

Opinion

from

**Associate Professor Dr. Albena Tacheva Daskalova, Institute of Electronics - BAS
by competition for the occupation of the academic position "Associate Professor" in
in professional direction 4.1 "Physical sciences" according to the announcement in SG
no. 35 of 10.05.2022**

**Candidate: Dr. Velichka Strizhkova - Kenderova, chief assistant at the Institute of
Optical Materials and Technologies – BAS**

Brief biographical data and professional development

Assistant professor Dr. Velichka Strizhkova - Kenderova was born on September 18, 1973. She graduated as a "master" in physics at Sofia University "St. Kliment Ohridski, Faculty of Physics in 1998.

The professional development of Dr. Velichka Strizhkova - Kenderova after graduation is as follows:

2009 - 2011 - Research Associate III, II, I year, Central Laboratory of Photoprocesses "Acad. J. Malinovski" – BAS.

2011 - until now - Chief Assistant in the "Optical Materials" department, Institute of Optical Materials and Technologies "Academic Y. Malinovski" - BAS

2014 - Obtained the academic title of doctor from the Institute of Optical Materials and Technologies "Acad. J. Malinovski"

2008-2019 - Physics teacher at "Roerich" Private Secondary School, "EUROOPTIC" Vocational Training Center, "Educational Technologies" Secondary School, "Educational Technologies" CNC.

She speaks English and Russian.

Research activity

Assistant professor Dr. Velichka Strizhkova - Kenderova has a total of **67** articles, **41** of which are indexed in WoS, Scopus. The total number of noticed citations (without the self-citations of all authors) is **104**. The H-factor (Hirsch index) of the candidate is **6**. She participated in the competition with a total of **19** publications, all of which are in publications with an impact factor and an impact rank. Participated in the competition with **50** pcs. citations. There are **39** participations in 26 national and international scientific events. For the period from 2014 to the present, the candidate participated in a total of **10** projects, eight of which are part of the unit and two external with personal participation.

The main thematic directions in research activity of chief assistant Velichka Strizhkova-Kenderova are the following:

Contributions related to habilitation work

1. Morphometric and nanomechanical characteristics of erythrocytes in the norm and pathology – **2** publications.

2. Investigation of the conditions of holographic recording of gratings with adjustable polarization and surface relief carried out in azopolymer PAZO and in azopolymer nanocomposites - **4** publications.

The scientific activity of Velichka Strizhkova-Kenderova in the professional direction "Physical Sciences" fully corresponds to the announced direction of the competition.

The main scientific results of the candidate related to the habilitation thesis are divided into two themes: research of surface properties of nanomaterials in the form of bulk samples or thin layers, as well as characterization of biological objects using Atomic Force Microscopy (AFM).

On the first topic, two approaches have been used to control the properties of simultaneously recorded volume polarization and surface relief gratings. The first approach is applied at the layer preparation stage, by varying the thickness of the azopolymer or the type, concentration and size of nanoparticles in the polymer matrix. The second approach to changing properties is by varying the recording conditions. AFM studies of the dependence of the height and period of the gratings on the thickness of the layers and the recording angle showed that surface relief gratings can be recorded in azopolymers with adjustable parameters-period - from 800 nm to 2000 nm and a height of more than 250 nm. The obtained results show that these gratings can find numerous applications, such as all-optical micro- and nanopatterning of materials. The results obtained from the application of Atomic Force Microscopy for the study of red blood cells (RBCs) in women at risk of pregnancy and patients with neurodegenerative diseases (NDD) complement important aspects of the mechanism of the aging process of RBCs. The introduction of new, non-invasive diagnostic approaches to serve as complementary methods to the currently applied diagnostic tests is extremely important for the prevention of some pathologies and/or adequate treatment of still incurable diseases, such as neurodegenerative diseases. I appreciate the presented results on the topic related to the characterization of biological objects using Atomic Force Microscopy (AFM), as a significant contribution in a social aspect.

