

## STANDPOINT

for the competition for awarding the academic position *Professor*  
at the Institute of Physical Chemistry - BAS  
in Professional field 4.2. Chemical sciences, specialty Physical chemistry,  
announced in State Gazette № 20 of 10.03.2020  
with candidate Associate Professor Dr. Dragomir Mladenov Tachev  
Member of the scientific jury: Prof. DSc Vessela Tsvetanova Tsakova-Stancheva

### 1. General characteristics of the research and applied activities of the candidate

Assoc. Prof. Dr. Dragomir Tachev is the author and co-author of a total of 49 publications, of which 34 have not been used in associate professor's competition or in his doctoral dissertation. According to the *Information for fulfillment of minimum requirements of the Institute of Physical Chemistry "Acad. R. Kaishev"* - BAS in this competition he participates with 23 publications. Twelve publications are considered equivalent to habilitation work (indicator "B") with a total number of points 182 with a minimum required of 100, and eleven other publications, other than those included in habilitation work, were included under indicator "G" and collected a total of 270 points at a minimum required of 220. According to formal criteria, the submitted works exceed the requirements of the Regulations of IPC-BAS to ZRASRB.

It is noteworthy that in the second group "G" are concentrated 10 articles published in journals with rank Q1 (and one article with Q2) while in the group of publications equivalent to habilitation work are included articles published in magazines with lower rank (five articles with Q2, two - with Q3, one - with Q4 and four - with SJR, without IF). The distribution of publications in the two groups seems formal without looking for a thematic link within each of the groups, which in my opinion complicates their evaluation and does not point to the main contributions in connection with the competition.

The total number of points on the other indicators - the number of citations (indicator from group "D") 976 points (with a required minimum of 120 points) and participation in projects (indicator of group "E") - 360 points (with a required minimum of 150 points) significantly exceed the corresponding minimum requirements.

Almost all publications of the candidate are related to the use of X-ray methods to characterize different types of multicomponent systems and in this sense fall exactly within the scope of the competition announced for the needs of the *Laboratory of X-ray diffraction methods and computed tomography* of the Institute of Physical Chemistry, BAS.

### 2. Main scientific and scientific-applied contributions

The research of Assoc. Prof. Tachev in the period after the defense of his PhD thesis and his election as an associate professor are generally related to the application of non-diffraction X-ray methods for characterization of heterogeneous in its phase composition and structure materials. The main methods he successfully applies to more and more diverse systems are Small-angle X-ray Scattering (SAXS) and, in some cases, neutrons (SANS), anomalous low-angle scattering and computed tomography. Therefore, I will comment on the contributions based on the three main methods used and developed in the work of Assoc. Prof. Dragomir Tachev:

A central method for studying systems involving nanoscale phase included in the base solid matrix is the **small-angle scattering of X-rays or neutrons**, which makes it possible to determine with high statistical reliability the size distributions of nanoscale formations in the volume of solid media. This method was used to study the nucleation and growth of nickel particles in the chemically deposited hypoeutectic Ni-P alloy, of gold, silver-gold and iron-manganese oxide nanoparticles in sodium silicate glass and also of iron oxide and silver nanoparticles formed in ferritin-like proteins [23, 28-34]. In all cases, valuable information was obtained about the characteristics of the nanometric phase. Furthermore to validate the results obtained, additional methods were used, allowing the evaluation of the so-called form-factor the latter determining the way of interpretation of the experimental data.

The method of **anomalous low-angle X-ray scattering** near the edge of absorption of a chemical element in the composition of a sample is based on the variation of the scattering contrast depending on the energy of the X-ray radiation used. This effect was used to study the composition of crystalline nickel-phosphorus particles in an amorphous nickel-phosphorus matrix and to determine the composition of a nickel precursor and a platinum-nickel catalyst deposited chemically on a carbon and / or TiO<sub>2</sub> powder carrier [35]. In a separate publication [25] Assoc. Prof. Tachev contributes to the development of the theory of anomalous X-ray scattering of multiphase samples by covering in a consistent manner the methods used so far to vary the contrast, gives a new vision for their interpretation and reveals opportunities for constructing new schemes to vary the contrast of the scattering.

Recently, the scientific and scientific-applied activity of the candidate is related to the method of **computed tomography**. As a result of laser irradiation of the biocompatible polymer dimethylsiloxane (suitable for ocular implants), an inhomogeneous swelling process was observed, associated with the formation of conical cavities in the irradiated volume [37]. Using computed tomography, porosity changes were detected in an electrode of highly oriented pyrolytic graphite during intercalation of AlCl<sub>4</sub><sup>-</sup> anions. In this study the results were combined with measurements by small-angle scattering, allowing direct determination of the degree of intercalation [45].

### **3. Reflection of the scientific publications of the candidate in the Bulgarian and foreign literature**

The works of Assoc. Prof. Tachev have found significant reflection in the international literature - a total of 488 references according to data from Scopus and Web of Science. The candidate's Hirsch index is 13. The publications with which the candidate participates in the competition, all published since 2009, have so far received over 190 citations. Among the most cited works included in the competition, it is worth noting publications [23, 24, 28 and 29] with a total of 119 citations in the international scientific literature. All four publications demonstrate the capabilities of X-ray low-angle scattering methods to characterize heterogeneous systems with nanophase inclusions.

### **4. Critical remarks and recommendations to the scientific works of the candidate**

I have no remarks or recommendations on the works of the candidate, but I will allow myself to note the following:

I consider non-convenient the structuring and formulation of the candidate's contributions in the author's reference. There are three areas of research and applied research, of which the third thematic area is inappropriately called "other publications". In addition, most likely due to their logical and thematic connection, the contributions of the publications with which the candidate participates in the current competition are not well distinguished from those that were included in the competition for associate professor and the PhD thesis.

It is also noteworthy that until now Assoc. Prof. Tachev has been mainly in the role of a participant in research projects arising from the successful research group led by Prof. St. Armyanov, in which he grew up as a scientist. To some extent, this is due to his involvement in mastering new techniques (X-ray diffraction and then computed tomography) and not least his great administrative workload in recent years, which I have witnessed and know well. Nevertheless, Assoc. Prof. Tachev should consider leading himself research projects in which the X-ray non-diffraction methods, which he is well versed in, should play the central role.

### CONCLUSION

**Based on the materials submitted for the competition, the quality of scientific publications, their high citation rate, and last but not least the clearly defined high scientific competence of the candidate in the field of non-diffraction X-ray methods in materials science, I believe that he fully meets the requirements of ZRASRB and the corresponding Regulations to hold the academic position of "professor".**

**With deep conviction and pleasure I support the appointment of Assoc. Prof. Dr. Dragomir Tachev as a professor at the Institute of Physical Chemistry "Acad. Rostislav Kaischew", BAS.**

Date: 14.09.2020

Signature: