REVIEW

by competition for an academic position

"professor"

in professional direction 4.1 "Physical Sciences",

for the needs of Sofia University "St. Kliment Ohridski" (SU),

Faculty of Physics, announced in SG no. 24 of 17.03.2023

The review was prepared by: Prof. DSc Miroslav Vergilov Abrashev - FzF, SU, in his capacity as a member of the scientific jury under 4.1. Physical Sciences (General Physics) for the competition according to order No. RD-38-173 / 20.04.2023 of the Rector of Sofia University.

To participate in the announced competition, the **only candidate** submitted documents: Associate Professor of Physics, DSc, Veselin Todorov Donchev, Sofia University, Faculty of Physics

I. General description of the presented materials

1. Application data

The documents submitted by the candidate in the competition correspond to the requirements of the ZRASRB, PPZRASRB and the Regulations for the terms and conditions for acquiring scientific degrees and occupying academic positions at SU "St. Kliment Ohridski" (PURPNSZADSU).

To participate in the competition, the candidate Veselin Todorov Donchev submitted a list of a total of 156 titles, incl. 137 publications in Bulgarian and foreign scientific publications and scientific forums, 0 studies, 0 monographs, 2 book chapters, 0 certificates and patents, 3 textbooks and teaching aids. A total of 17 other documents (in the form of official notes and certificates from an employer, project manager, funding organization or project contractor, references and reviews, awards and other relevant evidence) supporting the applicant's achievements are also presented. From the total number of papers given above, in the "Professor" competition the candidate participated with 16 publications in IF journals and 6 publications in conference proceedings. A complete reference table is presented for the fulfillment of the minimum requirements for the groups of indicators for obtaining the academic position "professor". The first part of the table contains the number of points on the indicators

covering the national requirements. The next part of the table contains the number of points on the indicators covering the additional requirements of the FS of the SU. The following is a table outlining the parameters of each of the applicant's submitted papers (substantial contribution or not, IF, quartile, year, source, number of points and group). According to the requirements, the articles are divided into groups according to the previous competitions in which the candidate has participated - "doctor", "principal assistant", "associate professor" and "doctor of science". The following is a reference for compliance of the citations with the "additional requirements..." of the FzF, SU, where the citations are distributed according to the previous competitions for "Associate Professor" and "Doctor of Sciences" and the current one for "Professor". From the submitted documents, it can be concluded that the applicant fulfills all quantitative criteria of all regulatory documents

2. Applicant data

Veselin Donchev graduated in "Physics" with a specialization in "Physics of the solid state" at the Faculty of Physics of the SU in 1985 with an excellent grade of 5.97. In 1991, he received the scientific degree "doctor" ("candidate of physical sciences") with the thesis "Investigation of electrical and optical properties of point defects in gallium arsenide" (supervisor: Assoc. Prof. Krasimira Germanova). Since 1991, he has worked in the Faculty of Physics of the SU successively as a physicist (1991-1992), senior assistant (1993-1997), ch. assistant professor (1997-2004) and associate professor (2004-present). In the period 2010-2013, he worked as an administrator at the European Commission in Brussels (administration of scientific projects in the field of nanoelectronics and microsystems). Head of the Department "Condensed Matter Physics and Microelectronics" (2013-present). In 2022, he received the scientific degree "Doctor of Science" with the thesis "Surface Photovoltaic Spectroscopy of Semiconductor Optoelectronic Materials and Nanostructures". His main research interests are in the field of electronic and optical properties of semiconductor materials and structures. He carried out 8 long-term scientific visits with a total duration of 48 months to various universities and research centers in France, Germany, Switzerland, Sweden, Brazil and Scotland.