Contributions beyond the habilitation work:

3. Transparent conductive doped zinc oxide layers with application as transparent electrodes and devices for "capturing" instantaneous energy - 4 publications.
4. Two-dimensional (2D) dichalcogenides of transition metals as materials with application in optoelectronics - 2 publications.
5. Atomically deposited layers of AlN with application in surface acoustic wave devices - 3 publications
6. Development of a polymer dye medium for application as an active medium for lasers - 2 publications.

Regarding the main contributions outside the habilitation work, it is striking that the studies of the structure, optical properties and time stability of the sheet resistance (sheet resistance) for AZO layers deposited by the ALD technique on glass and PET substrates reveal a great potential of AZO for integration as a functional transparent conductor material. The aforementioned developments may find application in modern optoelectronics. Another study on the synthesis of large-sized and high-quality single crystals of tungsten ditelluride (WTe_2) reveals the enormous potential of WTe_2 for the development of next-generation low-loss light modulation devices (planar optical elements providing spatial and polarization separation of light), for energy storage and in quantum computers (spintronics). Research on aluminum nitride (AlN) layers offer a unique combination of material and properties, including a band gap of 6.2 eV and high thermal conductivity, making them suitable materials for UV detectors, for applications in electronics. From the AFM results, the dependence between the conditions of preparation and the surface roughness of the AlN layers on the one hand and the dependence between the surface roughness and the substrates used on the other hand was established. The development of new materials for various optical applications is one of the most important topics for the photonics industry. With the help of AFM, an investigation of the interior of the developed medium was carried out in order to clarify the influence of the structure on the properties and the process of generating laser radiation. The last topic is related to AFM surface

analysis of the directly immobilized layers of Hb or Mb on an SPR transducer (diffraction grating) and on Si substrates. From the obtained results, conclusions were made about the MAPLE deposition parameters and the optimal conditions were established under which successful immobilization of Hb/Mb molecules was achieved to obtain a continuous layer with preserved bioactivity.

From the presented habilitation report, it is striking that the scientific activity of the candidate was carried out mainly in IOMT for the period 2017-2022. The majority of publications are co-authored with scientists from IOMT, and there are also those that are in collaboration with scientists from: Institute of Biophysics and Biomedical Engineering - BAS, Medical University - Pleven, University Clinic of Obstetrics and Gynecology "Mother's House" - Sofia; Institute of Electronics - BAS, Technical University - Sofia, National Center for Infectious and Parasitic Diseases. This proves the ability of chief assistant Velichka Strizhkova to work with teams from different fields successfully and to create and participate in common scientific production successfully.

According to the presented report on the pedagogical activity, the active participation of Dr. Velichka Strizhkova-Kenderova is evident, expressed in her work as a physics teacher in various schools and training of students and doctoral students to work with atomic force microscope, ZETA optical profilometer and vacuum deposition box.

Critical notes and recommendations

I have no critical notes.

Conclusion

After getting acquainted with the presented materials, I can conclude without hesitation that Dr. Velichka Strizhkova is a promising, motivated scientist who has the necessary qualities to carry out independent scientific work. The results achieved are original and have potential for practical application. From what has been said so far, it can be concluded that Dr. Velichka Strizhkova - Kenderova is an established scientist in the field of physics, who is able to conduct and organize independent scientific research. Furthermore,

Assistant professor Dr. Velichka Strizhkova-Kenderova fully meets the minimum national requirements and the additional requirements of the Institute of Optical Materials and Technologies - BAS for holding the academic position "Associate Professor."

This gives me the reason, with full conviction, to recommend to the members of the Scientific Council of the Institute of Optical Materials and Technologies - BAS, to elect chief assistant Dr. Velichka Strizhkova - Kenderova to the academic position of "Associate Professor" in professional direction 4.1 Physical Sciences.

09/05/2022

Prepared by:

/ Assoc. Dr. Albena Daskalova /