

Review

by Prof. Dr. Slavka Stoyanova Tcholakova

Part of the scientific jury

Appointed with commandment of the Rector RD38-224 from 10.05.2019

for a contest for obtaining an academic position «Professor»

Announced in SG ed. 25 on 26.03.2019

Professional field 4.2 Chemical Sciences (Physical chemistry)

At the contest for obtaining an academic position «Professor» in scientific field 4.2 Chemical sciences (Physical chemistry) announced in SG edition 25 from 26.03.2019, in accordance to the needs of Department of Physical Chemistry at the Faculty of Chemistry and Pharmacy at Sofia University “Saint Kliment Ohridski”, there was one candidate – associate professor (Docent) Dr. Stoyan Ivanov Karakashev, lecturer at the same department.

Stoyan Karakashev was born in 1970. In 1995 he graduated the Faculty of Chemistry at SU with a degree of “Chemistry” and major in “Theoretical chemistry and physical chemistry”. In 1997 he graduated a second Master programme: “Control and purification of waters”. In 2002 he defended a PhD thesis on the topic of “Theoretical adsorption models and their application to ionic, nonionic and mixed surfactants at air-water interface”.

From 2001 until 2003 Stoyan Karakashev worked as a researcher 2nd degree at the Institute of Biochemistry at BAS. From December of 2003 until May of 2004 he was a guest researcher at the Department of Chemical Engineering at the Newcastle University, Australia. From January 2007 until December of 2008 he was a scientific associate in the Department of Chemical Engineering at Queensland University, Australia.

From September of 2009 until May 2013, Stoyan was Chief Assistant at the department of Physical Chemistry at Sofia University. In May of 2013 he won the competition for associate professor (Docent) announced for the needs of the Physical chemistry department at Sofia University. After September 2009 he was a guest researcher in 2 one-month and 1 three-month visits at the institute of Polymers Research in Leibnitz, Germany. He also has multiple one month visits at the Utah University, United States; Cambridge University, United Kingdom; Illinois University, United States. This shows that associate professor Karakashev has substantial international experience and the ability to work with researchers from different institutes and universities around the world.

Dr. Stoyan Karakashev led 2 projects of the Newcastle University, Australia in 2006; 2 reintegration projects of the Marie Curie fellowship in 2007 and 2008; 1 project from the German academic exchange service in 2010; 2 projects financed by Sofia University. He is also a project leader of a project financed by the National Science Fund, as well as a member of two other such projects. He has a wide experience in preparing, executing and leading scientific projects funded by public funds.

Dr. Stoyan Karakashev is a co-author of 90 scientific publications, 2 of which are book chapters, 75 in peer-review journals, 7 of them are in conference collections, and 6 publications are in non-referenced journals. Search in Scopus shows that 68 of his scientific publications can be found in the database, they have 661 citations and h-index of 15. This is after excluding self-citations of all co-authors.

Stoyan Karakashev defended his PhD Thesis in 2002, holds the academic position of docent since May of 2013, he has presented a list of 21 publications to be part of the competition as well as a habilitation thesis which is based on 9 of these 21 publications. He has completed a form claiming that he meets the minimum requirements from article 2b of the Law for academic career development of Bulgaria. He has also provided an author inquiry showing his contribution to the publications, which he has provided in connection to the professor contest.

In accordance to the rules of article 61 of the Rules for the implementation of the law for academic career development of Bulgaria, the scientific jury must evaluate the candidate in accordance to the rules set in paragraphs 1 and 2 of article 60 of the same law, as well as with the information reference from paragraph 3 of article 60. Dr. Karakashev meets the criteria set in article 60 paragraphs 1 and 2 as he obtained the PhD Degree in 2002 and has been holding the position of associate professor for more than 2 years.

In accordance with article 60 paragraph 3 from the Rules for the implementation of the Law for academic career development, the candidate must either present a monographic book or equally impactful scientific publications in specialized scientific journals. He could also present proof for their original achievements in the field of arts which do not repeat the already presented proof when obtaining the PhD Degree, the degree of Doctor of the sciences, or the academic position of associate professor. Dr. Karakashev has not provided morphological book, but has provided publications in scientific journals, which were not present in his application for associate professor or in his PhD thesis.