3. General characteristics of the scientific works and achievements of the candidate

The candidate's scientific interests are in the field of electronic and optical properties of semiconductor materials and structures (photoelectric and optical methods, computer

simulations). The main directions in which he worked are: surface photovoltaic spectroscopy of materials for photovoltaics [Ga(In)As(Sb)N, Si, perovskites], as well as semiconductor materials and nanostructures for optoelectronic applications (emitters, detectors); calculation of reflection and transmission spectra of multilayer structures with consideration of interface roughness. Over the years he has researched the following objects and their properties: point defects in GaAs - EL2, Cr deep levels, shallow impurities - photoconductivity, optical absorption, sheet resistance, wafer topographic studies; DX-centers in AlGaAs; band discontinuities in GaAs/GaInP heterojunctions; photoluminescence of GaAs/AlGaAs quantum wells and quantum wires; potential fluctuations in bulk semi-insulating GaAs caused by non-uniform distribution of defects (photoconductivity without applied electric voltage, theoretical modelling); photoluminescence and electronic structure calculations of AlAs/GaAs superlattices with embedded GaAs quantum wells; experimental and theoretical reflection spectra in GaAs/AlGaAs multi-quantum wells; electron transport in electron-irradiated infrared detectors based on GaAs/AlGaAs multi-quantum wells; electrical properties of GaAs grown at low temperatures; photoluminescence of individual quantum currents from InAs/GaAs; calculation of the electronic structure of GaAs/AlGaAs quantum wires with fuzzy interfaces; computer modeling of the dielectric properties of Si/SiOx nanocomposites. Motivated and definite to say that:

a) scientific works meet the minimum national requirements (according to Article 2b, paragraphs 2 and 3 of the RSARB) and, accordingly, the additional requirements of SU "St. Kliment Ohridski" for occupying the academic position of "professor" in the scientific field and professional direction of the competition;

b) the scientific works presented by the candidate do not repeat those from previous procedures for acquiring a scientific title and academic position;

в) no plagiarism has been proven in the scientific works presented in the competition according to the law.

4. Characteristics and assessment of the candidate's teaching activity

As a teacher, he led both courses in General Physics (lectures on "Mechanics" and "Molecular Physics", as well as seminars and laboratory exercises, including other courses in General Physics), as well as specialized courses: "Optoelectronic Instruments" for the undergraduate engineering program "Computer Engineering", "Nanostructured Materials and Devices for Information Technology" and "Physical Foundations of Optoelectronics" in M.Sc. program "Microelectronics and Information Technologies". He is the head of the teaching la-

boratory "Electricity and Magnetism" (2004-2010 and 2013-present). Supervisor of 1 defended and 1 currently studying doctoral student, consultant of 2 doctoral students, supervisor of 6 and consultant of 4 graduate students. The applicant has submitted a report on his academic employment during the last 5 academic years: 2017/2018 – 462.2 hours (405 classrooms), 2018/2019 – 445.8 hours (360 classrooms), 2019/2020 – 442.6 hours (301 classrooms), 2020/2021 – 399 hours (375 classrooms), 2021/2022 – 399 hours (375 classrooms). During his certification as a teacher, in the "Student Opinion" section, he always received the maximum rating "positive".

5. Content analysis of the applicant's scientific and scientific-applied achievments contained in the materials for participation in the competition

The candidate's scientific and scientific-applied achievements throughout his scientific career can be summarized as follows:

- Identification and discussion for the first time of the contribution of the deep EL2 level in the photoconductivity spectrum of semi-insulating Cr-doped GaAs. (Article A2 of the general list).
- An extension of the widely used model for the dark current in multiple GaAs/AlGaAs quantum wells (based on electron emission and capture from the quantum wells) to account for the reduction of the emission barrier caused by the Poole-Frenkel effect (paper A17).
- A new approach has been developed for calculating of the optical reflection and transmission spectra of a multilayer structure, which takes into account the roughness of the interfaces (articles A16 and B1 of the general list).
- An experimental setup and methodology for surface photovoltage (SPV) spectroscopy in a wide spectral and temperature range has been developed. New approaches have been developed to extract information from the SPV phase spectra and a vector model of the SPV signal, allowing a combined analysis of the amplitude and phase SPV spectra for a correct interpretation of the experimental data. (papers A29, A32, A33, A44 from the general list and F15 from those presented in the competition).
- Pioneered SPV studies of a number of semiconductor nanostructures and bulk layers and structures for optoelectronic applications. (articles A30, A31, A32, A35, A38, A40, A41, A43, A45, A46 from the general list and F1, F2, F4, F5 from those presented in the competition).

