E V A L U A T I O N R E P O R T

Concerning the competition for awarding the academic position of **"Professor"** in professional field 4.1 "Physical Sciences", scientific speciality "Physics of Condensed Matter" pursuant to announcement in State Gazette No 26 of April 01 2022.

Candidate: **Assoc. Prof. Dr. Lilyana Petrova Kolaklieva**, Central Laboratory for Applied Physics, Plovdiv, Bulgarian Academy of Sciences

Member of the Scientific Jury: Assoc. Prof. Dr. Tatyana Koutzarova, Institute of Electronics, Bulgarian Academy of Sciences.

1. *General characterization of the presented materials:* Assoc. Prof. Dr. Lilyana Kolaklieva, the sole candidate in the competition, has graduated from the Faculty of Physics, St. Kliment Ohridski University of Sofia, majoring in "Physics of Semiconductors". She has acquired the educational-scientific degree of "doctor", with thesis topic of "Development and studies of temperature-stable ohmic and Schottky contacts for high-power SiC devices". At present, she holds the academic position of "Assoc. Prof." in the Central Laboratory for Applied Physics, Plovdiv, Bulgarian Academy of Sciences and is its Administrative Director. Concerning Indicator B – habilitation work – scientific publications refereed and indexed in worldwide databases with scientific information – she participates in the competition with eight publications in refereed international journals (Web of Science; Scopus), of which one in Q1, six in Q2 and one in Q3 (six of the publications appeared in journals with impact factor). The points acquired under this Indicator are 160. Concerning Indicator D – 14 publications in refereed international journals (Web of Science; Scopus) are submitted, of which four falling in Q2, four in Q3, three in Q4, and three in SJR without IF; two chapters in monographs, three useful models. The sum of points under this Indicator is 311. Concerning Indicator E 11, 296 independent citations in 58 scientific journals are presented, pointing to the wide response within and recognition by the scientific community. Under this Indicator, the number of points is 592 (the minimum required being 200). Concerning Indicator F, Assoc. Prof. Dr. L. Kolaklieva has submitted a list of the research projects of which she had been the Coordinator or a Research Team Member, together with the funding received (965 points). The number of points under Indicators A, B, C, D and F is in compliance with the minimal national requirements, the requirements of the Rules for Implementation of the Law on the Development of the Scientific Staff in Republic of Bulgaria, and exceeds the requirement for the minimal number of points under the respective Indicators as stipulated in the Requirements, Conditions, Rules and Resolutions of the Scientific Council of the Institute for Solid State Physics, part of the Rules for the Conditions and Order of Acquiring Scientific Degrees and Holding Academic Positions in the Bulgarian Academy of Sciences.

2. *General characterization of the candidate's scientific, applied scientific and pedagogical activities:* Assoc. Prof. Dr. L. Kolaklieva takes part in the competition in question with scientific and applied scientific contributions related to the field of Materials Science. As evidenced by the submitted scientific papers and useful models, Assoc. Prof. Dr. L. Kolaklieva's contributions concern the development and characterization of the composition, structure, and electrical, mechanical, tribological and thermal properties of thin films, including studies on the their formation mechanisms. The research has had to do with these films applications as ohmic contacts in high-power high-temperature microelectronics and as hard and ultra-hard nanocomposite coatings for the industry. The total number of her publications is 101; the number of the independent citations is 339. She has been a volume editor of the journals Solid State Phenomena and Micro and Nanosystems, as well as an editor of two Proceedings of International Conferences. Evidence for the applied nature of her research are the seven registered useful models. Assoc. Prof. Dr. L. Kolaklieva has been the scientific advisor of two doctoral students (now de-listed with

the right for defending their theses) and one active doctoral student. She has been the Coordinator of national and international projects, as well as a member of the Research Team of such projects. She has also been a Coordinator of a project under the Operational Program "Development of the Competitiveness of the Bulgarian Economy". At present, she is the Head of the Research Team of the Central Laboratory for Applied Physics under two projects funded by the Ministry of Education Science of Republic of Bulgaria, two projects of the Centers for Excellence Program and one of the National Roadmap for Scientific Infrastructure. The administrative activities of Assoc. Prof. Dr. L. Kolaklieva include the positions of Deputy Director of the Central Laboratory for Applied Physics (2012 – 2022) and Director of the Central Laboratory for Applied Physics (2022 -).

3. Major scientific and/or applied scientific contributions: The candidate points to two major thematic areas: 1. Ohmic contacts for high-power and high-temperature microelectronics; 2. Nanostructured coatings for surface modification. A technology has been developed and optimized for the deposition and formation of ohmic contacts on an AlGaN/GaN HEMT structure. The mechanism has been explained of the ohmic properties formation and of the role of the (Ti/Al) ratio in the first contact layer and of the barrier layer (Ti or Mo) in the (Ti/Al) contact structures. The effect has been studied of the (Ti/Al) ratio and of the barrier layer on the surface morphology and composition. A technique has been developed whereby a thermal stability test is used to study the reliability of the (Ti/Al) contacts on AlGaN/GaN HEMT structures. A gradient nanocomposite TiAlSiN coatings has been developed that has found industrial application as a coating on metal cutting tools. A gradient CrAlSiN coating has been developed, together with a technology for its deposition. A nanocomposite coating (CrAlSiN-AlSiN) has been developed with a periodically-modulates composition, which combines the properties of ultra-hardness with a high resilience to elastic and plastic deformations. In what concerns the useful models, the applied scientific contributions are related to developing multi-layer nanocomposite coatings that modify the surface properties of cutting, drilling and forming industrial and dentistry tools, as well as designing and implementing a planetary mechanism used for their deposition.

The analysis of the submitted documents proves that the scientific and the applied scientific works cited by the candidate constitute her personal contributions. These can be described as enriching the existing theoretical and experimental knowledge regarding the practical applications of the scientific research.

4. *Critical remarks and recommendations on the submitted works:* None.

5. *Conclusions*: The review made of the scientific, applied scientific and scientific metrics indicators concerning the candidate demonstrate a full compliance with all applicable requirements – minimal national requirements pursuant to the Law on the Development of the Scientific Staff in Republic of Bulgaria and the Rules for its Implementation, to the minimal requirements of the Rules for the Conditions and Order of Acquiring Scientific Degrees and Holding Academic Positions in the Bulgarian Academy of Sciences, as well as to the Requirements, Conditions, Rules and Resolutions of the Scientific Council of the Institute for Solid State Physics, part of the Rules for the Conditions and Order of Acquiring Scientific Degrees and Holding Academic Positions in the Bulgarian Academy of Sciences. **All the above give me reasons to be deeply convicted in recommending the Scientific Jury to make a positive decision concerning Assoc. Prof. Dr. Lilyana Petrova Kolaklieva being awarded the academic position of "Professor" in professional field 4.1 "Physical Sciences", scientific speciality "Physics of Condensed Matter".**

Date: August 22, 2022.

Compiled by:

(Assoc. Prof. Dr. Tatyana Koutzarova)