REVIEW

by competition for a professorship at the Institute of Engineering Chemistry at the BAS announced in SG No. 66/16.8.2022 with candidate Assoc. Dr. Maxim Ivanov Boyanov

Reviewer: Prof. Dr. Venko N. Beschkov

Professional direction 4.2. Chemical Sciences (Processes and Apparatus in Chemical and Biochemical Technology).

1. Brief biographical data and characteristics of the scientific interests of the candidate.

The candidate Maxim Iv. Boyanov was born in Sofia in 1973. He began his secondary education at the English Language High School in Sofia and finished it in Chicago, USA. There he enrolled in the specialty of physics at the Illinois Institute of Technology (Chicago, USA), which he graduated at the Faculty of Physics of Sofia University «St. Kliment Ohridski" in 1995.

After completing regular military service, he became a doctoral student at the University of Notre Dame (Indiana, USA), where in 2003 he defended his PhD thesis on the topic "Determining the atomic structure of surface and bulk metal-organic complexes by X-ray spectoscopy».

In the period 2003/2007, he was a specialist (post-doc) in two laboratories and universities in the USA - the Argonne National Research Laboratory (Illinois, USA) and the University of Notre Dame (Indiana, USA). After his graduation in Bulgaria, he worked successively in the Faculty of Chemistry of the Sofia University, as Head. Assistant Professor at the Faculty of Physics of the SU and at the Argonne National Research Laboratory (Illinois, USA, 2008/2014). After his entry as a Senior Assistant Professor at the Institute of Chemical Engineering (IChE) –Bulgarian Academy of Sciences in 2014, he continues to lead a project funded by the Argonne National Research Laboratory (Illinois, USA), already under a contract between IChE and the Laboratory.

Dr. M. Boyanov acquired the academic position of "Associate Professor" at IChE-BAS in the same year.

2. General characteristics of scientific research and applied science activity of the candidate (including participation in national and European contracts, expert activity, supervision of doctoral students, scientific-organizational activity, etc.).

The scientific research activity of the candidate is determined by his qualifications, knowledge and experience. The main subject of his research activity is water treatment

for different pollutants, mainly compounds of heavy metals by different means. A major tool in his research practice is X-ray spectroscopy in its latest modifications. Outside of research work, he has an active teaching activity: guidance of exercises and laboratory sessions (University of Notre Dame, USA), lectures (Physical Faculty, Sofia University, Bulgaria), supervision of a doctoral student (Argonne National Research Laboratory, USA).

During the 2018/19 period, he was the supervisor of a doctoral student jointly between the Argonne National Research Laboratory and IChE-BAS.

He is the leader (of one project) and co-leader of two projects at Argonne National Research Laboratory, USA. He is currently the head of the IIH in a new project with the same laboratory on the topic "Investigation of the processes related to the transformations of Fe, P, and S in wetland ecosystems" with a term of 2022/25.

The candidate was the organizer and chairman of three scientific sessions - two in the USA and one in the city of Prague, Czech Republic. He was also a reviewer of 49 scientific papers submitted for publication in international scientific journals.

He is and has been a member of two prestigious scientific societies in the USA - the American Physical Society (1998) and the American Chemical Society (2007, 2014-2021).

All this speaks of the exceptionally high qualification and international prestige of the candidate in the fields of research conducted by him.

3. Evaluation of the presented materials

The candidate's total scientific output is 80 scientific works. A total of 1024 citations (excluding self-citations) were observed.

Candidate Dr. M. Boyanov presented himself at the competition for professor with 25 scientific publications, all in refereed scientific journals and one chapter of a scientific book in co-authorship. All in journals scored for quartiles as follows: With Q1- seventeen; with Q2 – one; with Q3 – two; with Q4 – five. Paper number 13 was published in the journal Current Inorganic Chemistry, for which I found an impact factor of 1.4 (impact score 0.6), but no quartile score data. All works are on the theme of the competition.

The candidate participated as an invited speaker at 50 scientific fora (conferences, congresses), of which twenty seven were outside of his participation in the competition for Associate Professor in 2014. He is the author of other 144 reports and posters (attached to the competition for professorship), of which he personally presented twenty-seven.