- A coherent explanation of SPV spectra and SPV transients measured in novel perovskite/silicon heterostructures is presented. (articles F1, F2 from those presented in the competition).

In particular, among the articles included in the "professor" list, the widest response (highest number of citations so far) have received works F9(A27), F15(B18) and F3(A39). In F9(A27) single quantum dots were investigated using dual laser excitation microphotoluminescence. Additionally, the infrared laser used affects the charge configuration of the point and increases the intensity of its luminescence. This is explained by the separate generation of additional electrons and holes at the point by the two lasers. With increasing dot density and/or sample temperature, the increase in luminescence intensity progressively disappears, while the ability to control the dot charge remains. F15(B18) an original experimental technique for surface photovoltage spectroscopy at temperatures from 65 to 300 K based on the metal-insulator-semiconductor variant is presented. It has been used for spectral measurements and to estimate the diffusion length of minor carriers in p-Si obtained by zone melting coated with (Al2O3)TiO2. The surface recombination rate was estimated from the obtained data. In F3(A39) a study of rare nitride InGaAsN layers by X-ray photoelectron spectroscopy (XPS), Raman and photoluminescence (PL) spectroscopy is presented. The objective is to determine the degree of atomic ordering in the quaternary alloy during epitaxial growth from a melt under conditions close to thermodynamic equilibrium and its influence on band gap formation. Despite the low concentration of In (~3%), the XPS data show a strong preference for the In-N bonding configuration in the InGaAsN samples. Raman spectra reveal that most of the N atoms are bonded to In instead of Ga atoms and the formation of N-centered In3Ga1 clusters. PL measurements show a smaller decrease in the optical bandgap compared to theoretical predictions for disordered alloys and tails from localized states near the bandgap minimum.

The applicant has submitted the following scientometric information: according to the submitted SCOPUS screenshots (covering 85 papers), the applicant has 402 independent citations with an h-index of 9. However, according to the applicant's submitted citation list (covering all his works), the author has 469 citations with an h-index of 12.

6. Critical notes and recommendations

I have no critical remarks to the author. He demonstrates excellent experimental skills, ability for deep analysis and generalizations, high methodological level, accuracy and completeness of results, and excellent literature awareness.

7. Personal impressions of the candidate

I have known Veselin Donchev since 1983. My impressions of him as a fellow student, scientist, teacher and colleague are excellent.

8. Conclusion on the application

After having familiarized myself with the materials and scientific works presented in the competition and based on the analysis of their significance and the scientific and scientific-applied contributions contained in them, I **confirm** that the scientific achievements meet the requirements of ZRASRB, the Regulations for its application and the relevant Regulations of SU "St. Kliment Ohridski" (which also includes the Additional requirements for candidates to acquire scientific degrees at the Faculty of Physics of SU "St. Kliment Ohridski" under direction 4.1. Physical Sciences) for the candidate to occupy the academic position of "professor" in the scientific field and professional direction of the competition. In particular, the candidate satisfies the minimum national requirements in the professional direction and no plagiarism has been found in the scientific works submitted for the competition.

I give my **positive** assessment to the application..

II. GENERAL CONCLUSION

Based on the above, I **recommend** the scientific jury to propose to the competent authority for the selection of the Faculty of Physics at SU "St. Kliment Ohridski" to elect Veselin Todorov Donchev to occupy the academic position of "professor" in professional direction 4.1. Physical Sciences (General Physics).

03.07.2023 Prepared the review:

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