OPINION

On a competition for the academic position "professor"
professional field 4.1 "Physical Sciences", specialty "Physics of Condensed Matter"
(Creation and study of thin layers for surface modification) for the needs of the,
Plovdiv, according to the announcement in State Gazette No. 26/01.04.2022.
candidate: Liliana Petrova Kolaklieva, Ph.D., associate professor at the CLPF-BAS, Plovdiv
Reviewer: Evgenia Petrova Valcheva, PhD, Doctor of science, Faculty of Physics of SU "St. Kliment Ohridski"

1. General characteristics of the presented materials

The only candidate for the announced competition is associate professor Dr. Liliana Petrova Kolaklieva. The candidate has submitted all materials for the competition required by the Law on the Development of the Academic Staff in the Republic of Bulgaria.

Dr. Kolaklieva has a master's degree in physics, majoring in "Physics of semiconductors" from the Faculty of Physics of SU "St. Kliment Ohridski" from 1980 with a diploma thesis on the topic: "Lateral inhomogeneities in Si-SiO2 structures", prepared at ISSP-BAS. From her graduation until now, she has worked at CLPF-BAS, Plovdiv as a physicist, a research assistant from the 3 to the 1st level, and an associate professor since 2011. In 2000, she defended a dissertation for the acquisition of the Doctor's degree on the topic "Creation and research of temperature-stable ohmic and Schottky contacts for high-power devices from SiC", prepared at the CLPF-BAS, Plovdiv. Throughout her working experience, Dr. Kolaklieva purposefully developed through a number of specializations in prestigious scientific organizations such as "Institute of Physics of Semiconductors", SO AN, Russia (1986), FORTH - Hellas, Crete, Greece (2000), Linkoping University, Sweden (2002, 2003, 2004). In the CLPF - BAS, she has repeatedly held various leading administrative-scientific positions, such as deputy director and director.

The complete list of publications of Dr. Kolaklieva includes a total of 101 publications (70 after habilitation), 339 citations, 7 useful models. The candidate co-authored 2 book chapters as first author. A list with an impressive number of participations in national and international conferences is presented.

Dr. Kolaklieva participates in the competition with 24 articles published in IF and SJR journals, 2 book chapters and 3 useful models. From the summarized data according to various criteria in tabular form according to the requirements for occupying the academic position "professor" laid down in the Law on the Development of the Academic Staff in the RB (ZRASRB) and the regulations of BAS, it can be seen that the candidate has submitted for: criterion A - dissertation for scientific degree "doctor" (50 points); criterion B - 8 publications with indexes Q1-Q4 (total 160 items, required 100 items)); criterion G7 - 14 articles; D8 - 2 book chapters; D9 – 3 useful models (311 items in total, with 220 items required according to ZRAS - IFTT); criterion D - 592 specified citations (for the required 200 items); to criterion E - 965 (with required 150 points).

Assoc. Prof. Kolaklieva demonstrates extreme activity in scientific projects, national and international, of which I would like to highlight the leadership of the team of the National Research Center for Excellence in the Center for Excellence "National Center for Mechatronics and Clean Technologies" and the Center for Competence "Intelligent Mechatronic, Eco- and energy-saving systems and technologies". The data presented by Assoc. Prof. Kolaklieva fully meet the quantitative indicators of the requirements of ZRASRB

and the requirements of BAS. The reference provided to meet the minimum requirements is according to Web of Science/Scopus. The Hirsch index for the citation of publications is h: 9.

2. General characteristics of the candidate's scientific, scientific-applied and pedagogical activities (scientific areas and problems; prepared doctoral students and graduates.

The scientific and scientific-applied activity of Associate Professor Kolaklieva is in the field of materials science and more specifically research of thin layers obtained by physical deposition methods (PVD) on the surface of various materials to achieve specific surface properties. The composition and structure of the layers and interfaces, the processes causing changes and the mechanisms, as a result of which their properties change as a result of various impacts, have been studied. Research is motivated by applications in microelectronics, mechanical engineering and the metalworking industry.

The thin films developed for microelectronics applications are metallic nanoscale multilayer structures to produce ohmic contacts. The materials on which the SiC contacts and III-V nitrides (GaN, AlN, c-BN) are formed are used in powerful and high-temperature semiconductor devices. Another area of application of thin films covers nanostructured coatings to modify the surface in order to improve certain properties or create new ones for the engineering and metalworking industries. The goal is to achieve improved mechanical and tribological properties, increased temperature stability, corrosion and wear resistance. Prof. Kolaklieva's pedagogical activity includes the training of two doctoral students enrolled with the right of defense and one doctoral student enrolled in 2020.

3. Basic scientific and/or scientific-applied contributions with an assessment to what extent they are the candidate's personal work.

The scientific works with which you participate in the competition in both subjects are of scientific and scientific-applied significance and enrichment of existing knowledge. In the first thematic area, the main contribution is the development and optimization of a technology for applying and forming ohmic contacts to an AlGaN/GaN HEMT structure based on the contact structures (Ti/Al)TiAu and (Ti/Al)MoAu; The mechanism of formation of ohmic properties is explained, the reliability is investigated. In the second thematic area, the main contributions are the development and research of hard and superhard nanocomposite coatings, multilayer coatings and gradient coatings for industrial applications. A TiAlSiN gradient nanocomposite coating (Ti-TiN gradient adhesion layer, TiAlSiN gradient nanolayer and TiAlN/SiN nanocomposite layer) was developed and its mechanical properties, structure, composition, oxidation and corrosion resistance were investigated. The developed gradient nanocomposite coating is ultra-hard, resistant to high temperature and corrosion treatment. A gradient CrAlSiN coating was created and the technology for its application was developed. Its structure and oxidation stability, suitable for application on high-speed steel tools, were investigated. For the first time, a CrAlSiN-AlSiN nanocomposite coating with periodically modulated composition was created, combining ultra-hardness and high resistance to elastic and plastic deformations. The coating retains the combination of ultra-hardness with resistance to elastic stresses and plastic deformations up to 800 °C, which makes it suitable for high-temperature applications.

The main scientific and applied contributions are related to developments, with the potential for innovative transfer in industry. These contributions are intellectual property protected by utility models. The competition includes 3 useful models based on developments in the second thematic area. The analytical assessment of the contributions formulated in this way characterizes them as enrichment of existing knowledge and theories, creation of new methods for obtaining materials for thin-layer coatings for application in practice. The fact that Dr. Kolaklieva is the first author of a significant number of publications, as well as the

chapters of the book with which the application is made, is an indication that to a large extent the contributions are the personal work of the candidate and shows her leading role in the research.

4. I have no critical comments regarding the submitted materials for the competition.

5. Having familiarized myself with the documents, materials and scientific works presented at the competition, and after analyzing their significance and the scientific, scientific-applied and applied contributions contained in them, I can conclude that scientometric indicators exceed specific indicators in all respects requirements of ZRASRB and the Rules of the BAS. The scientific qualification of Assoc. Dr. Kolaklieva meets the requirements for the academic position "professor" in professional direction 4.1. Physical sciences.

Date 23.08.2022

Prepared by:
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