The scientific-metric indicators of the candidate far exceed the requirements of the Law on the Development of the Academic Staff (ZRAS) and of the BAS: 541 points against the required 220 points for scientific publications; according to the total number of publications according to the requirements of the IChE (including in journals with an impact factor) – 50 (44 with IF) against the required 40 (12); citations – 1,789 points against the required 100 points according to the Regulations of ZRAS; 1024 citations noticed, meetings called for, fifty according to the IChE-BAS Regulations. The H-index of the candidate is 34, while H> 8 is required by the IChE Regulations.

Overhead expenses amounting to USD 258,000 for a total amount of USD 1.245 million have been received from the management of international projects for the period when the candidate worked at IChE-BAS..

From the reference made, it can be seen that the candidate fully meets the scientometric requirements for the academic position "Professor" in the Regulations of ZRAS, BAS and IChE for holding academic positions.

4. Basic scientific and scientific-applied contributions.

The works with which Dr. Boyanov appears at the competition are grouped into six research areas:

• Interactions of microbial cells (mainly bacteria) with heavy metal ions through biosorption on the cell walls – 3 in number (papers 1,10,15).

• Bioremediation of wastewater containing heavy metals and potentially radioactive ions (of uranium) (papers 2-4, 8, 11-13, 16, 17, 23, 24, 25). The ability of some bacteria to use high-valence metal ions for redox processes in their cells is used. As a result of the reduction, compounds of the metal ions already in a lower valence are precipitated or adsorbed. The main emphasis is on the reduction of uranium compounds.

• Adsorption processes - works 5, 6, 7, 9, 10, 15, 20, Processes of physical and chemisorption of ions of heavy metals on natural sorbents were investigated. The main emphasis is on the capture of uranium ions.

• Redox abiotic processes with the use of natural zeolites and minerals containing metal anions-reductors (papers 10, 13, 21-23) and catalysts – paper 14.

• Study of pollutant assimilation processes in biofilm (paper 18). In it, an electrochemical study of the assimilation of acetates and the reduction of uranium (VI) along the depth of the biofilm was carried out. The process of transfer and exchange of electrons to the

carrier was traced. The work deserves special attention, as modern techniques (NMR, TEM, X-ray spectroscopy) have been applied.

• Investigated the phyto-toxicity of nanoparticles containing copper and zinc oxide as a result of the accumulation of the metals in plants (in this case wheat, paper 19).

All studies were performed with modern spectroscopic methods (X-ray spectroscopy, X-ray diffraction analysis), scanning electron microscopy, transmission electron microscopy, etc.

I define the candidate's contributions as «enrichment of existing knowledge and theories» using modern research methods. The achieved scientific results, the developed experimental methodology will be of great benefit to the topic of IChE in the field of wastewater treatment, the extraction of valuable components from them, as well as to the improvement of experimental methodologies for the study of biofilms and the processes in them.

6. Reflection of the candidate's scientific publications in the Bulgarian and foreign literature.

A list of 1024 citations to the candidate's works is presented. The H-index of the candidate is 34 according to known databases. This is a very high indicator for the scientific field in which he applied. When the candidate participated in the competition for Associate Professor, there were 690 of them.

7. Critical notes and recommendations.

I have no particular critical remarks about the candidate's works. The large number of authors of the publications is impressive. However, given the interdisciplinary nature of research and the need to involve physicists, chemists and microbiologists, this can be explained.

8. Personal impressions of the reviewer about the candidate.

Dr. Maxim Boyanov has been working at IChE-BAS since February 2014. He presents himself as an independent and well-prepared specialist in his field. The awarding of the academic position of "Professor" will give him the opportunity to improve the research work at IChE-BAS and the guidance of young scientists at the institute.

CONCLUSION

Everything stated so far gives me reason to confidently recommend to the scientific jury of the competition to award Dr. Maxim Ivanov Boyanov the academic position and the scientific title of "Professor".

Sofia, 22/12/2022 Reviewer:

Prof. Dr. Venko N. Beschkov