

OPINION

by Assoc. Prof. Radostina Palcheva, PhD

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regarding: the materials submitted for participation in a competition for the academic position of “**professor**” in professional field 4.2. Chemical Sciences (Solid State Chemistry), announced in State Gazette No. 82 of 07.10.2025, for the needs of the Laboratory “Design and Characterization of Catalytic Materials” at the Institute of Catalysis – Bulgarian Academy of Sciences (IC–BAS)

In the competition announced by the Institute of Catalysis – BAS for the academic position of Professor, one candidate has applied – Assoc. Prof. Dr. Hristo Gospodinov Kolev. He has submitted all required documents in accordance with the Law on the Development of the Academic Staff in the Republic of Bulgaria, the Regulations for its implementation, and the Regulations for the conditions and procedures for acquiring scientific degrees and occupying academic positions at BAS and IC–BAS.

1. Brief biographical data of the candidate

Assoc. Prof. Hristo Kolev, PhD obtained his Master’s degree from the Faculty of Physics at Sofia University “St. Kliment Ohridski” in 1998, majoring in Engineering Physics. In the period 2001–2004 he was a PhD student at the Faculty of Mathematics and Natural Sciences of the Wilhelms University in Münster, Germany, and in 2009 he obtained the scientific degree “Doctor of Natural Sciences (Physics)” in the specialty “Electrical, magnetic and optical properties of condensed matter.” Since 2004 he has been working at the Institute of Catalysis – BAS as a physicist, and since 2011 he has held the position of Chief Assistant Professor. In 2014 he habilitated in the professional field “Solid State Chemistry” at the Laboratory “Design and Characterization of Catalytic Materials” at IC–BAS. Assoc. Prof. Kolev completed a specialization in synchrotron radiation and its applications in 2006 at the International Centre for Theoretical Physics and the ELETTRA synchrotron laboratory in Trieste, Italy. In 2017 he was awarded a six-month fellowship under the National Scholarship Programme SAIA of the Slovak Republic.

2. Description of the submitted documents and materials

The scientometric indicators of Assoc. Prof. Hristo Kolev, PhD significantly exceed the minimum national requirements as well as the additional criteria of IC–BAS for the academic position of Professor. He is co-author of 139 scientific publications, 113 of which were published after his habilitation. A total of 77 papers have been published in journals with an impact factor, distributed as follows: Q1 (including top-ranked journals in WoS) – 32; Q2 – 21; Q3 – 17; Q4 – 7. Ten of the publications submitted for the competition are included in the habilitation report, and results from another 10 papers are summarized in the author’s report. These 20 Q1 publications appear in prestigious journals in the fields of surface chemistry and heterogeneous catalysis. The scientific publications of Assoc. Prof. Kolev have been cited more than 1000 times (according to Web of Science and/or Scopus). His hirsch index (h-index) is 18. The total number of points with which the candidate participates in the competition exceeds 4000. The results of his research activity have been presented in 140 conference contributions, 32 of which were oral presentations, delivered at 77 national and international scientific forums. Assoc. Prof. Hristo Kolev, PhD has participated in more than 30 international and national research projects and has been the coordinator of two national and one international project. He has also taken part in organizing national and international scientific

forums, including the International Symposia on Heterogeneous Catalysis (2018, Sofia; 2024, Burgas) and the National Conference on Catalysis (2022, Sofia), and has trained students, young researchers, and foreign PhD students from partner institutions in the application of XPS for surface chemical analysis.

3. Main scientific and applied scientific contributions

The habilitation work entitled “**Electronic spectroscopy and chemical analysis of catalytic systems based on nanosized metal oxides**” falls within the field of surface and redox characterization of nanosized metal oxides, monitoring changes in oxidation states of metal components before and after catalytic reactions, and contributes valuable information on chemical composition, defect structure, and possible catalytic reaction mechanisms.

The main contributions can be summarized as follows:

- ✓ The role of mixed valence states $\text{Co}^{2+}/\text{Co}^{3+}$, $\text{Mn}^{3+}/\text{Mn}^{4+}$, $\text{Pd}^{2+}/\text{Pd}^0$ in oxygen mobility, redox activity, and Mars–van Krevelen-type catalytic mechanisms in oxidation of volatile organic compounds and methane has been determined.
- ✓ Redox transformations of Fe, Ni, Cu, and Ce ions in complex oxide and heterostructured systems and their significance for oxygen evolution reaction, peroxymonosulfate activation, and methanol decomposition have been revealed.
- ✓ By XPS, the stability and catalytic role of intermetallic Ni–Sn phases on Ce–Zr oxide supports and their relation to enhanced hydrogen selectivity during liquid-phase ethylene glycol reforming have been demonstrated.
- ✓ The importance of oxygen vacancies and defective surface states in ZnO modified with rare-earth oxides (La_2O_3 , Eu_2O_3) and their role in tribocatalytic degradation of antibiotics and paracetamol in wastewater has been clarified.
- ✓ It has been shown that surface redox dynamics and stability of active phases are key factors for long-term catalytic efficiency in environmentally important processes.

Publications included in the author’s report expand the scope toward other materials studied by XPS.

Generalized scientific and applied contributions:

- ✓ The role of oxygen defects, redox states, and cation substitutions in ion–electron transport and structural stability of high-entropy oxides and lithiated oxyhalides has been determined, leading to optimized charge/discharge mechanisms in Li-ion electrochemical systems.
- ✓ Structural–redox mechanisms controlling magnetic anisotropy, relaxivity, and hyperthermia efficiency of magnetic nanoparticles have been identified; highly sensitive electrochemical biosensors have been developed via controlled surface defect engineering.
- ✓ Correlations between valence states of rare-earth elements, charge-transfer transitions, and emission characteristics determining the optical behavior of MOF-based films, oxide phosphors, and functional optical coatings have been established.
- ✓ An expanded application of X-ray photoelectron spectroscopy (XPS) for analysis of valence states, oxygen defects, and surface chemistry in modern functional materials has been demonstrated.

The presented results convincingly demonstrate the consistent and purposeful scientific development of Assoc. Prof. Hristo Kolev, PhD in the field of XPS and functional nanomaterials with potential applications in environmental protection, photocatalysis, electrochemistry, and nanomedicine. His research topics are current and strongly interdisciplinary, and his contributions are characterized by originality, solid scientific foundation, and significant applied relevance. His work shows high expertise in XPS and materials science, as well as competence in interpreting results from other modern physicochemical techniques. He has established himself as a reliable research partner and has contributed to effective collaborations with researchers from other institutions.

Conclusion

The candidacy of **Assoc. Prof. Hristo Gospodinov Kolev, PhD** fully complies with the requirements of the Regulations for the implementation of the Law on the Development of the Academic Staff in the Republic of Bulgaria and the internal criteria of IC–BAS. His achievements reveal him as a highly qualified scientist with extensive experience in the development and application of X-ray photoelectron spectroscopy for studying the chemistry of solid surfaces. This gives me full confidence to recommend to the members of the Scientific Jury and the Scientific Council of IC–BAS his election to the academic position of “**Professor**” in professional field 4.2. Chemical Sciences (Solid State Chemistry) at the Institute of Catalysis, Bulgarian Academy of Sciences.

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Sofia