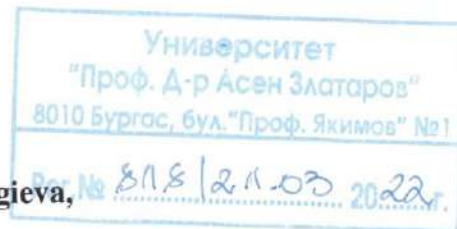


OPINION

by Assoc. Prof. Dr. Velyana Georgieva Georgieva,
Head of the Department of Chemistry
Prof. Dr. Asen Zlatarov University of Burgas and
Member of the Scientific Jury according to Order No. RD-11/14.01.2022.



Regarding the application of the academic position of "Associate Professor", announced in State Gazette, no. 95/16.11.2021., in the field of higher education 4. Natural Sciences, Mathematics and Informatics, professional field 4.2 Chemical Sciences, scientific specialty "Chemical Kinetics and Catalysis", for the needs of the Department of Chemical Technologies at the Faculty of Technical Sciences

The only candidate for the announced competition: Chief assistant professor Dr. Ivaylo Georgiev Tankov

Biographical data

Chief assistant professor Dr. Ivaylo Tankov graduated in 2007 as a chemical engineer in the specialty "Organic Chemical Technologies", Master's degree at the University "Prof. Dr. Asen Zlatarov"- Burgas. After graduation he started working as a chemist in the company "Solimex" - Burgas, where he participated in the production of inorganic salts with pharmacopoeial purity as a chemical process operator and performed chemical analysis of the product. During the period 2009 - 2012 he developed his PhD thesis on "Preparation and characterization of catalysts for reforming methane with carbon dioxide" at the Institute of Catalysis of the Bulgarian Academy of Sciences and successfully defended his PhD. In 2013, within a few months, he worked as a chemist at Spa Design Bulgaria Ltd, Burgas, where he analyzed various chemical indicators to determine the quality of water in swimming pools and prepared treatment schedules. The candidate's academic career started in February 2014 as an assistant professor at "Prof. Dr. Asen Zlatarov" University, and in September 2015 he was appointed to the academic position of "Chief assistant professor". At present, he leads lectures, practise exercises and seminars on some disciplines such as "Reaction Kinetics and Catalysis", "Technology of Basic Organic Synthesis", "Fine Organic Synthesis" and "Chemical Reactivity", "Organic Chemical Technologies", "Quantitative Study of Chemical Reactions in Petrochemical Synthesis", etc. at the Bachelor and Master degree programmes.

Research activity and scientific contributions

The candidate Dr. Ivaylo Tankov has submitted a list of 33 articles, of which 31 have been published in journals with impact factor IF (Web of Science) and with SJR without IF (Scopus) and 2 in conference proceedings presented in Conference Proceedings in Thomson Reuters and/or Scopus. Three of these publications have been included in his PhD thesis and 15 have not been declared in the competition. The report on participation in scientific forums shows his involvement in 5 national conferences with 3 poster presentations, 1 oral presentation and 1 publication in full text.

15 scientific publications have been declared under the competition, all indexed in the world famous databases Web of Science and Scopus and are in the professional field and scientific

specialty of the competition procedure. They are related to the preparation and characterization of new active and stable homogeneous and heterogeneous catalysts for esterification. In 13 of the publications submitted to the competition, the candidate is the first author and in the remaining two he is the second author, which shows his active participation in their development, conception and writing.

The number of citations of the scientific publications included in the reference according to regulation requirement is 72. Eleven of the publications have a τ_1 -index, which is evidence of the rapid response among the scientific community and the relevance of the scientific topic. The high productivity and significance of the candidate's publications can be judged by the total number of citations - 121 and the Hirsch index h - 11.

A reference according to regulation requirement and criteria of the Regulation and Terms and Procedure for Acquisition of Academic Degrees and Habilitation Procedure at "Prof. Dr Assen Zlatarov" University for the required indicators of the candidate is attached as follows:

1. Group A indicators

1.1. Indicator *A1 PhD thesis* – defended thesis on "Preparation and characterization of catalysts for methane reforming with carbon dioxide" in professional field 4.2 Chemical sciences, Diploma № 000388/26.02.2014 – **50 points**;

2. Group B indicators

2.1. Indicator *B4 Habilitation thesis - scientific publications, refereed and indexed in world-known databases with scientific information (Web of Science u Scopus)* – 5 publications are presented - one in quartile Q2 [1], and 4 in quartile Q1 [2-5] for the respective years of publication – **120 points**;

3. Group Г indicators

3.1. Indicator *Г7 Scientific publications, referenced and indexed in databases Web of Science and Scopus*– 10 publications are attached, respectively in quartiles Q1 – [6, 7, 10, 15] и Q2 – [8, 9, 11 – 14] – **220 points**;;

3.2. Indicator *Г7 An invention, patent or utility model with a duly protected document* – registered utility model with registration No 4077U 1, registered on the basis of application No 5308/26.05.2021, published for registration on 30.07.2021– **25 points**;;

4. Group Д indicators

4.1. Indicator *Д 11 Citations in scientific journals, monographs, collective volumes and patents, referenced and indexed in Web of Science u Scopus* – a reference with 72 citations of the candidate's publications is submitted. – **144 points**;;

5. Group E indicators

5.1. Indicator *E 14 Participation in a national scientific or educational project* – declared participation in 3 national projects – **30 points**;;

