or is participating in 10 projects under national programs. The Hirsch index according to SCOPUS is 6. Data are also presented that demonstrate many years of work as a teacher of physics to students. Dr. Strijkova has participated in 26 national and international conferences, which proves her skills in presenting scientific results and leading discussions. With his scientometric data, the candidate exceeds the minimum requirements set by ADASRB and Scientific council of IOMT. Scientific works are presented in publications that are referenced and indexed in world-renowned databases of scientific information, which are equivalent to habilitation work (indicator B). The total score for this indicator is 135, with a minimum of 100. Indicator D includes two papers published in the Journal of Physics: Conference Series in 2021 and 2022 with Q4. A reference in Scimago shows that for these years the journal does not fall into quartiles. This remark does not affect the score for meeting the minimum requirements, because even if the points from these articles are not taken into account, the total number for indicator D is again exceeded. According to

indicator E, related to citations of works in which Dr. Strijkova is a co-author, the specified points also exceed the required ones.

The scientific activity of Dr. Velichka Strijkova is directed to the field of research of surface properties of various materials, including biological objects using Atomic Force Microscopy (AFM). It includes analysis of morphological characteristics of micro- and nanostructures, thin layers and cells and their association with certain properties, control of key parameters for specific applications and prediction of future dynamics of biological objects, with a clear focus of these studies on the diagnosis of a number of diseases with high social significance. A wide range of materials with different applications are considered in the works presented for participation. Morphological features of red blood cells from patients with various pathologies (such as high-risk pregnancy) and with various neurodegenerative diseases were studied, and a laboratory model modeling the aging of such cells was developed. Specific characteristics are defined that distinguish them from those of healthy patients, and the methodology can be used for the analysis of specific diseases and their diagnosis. Another group of publications is related to preparation and characterization of composite azopolymers with application as media for polarization holography. Materials with higher values of the birefringence coefficient and more effective surface diffraction gratings were obtained. A number of thin-film structures of ZnO:Al, ITO/ZnO:Ga₂O₃, WSe₂, WTe₂, AlN were also investigated which are materials with potential applications in renewable energy sources, in photonics, as efficient piezoelectric elements, and as effective substitutes for established transparent electrodes. Some of the resulting systems are original, such as the deposition of ZnO:Al on mica, for which preservation of conductivity under bending has been demonstrated. An important result of the morphological studies is the characterization of the roughness of such layers, which is a key parameter in the design of piezoelectric devices. In two publications, layers of hemoglobin and myoglobin, cells infected with the COVID virus, immobilized on a sensor based on surface plasmon resonance were also considered. Transfer of proteins onto the sensor element while retaining their bioactivity has been reported. On the basis of morphological analyses, changes in the parameters of the cells before and after infection with the virus were established. Investigations of a polymer-dye medium with random laser properties are also presented, demonstrating stimulated cascade four-wave mixing in the visible spectral range (486 nm – 680 nm).

The listed topics are undoubtedly current and attract interest both from an applied point of view and for revealing fundamental processes in the field of material sciences. The presented research is directly related to the diagnosis and understanding of a number of important diseases, to the development of more efficient media for recording information, for applications in green technologies for obtaining and storing energy, in new light sources.

The works with which Dr. Strijkova participates in the current competition are multidisciplinary and include specialists from various fields. I associate the candidate's personal contribution with the fact that her analyzes of the morphological and mechanical properties of various materials and the discussions relating these properties to their behavior in various applications are key to a detailed study at a high scientific level. Essentially, the main scientific and scientific-applied contributions of the presented works can be attributed to obtaining new knowledge and enriching existing ones in the field of obtaining and characterizing materials with current applications. As the most significant, directly related to the candidate's contribution, the following can be mentioned:

- New results obtained based on AFM studies of specific morphological characteristics and elastic properties of red blood cells of patients with early pregnancy loss and neurodegenerative diseases, which demonstrate a clear difference with those of cells from healthy patients. Characteristics observed in the aging process of cells from patients with the specified diseases and those from healthy individuals were also obtained. These results can be applied in early diagnosis of these pathologies. Morphological studies of cells infected with COVID should also be noted here.

The results of the conducted research have been published in renowned publications, such as the International Journal of Molecular Sciences. The article, in which Dr. Strijkova is the first author, was published in 2022 and already has one citation, which is proof of the quality of the research, the reliability of the results and the topicality of the direction.

As an enrichment of existing knowledge in the field of preparation and characterization of materials with current applications, the results of the detailed morphological characterization of composite azopolymers and various structures of dichalcogenides of transition metals (WSe_2 , WTe_2) can be mentioned; transparent conductive layers based on ZnO:Al , $\text{ITO:ZnO:Ga}_2\text{O}_3$; random laser medium; and the various biological structures deposited on the surface of a plasmonic sensor.

I have no critical remarks on the substance, as well as on the technical presentation of the documents. I would recommend that the candidate, after successfully completing the competition and taking the position of "associate professor", use the self-confidence and courage that it gives and develop his subject and actively lead scientific projects.

Conclusion:

My review of the results of the research activity of Dr. Velichka Strijkova gives me reason to believe that she is an established scientist with a significant contribution in the field of morphological analysis of a wide range of materials, with the skills and ability to determine and lead scientific research at a high level. The quantitative indicators of her scientific activity correspond to the criteria set by the law, BAS and by the scientific council of Institute of Optical Materials and Technologies, necessary for holding the academic position of "associate professor (docent)". My personal opinion is that Dr. Strijkova is a responsible scientist with deep knowledge in the field in which she works, highly motivated and organized.

Based on the above, I express a positive assessment and support for her candidacy and recommend the Scientific Jury to support and propose to the scientific council of the Institute of Optical Materials and Technologies, assistant prof. Dr. Velichka Strijkova to be elected to the academic position of "docent" under direction 4.1. Physical sciences, specialty "Electrical, magnetic and optical properties of condensed matter".

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Prof. DSc N. Nedyalkov