The publications, which Dr. Karakashev has shown to be equivalent of a published monographic book are 9 in total and are part of the habilitation thesis presented by him. The presented habilitation thesis has no introduction and no attempt to summarize the obtained results in the different publications. This text, full with many spelling and terminological errors, leaves a bad impression.

Many of the sentences lack in clarity of their meaning. For example:

Page 2 „...Сумарно се получава, че много йони имат отрицателна специфична енергия на адсорбция, т.е. те се адсорбират на междуфазовата граница, но това важи за разредени разтвори на сол (до 2 mM). При по-концентрирани разтвори на сол йоните се отблъскват от повърхността вода/въздух“.

I have no idea how the ions will be adsorbed at the surface when the concentration of salt is low and will be repelled from the surface when the concentration of salt is high.

In table 2 of the habilitation thesis, doc. Karakashev presents results, which are unclear as to whether they have been calculated by the applicant and his co-authors or have been taken from the literature, and here the values of the specific ion energy are already positive for some ions like H_3O^+ and negative for others, such as OH^- и HCO_3^- , which suggests that some ions will adsorb while others will not.

On page 4 the claim that *„Доколкото не разполагаме с теория, способна да опише количествено адсорбцията на повърхността въздух/вода, на този етап можем да заявим, че те са положително адсорбирани и зареждат повърхността въздух/вода отрицателно“* remains unclear. I recommend to doc. Karakashev to explain which ions are referenced in this part.

On the same page doc. Karakashev claims that: *„Емулсионната вода в маслени филми се произвежда в клетка на Шулудко-Екзерова [1]...“*. This sentence clearly shows that doc. Karakashev has not given enough attention when preparing his habilitation thesis as the meaning of the sentence is unclear and the names of scientists such as acad. Scheludko and acad. Exerowa, whose studies are fundamental in the area of the thin liquid films, are spelt wrongly. There are multiple other occasions in which these names are misspelt, which is clearly unacceptable in a habilitation thesis, in which the main methodology used is developed by acad. Scheludko and acad. Exerowa.

All of these notes make me to recommend to Dr. Karakashev to revise his habilitation thesis in order to show his main scientific achievements in a coherent way. As a document describing the original academic contributions can be used instead of a habilitation thesis and with accordance to the rules set in the rule book of Sofia University for acquiring and holding academic degrees and positions, a habilitation thesis is not mandatory, I will not continue to point out the other errors and problems in Dr. Karakashev's habilitation thesis.

In accordance to the rule book of Sofia University for acquiring and holding academic degrees and positions, the members of the jury evaluate the candidate in accordance to the criteria set in article 115, paragraphs 1 and 2, which require the candidate to have obtained a PhD Degree as well as to have held an associate professor position for at least two academic years. Dr. Karakashev meets both these criteria. Another required evaluation is based on article 117, paragraph 1, points 12 through 14 of the same rule book, which are the following: reference for meeting minimum national requirements, reference for citations, and reference for the original scientific contributions of the candidate. The following should have the sufficient evidence attached.

I am about to analyse the reference for meeting the minimum national requirements, and the citation's reference. I will also focus on the reference for original scientific contributions, which includes the 9 publications used instead of the monographic book of the candidate, which I must evaluate in accordance to law. I was unable to do so in the habilitation thesis as there were no original scientific contributions explained in it.

In accordance to the presented reference trying to satisfy article 117 paragraph 1 point 12 from the rule book of Sofia University for acquiring and holding academic degrees and positions, Dr. Karakashev meets the criteria in group A, which require an educational and scientific qualification of PhD Degree. He has not presented information about the criteria in group B requiring the candidate to have obtained the scientific qualification of Doctor of Sciences. However that is not a mandatory requirement for a candidate to hold an academic position of professor. When it comes to group C, the candidate has presented 9 scientific publications, 7 of them have been published in journals from the Q1 quartile, 1 in a journal in the Q2 quartile and 1 of them is in a journal without impact factor. These publications meet the minimum required points in group C. For group D, the candidate has presented information on indicator 7. This is where he includes 12 of other scientific papers, which are included in his contest for professor. 5 of these articles are published in journals from the Q1 quartile, 5 in the Q2 quartile, and 2 are in journals without impact factor. This meets the minimum required points in group D and indicator 7. In group E, Dr. Karakashev has presented 936 citations in his Scopus reference. That number includes self citations as well as citations, which have been included in his presentation for Docent. This is not acceptable. After deducting those citations, the Scopus reference shows 661 citations. To be certain that Dr. Karakashev meets the minimum requirements I counted how many citations the articles presented in his contest for professor have, which amounts to 79. These citations convert into 158 points, which are enough to meet the minimum requirement of 100 points in this group. To meet the minimum requirements in group F, Dr. Karakashev has used his project leadership and participation in international and national projects as well as the attraction of funds to these projects. Part of these projects ended before he became an Associate professor, however as there are no minimal required points in this group when he applied for Associate professor, I believe these projects can be used in the current application. What I find to be concerning is the fact that Dr. Karakashev has not been a supervisor of any diploma thesis for obtaining a Master's degree or a supervisor of a single PhD student. I firmly believe that these two requirements should be included in order for anyone to obtain the academic position of professor. However, as there is no such requirement either in the law or in the additional criteria of the Faculty of Chemistry and Pharmacy, I accept that with the showed participation in scientific project from before he became an associate professor, the candidate meets the minimum criteria from the last group.

