

OPINION OF REVIEWER

from Prof. Zara Cherkezova-Zheleva, Institute of Catalysis - Bulgarian Academy of Sciences (chairperson of the Scientific Jury)

on the competition for occupying the academic position “professor” in the professional field 4.2. "Chemical sciences", scientific specialty "Solid State Chemistry" for the needs of the Institute of Catalysis at the Bulgarian Academy of Sciences, Laboratory "Design and Characterization of Catalytic Materials" - "Surface Analysis",
announced in the State Gazette 82/07.10.2025

According to the Order № ПД-09-92/09.12.2025, issued by the Director of the Institute of Catalysis, BAS (IC-BAS), I was appointed as a member of the Scientific Jury for accomplishing the procedure in the competition for occupation of the academic position „professor” in IC-BAS in the professional field 4.2 „Chemical Sciences”, scientific research area „Solid State Chemistry”, for the needs of the Laboratory "Design and Characterization of Catalytic Materials" - "Surface Analysis" in IC-BAS announced in the State Gazette 82/07.10.2025.

Attitude on the obtained materials: Assoc. Prof. PhD Hristo Gospodinov Kolev is the only candidate, applying for the academic position “Professor” in the competition, announced by the IC-BAS for the needs of the Laboratory "Design and Characterization of Catalytic Materials". He has submitted a full set of application documents according to the requirements of the Regulation for the Terms and Procedure for Acquisition of Academic Degrees and for Occupation of Academic Positions in the Institute of Catalysis of BAS. Assoc. Prof. PhD Hristo Kolev fulfils all the relevant law requirements for occupation of the academic position “Professor”.

Education: In 1998 he received Master's degree in Engineering Physics, Sofia University "St. Kliment Ohridski" - Sofia, Bulgaria. In 2009 he successfully defended his PhD thesis in Physics at the Westfälische Wilhelms University of Münster, Münster, Germany in the scientific specialty 01.03.26 - Electrical, magnetic and optical properties of condensed matter, with a dissertation on the topic: "Electronic structure and magnetic properties of multicomponent ferromagnetic systems", which was recognized in the Republic of Bulgaria with Certificate No.: 1279-BAK/07.12.2009. In 2006, the candidate obtained the qualification "Synchrotron radiation and application" at Abdus Salam - International Center for Theoretical Physics and ELETRA Synchrotron Radiation Laboratory in Trieste, Italy. In 2012, he was trained at the Cisco Entrepreneurial Institute to acquire business startup skills. In 2017-18, for 6 months, Dr. Kolev was a SAIA scholarship holder of the Slovak Republic at the Faculty of Mining, Ecology, Process Management and Geotechnology at the Technical University of Košice, Slovakia, as a senior researcher in the program "Application of X-ray Photoelectron Spectroscopy (XPS) for a Better Understanding of Surface Properties".

Research positions: from 1999 to 2002, the candidate was appointed as a physicist at the Institute of General and Inorganic Chemistry - BAS, and from 2004 to 2006 – to the same position at the Institute of Catalysis-BAS - in Laboratory "Surface Analysis". After winning a competition in 2006, he was appointed as an assistant professor in the same laboratory, and since 2011 he has been working as a chief assistant professor at the IC-BAS. Since 2014, after winning a competition, Dr. Kolev has held the position of associate professor at the IC-BAS, and his scientific interests and expertise are in the field of surface analysis and X-ray photoelectron spectroscopy (XPS), maintenance and operation of XPS equipment and interpretation of spectral data. A significant contribution to his education has been made by the scientific research conducted at the Westfälische Wilhelms University of Münster, Münster, Germany, conducted after the defense of his doctoral thesis in the period 05 - 10.2000, 11.2000

- 03.2004 and 11.2004 - 04.2005. In the period 04.2010 - 2018, the candidate worked as an expert in Specialized Sensors and Devices at IMSTCHA - BAS "Acad. A. Balevski", Sofia, Bulgaria. As of 01.10.2025, he has an internship in the specialty, which is more than the required one according to the relevant documents for participation in the competition for the academic position of "professor" at IC - BAS.

The set of materials submitted by Dr. Hristo Kolev in electronic form is fully in accordance with the requirements of Regulation of the Terms and Procedure for Acquisition of Academic Degrees and for Occupation of Academic Positions in the IC-BAS. Based on the submitted summary by applicant it can be clearly seen that he completely fulfils all the relevant criteria under Art. 5 of the Regulations on the Terms and Conditions for Acquisition of Academic Degrees and Occupation of Academic Positions at the IC-BAS. Dr. Hristo Kolev has a sufficient score for each of the relevant indicators. For some of the indicators his score exceed the minimal requirements (e.g. B - about 2.5 times, Г - about 6.8 times, Д - about 20.8 times and E - about 3.2 times). The candidate participated in the competition with a total of 4226 points.