5.2. Indicator *E 15 Participation in an international scientific or educational project* – involved in 1 international scientific project – **20 points**;

5.3. показател *E 19 Published university textbook or used textbook in the school network* – a textbook on "Quantitative study of chemical reactions in petrochemical synthesis" is presented – **20 points**;

Total for all groups indicators 629 points

It is evident from the detailed reference submitted that the applicant exceeds the minimum national requirements. Regarding the fulfilment of the minimum requirements under the Regulation and Terms and Procedure for Acquisition of Academic Degrees and Habilitation Procedure at "Prof. Dr Assen Zlatarov" University, it can be summarized that, with the exception of group of indicators E, all the others are met and even exceed the required points. On the basis of the national indicators for the academic post of "Associate Professor", I believe that a significant number of points are required for indicator E in the above mentioned regulations.

The candidate's scientific and applied contributions are presented in four thematic areas:

1. Preparation of new ionic liquids and investigation of their composition and structure

Five new compounds have been synthesized and assigned to the so-called "ionic liquids". All the obtained samples have been characterized by a wide range of instrumental methods and the application of quantum chemical analysis. The presence of their cyclic structure, formed as a result of intramolecular hydrogen bonds between the organic cation and the inorganic anion, was established. The difference in the length of chemical bonds in the studied samples was explained by the degree of hybridization of molecular orbitals. Based on detailed analyses of the synthesized ionic liquids, their molecular geometry has been determined. The aromaticity of inorganic anion in their structure was confirmed. Three types of heterogeneous systems (PHS/ α -Al₂O₃, PHS/RHA, and xRHS/AC) were synthesized by impregnating the given carrier with an aqueous solution of ionic liquid. The textural characteristics of pure and modified carriers were investigated and differences in their surface properties were observed.

The main contributions in this field have been published in papers numbered 2, 3, 5 -8, 11, 12. The number of noticed citations for 3 years is 67, which is indicative of the significance and actuality of the conducted research.

2. Analysis of surface phenomena occurring in heterogeneous ionic liquids

The ionic liquid-carrier interface phenomena in the synthesized heterogeneous systems are described by means of IR and X-ray photoelectron spectroscopy. Detailed information on vibrational couplings in ionic liquids and the investigated heterogeneous systems has been obtained. A correlation between the nature of their surface interactions and the nature of the carrier has been established. The reasons for the spatial arrangement of the active phases after carrier impregnation have been explained.

The results of the research are reported in publications numbered 5, 6, 13 and 15, published in the period 2020-2021 and have gained 2 citations.

3. Study of thermal decomposition kinetics of ionic liquids

The thermal stability of the synthesized ionic liquids and the heterogeneous systems obtained on their basis was studied. Their melting and decomposition mechanisms have been determined and correlations between their thermal behavior, the degree of intramolecular hydrogen bonding and the nature of the carrier have been established. The isoconversional method was applied to calculate kinetic and thermodynamic parameters and functions of state for the decomposition and melting of the newly synthesized materials. Two citations are noted on publications in this area (numbers 5, 9 and 14).

4. Investigation of new ionic liquids as efficient catalysts for esterification

The catalytic behavior of pure ionic liquids and synthesized heterogeneous systems in butyl acetate and methyl oleate (biodiesel) production processes is described. The preparation

conditions of the two target products were optimized in terms of the influence of catalyst content, initial mole ratio and temperature. The kinetic and thermodynamic parameters of the studied reactions were calculated. The mechanism of butyl acetate production involving the formation of an active complex with the participation of ionic liquid (PHS) as a catalyst was determined. The significant number of citations (32) of the publications referred to this direction is a proof of the high value of the obtained results.

Teaching activities

During the period from 2014 to the present moment, Dr. Ivaylo Tankov has given lectures, seminars and laboratory exercises in the Bachelor and Master degree programmes in more than 10 disciplines. He has participated in the development and updating of teaching documentation in 13 disciplines. Four students have successfully defended their thesis under his supervision. It is evident from the submitted documents that Dr. Tankov has had a full teaching load and has developed active teaching activities. This gives me reason to believe that over the years he has established himself as a good lecturer combining high professionalism and innovative teaching approach.

Conclusion

I know Dr. Ivaylo Tankov since his appointment at Prof. Dr. Asen Zlatarov University, I follow his consistent, innovative and thorough research activity, his active publishing, and therefore I believe that he has long deserved the academic position of Associate Professor. In addition to his excellent qualities as a motivated researcher and scholar, he is also a dedicated university lecturer who knows how to engage students in research. My words are confirmed by the assignment of one of his graduate students as a PhD student to the Department of Chemistry.

In accordance with the enclosed competition materials, scientific publications and the analysis of their relevance and significance, I believe that I have grounds to recommend to the honorable members of the Scientific Jury to vote positively and to recommend to the Faculty Council of the Faculty of Natural Sciences of the "Prof. Dr. Asen Zlatarov" University to elect Dr. Ivaylo Tankov to the academic position of Associate Professor in the field of higher education 4. Natural Sciences, Mathematics and Informatics, professional field 4.2 Chemical Sciences, scientific specialty Chemical Kinetics and Catalysis, for the needs of the Department of Chemical Technologies at the Faculty of Technical Sciences.

18.03.2022 г.

Member of the Scientific Jury:

(Assoc. Prof. Dr. Velyana Georgieva)