I'm now going to analyse the presented reference of original scientific works required by article 117, paragraph 1, point 14 of the rule book of Sofia University for acquiring and holding academic degrees and positions. However, the presented reference – just like the habilitation thesis – is filled with a number of spelling and printing errors. I recommend to Dr. Karakashev to use spell check before uploading the document to the website of Sofia University.

Dr. Karakashev presents his scientific contributions with bullet points but I will numerate them so it is cleared which one I am referring to. There are 20 contributions in total, based on 21 scientific publications with contribution 3 being based on two separate publications. The

author's reference and the reference of publications presented have different numeration. I will base my review on the numeration used in the author's reference.

Publications numbered 3, 4, 6, 8, 9, 12, 18, 20, 21 from the author's reference are presented instead of monographic book in order to meet the indicators of group C. The other publications have been presented in order to meet the minimum criteria of group D.

I accept contributions numbered 4, 10, 11, 15, 17 which are based on publications with numbers 5, 11, 12, 16 and 18.

Contributions 7, 13, 16, and 18 are based on review articles. For them to meet the requirements for original scientific contributions, Dr. Karakashev must formulate what the original scientific contributions are based on the review. Currently the references show only which topic was reviewed but that is insufficient.

In the next part of this review I will comment on what I find unacceptable or what should be improved in the other contributions:

The first scientific contribution is related to the difference between the rate of gas supply across a porous membrane into SDP2S solution and the rate of increase of the foam formed. It is found that after a given critical rate of gas supply one observes a higher rate of foam generation, as compared to the gas supply, depending on the dynamic surface tension. This finding is interesting, however after a careful reading of the original paper by Karakashev and co-authors (1st in the author's reference) we can see that part of the results have been published by other authors before that (Dushkin et al. Coll. Polym. Sci. **2003**, 281, 130) and in the latter paper the authors found a relationship between the dynamic surface tension and the regime switch. I recommend to Dr. Karakashev to define his contribution more precisely.

The first sentence of **the second contribution** is based on already published experimental results, without the participation of Dr. Karakashev. This means that this contribution should not be part of his author's contributions. From what I understand Dr. Karakashev developed the theoretical model, which explains the obtained experimental results. I once again recommend to Dr. Karakashev to define his contribution more precisely.

I do not accept **the third contribution** which is based on publications 3 and 4 from the author's reference (articles with numbers 15 and 16 in the list of publications) as the relationship between the buoyancy force and the velocity of the bubble in contact with the hydrophilic wall has been investigated in a number of scientific papers before the works published by Dr. Karakashev and co-authors. I recommend to Dr. Karakashev to review the significance of these two publications.

Using the description „интересна зависимост“ (interesting dependence) in the **fifth contribution** needs to be reviewed and an explanation of what is interesting and new in the observed relationship between the damping coefficient of the oscillations and the type and concentration of surfactant should be clarified.