The total number of scientific publications submitted by Dr. Hristo Kolev for participation in the competition is 77. All of them are published in journals referred by WoS and Scopus databases and do not repeat those presented in the habilitation competition. These articles have been published in renowned international journals in the field, including Applied Catalysis B: Environmental and Energy, Applied Surface Science, Catalysis Today, Carbon, Nanomaterials, Royal Society of Chemistry, Electrochimica Acta, Chemical Engineering Journal, etc., which are distributed by quartiles as follows: Q1 – 32, with 4 of them being publications in journals that top the rankings; Q2 – 21; Q3 – 17; Q4 – 7. No evidence of plagiarism has been identified for any of the publications presented. 10 publications have been identified as equivalent to a habilitation thesis (B.4.). The other 67 original scientific publications outside the habilitation thesis (Г.7.) fully meet the requirements of the present procedure. The results of the candidate's scientific research have been presented as 32 oral and 107 poster reports at 77 international and national scientific forums. After his habilitation, Dr. Hristo Kolev has been a participant in the working team of 33 scientific projects, in 3 of which he is the leader or team leader of the IC-BAS team. The candidate has mentioned 1040 citations in Web of Science/Scopus database. The Hirsch index based on all the candidate's publications is 19. The candidate is a co-author of two patents and the winner of the first (in 2011) and second prize (in 2013) in the competition of BAS for the best theoretical and applied research in honor of May 24, IMSTCHA "Acad. A. Balevski".

Contributions of the research activities of the candidate:

The main scientific contributions of Assoc. Prof. Dr. Hristo Kolev are original and indisputable. They can be distinguished as a X-ray photoelectron spectroscopy (XPS) investigation on the surface of advanced high-tech materials toward establishment of their functional properties and increasing of their efficiency in the following areas: (1) materials for energy storage and conversion, (2) nanomaterials with application in medicine and (3) luminescent oxide and MOF-based systems. Dependencies between physicochemical and functional properties of the studied materials, as well as mechanisms for optimizing their synthesis and properties with the aim of applying the materials in practice have been established. The presented results demonstrate the detail material investigation by integration of XPS with different methods such as X-ray powder diffraction, Electron microscopy, Atomic force microscopy, Infrared and Raman spectroscopy, Electron Paramagnetic Resonance, SQUID, Inductively coupled plasma - atomic emission spectrometry, N₂-physisorption, Thermal analysis and thermoprogrammable processes, Electrochemical impedance spectroscopy, cyclic and pulse voltammetry, as well as theoretical calculations. Such a complex

study of structural and functional characteristics of materials outlines clear dependencies that determine their application in energy, biomedicine and optoelectronics.

The main scientific contributions of Dr. Hristo Kolev submitted for participation in the competition are realized in co-authorship and are entirely in the field of the competition - "Solid State Chemistry" and the thematic area "Surface Analysis". The candidate's contributions can be grouped into the following main areas:

1.) **Investigation of catalytic systems based on nanoscale metal oxides (publications B1–B10):** catalytic materials based on wide range of transition metal and rare earth oxides – Co, Mn, Ni, Fe, Ce, Sm, Zn, etc. The main goal of these studies is to clarify the surface and redox characteristics of nanoscale metal oxides, as well as their relationship with catalytic activity in various oxidation-reduction processes.

2.) **XPS study of oxide and hybrid materials for energy storage and conversion:** innovative development of the preparation methodology of oxide materials for solid oxide fuel cells and electrode materials for lithium-ion batteries, (publications Г.1, Г.6 and Г.9). The performed XPS analyses are a basic tool for surface analysis with tracking the relationship between the crystal and electronic structure, oxygen defects and ion-electron transport.

3.) **XPS study of rare earth oxides with application in luminescence devices** (publications Г.2 - Г.5): XPS was applied as a basic analytical approach for the study of lanthanide-containing oxides and MOF-based materials with luminescent properties. Detailed surface characterization by XPS reveals the correlation between the registered valence states, coordination environment and optical properties.

4.) **XPS study of nanomaterials with application in medicine** (publications Г.7, Г.8 and Г.10): XPS was used to investigate surface chemistry and active sites (that determine the magnetic, catalytic and electrochemical properties) in development of magnetic nanoparticles and functional nanomaterials with potential application in medicine - for magnetic hyperthermia, MRI contrast agents and electrochemical biosensors.

Based on the review of submitted documents for the announced competition and my personal opinion, it can be concluded that scientific contributions of Dr. Hristo Kolev are significant and correctly presented. They logically follow the obtained results. The candidate's scientific contributions are mainly related to methodological development on the application of X-ray photoelectron spectroscopy for detailed study of the sample surface. Registration and in-depth interpretation of XPS spectra has significant contribution to revealing the mechanisms for improving the relevant functional properties. The presented contributions demonstrate the application of XPS for precise analysis of valence states, oxygen defects and surface chemistry in advanced materials, including MOF frameworks, high-entropy oxides, nanomagnetites and rare-earth oxides. The results achieved by Dr. Hristo Kolev open up new opportunities for future research toward development of materials for nanomedicine, luminescent materials and active catalysts.

CONCLUSION: The documents and materials presented by Assoc. Prof. Dr. Hristo Gospodinov Kolev meet all the requirements of the Law for the Development of the Academic Staff in the Republic of Bulgaria, the Regulations for its implementation and the corresponding rules for the implementation of the law in the IC - BAS. The candidate submitted a sufficient number of scientific papers, published after receiving the PhD degree and after the competition for the academic position "Associate Professor". The obtained results based on the research activity of Dr. Hristo Kolev are original and have significant scientific contribution to the studied area. They completely fulfilled the relevant requirements of IC-BAS for occupation of the academic position "Professor" in the field of competition and are far above them. I strongly support the application and recommend to the members of the Scientific Jury and to the Scientific Council of Institute

of Catalysis – BAS to award to Assoc. Prof. Dr. Hristo Gospodinov Kolev the academic position "Professor" in the professional field 4.2. "Chemical sciences", scientific specialty "Solid State Chemistry".

02/02/2026
Sofia

Reviewer:

(Prof. Dr. Z. Cherkezova-Zheleva,
chairperson of the Scientific Jury)