The sixth contribution is based on publication 7 from the author's reference. It also needs to be reviewed to better reflect what was done by docent Karakashev in this scientific publication. The theory used to calculate the adsorption energy of the hydrophilic heads of the surfactants has been already published by *Slavchov et al. Surfactant Science and Technology, Ed. L. Romsted, CRC Press, Taylor & Francis Group, Boca Raton London New York, 2014, pp. 53-117*. For example, in the paper by *Slavchov et al.* the authors used data for alkylsulfates with hydrocarbon chain length between 8 and 12 carbon atoms whereas in publication 7 presented by Dr. Karakashev we see added data for alkyl sulfates with carbon atoms between 7 and 12. Therefore, I recommend this contribution to be formulated more precisely. Furthermore, the proposed procedure for data interpretation gives strange results, especially for the excluded area per surfactant molecule, α_0 , which varies for the homologs of the sodium alkylulfates while their tails vary the length from 7 to 12 carbon atoms in the range between 0.19 до 0.22 nm² without a clear trend. This area is expected to be a constant value, e.g., representing the cross-section of the surfactant hydrophobic tail.

In the eight contribution it is not clear what the meaning of „*по-сложен механизъм*“ (more complex mechanism) is.

The ninth contribution is based on publication 10, which in large part copies the results, which had been used in publication 7. A large part of the already known results had not been correctly cited. Again, large parts of the results from publications 7 and 10 are based on the publication by *Slavchov et al. Surfactant Science and Technology, Ed. L. Romsted, CRC Press, Taylor & Francis Group, Boca Raton London New York, 2014, pp. 53-117*. Figure 2 of publication 10 is the same as Figure 2 of publication 7. However, this has not been mentioned. Furthermore, Table 1A from publication 7 and table 2 from publication 9 are exactly the same. Again, this has not been mentioned anywhere. The only significant difference I can see between publication 10 and publication 7 is that the scale on the ordinate of figure 3 of publication 10 is changed – instead from 0.8 to 1.4 k_BT as in Figure 1A, it is in the range between 0 and 1.4 k_BT in order to accept that all hydrophilic groups with adsorption energy above 2 k_BT have energy of adsorption per one -CH₂- group of their hydrophobic tail of 1.16 k_BT, which might be argued if one considers the results in Figure 1A in publication 7 where the respective value per -CH₂ group for surfactants with SO₄⁻ head is 1.26 ± 0.023 k_BT. I suggest to Dr. Karakashev to explain why the same figures and tables are present in separate publications without a clear identification that this is the case. I would also like to know what the reason is that there are two separate values for the energy of adsorption of -CH₂ group for surfactants with SO₄⁻ heads in the two publications.

The twelfth contribution is based on publication 13. To a large extent the model published about the oil-water interface has already been published in the work of *Slavchov et al. Surfactant Science and Technology, Ed. L. Romsted, CRC Press, Taylor & Francis Group, Boca Raton London New York, 2014, pp. 53-117*. The claim that the model explains the difference at the air-water and oil-water interfaces is debatable as much of these differences have already been shown in numerous other publications most of which had been backed up

by experimental results based on neutron scattering from the interface. These do not match the model, which Dr. Karakashev presents in his work. The presented model can explain some differences in the adsorption, however a better explanation for which hydrophobic interfaces this model holds is required. It would also be beneficial if it could be supported by independent experimental results.

In the nineteenth contribution an explanation of what the reason is for the observed effect is needed.

I do not accept the twentieth contribution as it relates to presence of the negative charge of the bubbles in clear water. This however has already been showed in numerous scientific publications in the literature and I find it hard to differentiate the given explanation from the already known ones.

Dr. Karakashev would benefit from editing his author's reference. He should specially focus on outlining the scientific areas in which he works as well as showing more precisely what his scientific contributions are from the publications he has submitted to be part of the competition.

Dr. Karakashev teaches different disciplines in the bachelor's degrees in the Faculty of Chemistry and Pharmacy at Sofia University.

Conclusion

Following the review I can conclude that Dr. Stoyan Ivanov Karakashev meets all the criteria for occupying academic position «professor» in professional area 4.2 Chemical sciences (Physical Chemistry) set in the Rule book for implementation of the Law for development of the academic staff of Republic of Bulgaria. However, in order for me to vote positively for his appointment, he must revise his authors reference so as it correctly matches his scientific contributions of each of his publications presented in the competition.

I recommend to the members of the Council of Faculty of Chemistry and Pharmacy to add additional criteria for the awarding of the academic position professor, which include the supervision of PhD students and rules for the preparation for the author's reference about original scientific contributions.

Date: 28 July 2019

Member of the scientific jury:

Prof. Dr. Slavka Stoyanova Tcholakova