

**REPORT**

on the materials presented for the competition for the academic position of “**Professor**”, professional field **4.2. Chemical Sciences** ("Thermochemistry of natural and synthetic inorganic substances") for the needs of the Experimental Mineralogy and Crystallography Department at the Institute of Mineralogy and Crystallography (IMC)-Bulgarian Academy of Sci. (BAS), declared in the State Gazette, issue 81 / 15.10.2019

Candidate (only one): Assoc. Prof. Dr. Vilma Petkova Stoyanova - New Bulgarian University

Report: Assoc. Prof. Dr. Nadia Lubomirova Petrova - Institute of Mineralogy and Crystallography-BAS, Member of the Scientific Jury, appointed by order 561PД09 / 13.12.2019.

**1. General presentation of both the procedure and the applicant**

The documents and the materials presented by Assoc. Prof. Vilma Petkova Stoyanova respond to the requirements for the occupancy of the academic position "Professor" of the Law on Development of the Academic Staff in the Republic of Bulgaria, the regulations of BAS for the Implementation of this Law and the Regulations of IMC-BAS.

Vilma Petkova obtained her PhD with a diploma issued by the High Attestation Committee in 1993, and subsequently has been held the positions of "Research Associate" (1997-2000): Central Laboratory of Physic-chemistry Mechanic – BAS; (2000-2005): IMC – BAN and "Associate Professor" (2005-2013): IMC-BAS. From 2013 until now she is an associate professor at New Bulgarian University on a basic employment contract, as well, as a part of the scientific team at the IMC-BAS on a second employment contract. She is also currently a member of the Executive Board of the Research Fund.

**2. Characteristics of the presented materials and the activity of the applicant**

Assoc. Prof. Petkova is a co-author in 170 publications (75 with IF, JCR or SJR). From them 149 are out of competitions for the acquisition of both PhD and academic position “Assoc. Professor”. In this competition, Assoc. Prof. Petkova participates with 26 publications, 6 of which are in criterion “V” and 20 in criterion “G”. *The candidate in the competition is the first author in about of 60% of these publications*, a proof of her leading role in most of the presented articles. Criterion “V” articles (habilitation work- equivalent papers in journals referenced and indexed in Web of Science and Scopus) include 1 article in rank Q1, 3 in Q2, and 2 in rank Q3 journals. The presented 20 scientific papers for criterion “G” include 1 article in Q1-rank journals, 6 in Q2-rank journals, 10 in Q3-rank journals and 3 in Q4-rank journals. The candidate's scientific publications have been cited 448 times in the world literature, as from them 96 citations are noted within the competition. According to the Scopus and Web of Science databases, Assoc. Prof. Petkova owns the Hirsch Factor 11.

Assoc. Prof. Petkova actively participates in the work of scientific projects. After her election as “Assoc. Professor”, she has been a participant in 5 national projects and has been a leader of 4 national and 2 international projects. The amount of more than BGN 830 000 attracted funds for

international projects, managed by the candidate in the competition, is impressive. Assoc. Prof. Petkova is a co-supervisor of a successfully defended PhD student and has extensive teaching experience in training programs and as a bachelor and master's supervisor at NBU. *I would like to point out that the total number of points for participation in the competition exceeds almost twice the required number of points.* The extended author's reference to the contribution nature of the works is written clearly and in detail, with precisely differentiated references to the articles presented in this competition from those outside it, as well as to the articles according to the separate criteria "V" and "G". The candidate's scientific work related to the competition can be summarized in the following interdisciplinary scientific fields:

1. *Modeling of natural mineral and technogenic systems with application for construction industry* (including publications covering habilitation work requirements, criteria "V")

and

2. *Structural-phase, crystal-chemical and thermal studies in natural and synthetic samples of the Ca-P-O system with the participation of SiO<sub>2</sub>, CaCO<sub>3</sub>, F<sup>-</sup> / OH<sup>-</sup>* (with publications covering criteria "G")

Various approaches have been used to modify the properties, accelerate the phase transitions and provide solid-phase synthesis of natural and synthetic systems such as tribochemical activation, mechanochemistry, intensive energy activators; use of additives and reducers in solid or gas phase; thermal methods and etc. A wide range of methods have been used in these publications to identify the materials and used reaction products, such as powder X-ray diffraction, scanning electron microscopy, and simultaneous thermal analyses - TG(DTG) -DTA/DSC with gas phase evolving analysis (Mass-Spectroscopy).

*The first scientific area* includes publications related to scientific developments *in the field of building materials* for solving the raw, energy and environmental problems of modern construction-industry materials science. The candidate's personal scientific contribution in the presented publications with the co-authors is expressed in the detailed determination of the different stages of thermal decomposition in combination with the data of the qualitative mass spectroscopic analysis and subsequent analysis of the obtained results with the refinement of the reaction chemistry of the solid-phase reactions.

*The second scientific area* includes *synthetic and natural materials from the apatite group* as the main subject of study. The publications in this section have been grouped in terms of their thermochemical behavior in (i) pure forms; (ii) activated state with variations in activation duration, type and size of grinding bodies; (iii) using waste (NH<sub>4</sub>)<sub>2</sub>SO<sub>4</sub> as a composite additive without/with activation; (iv) use of natural and ion exchanged zeolite (clinoptilolite) as a composite additive with different used activation procedures. In interpreting the results in this group of publications, the possibilities of structural and thermal methods are used to demonstrate the increased reactivity of the apatite (alone or with additives) and to perform solid-state reactions between the components of the system.

The main personal contribution of Assoc. Prof. Petkova in the presented publications is the proposed reaction schemes describing the chemistry of the solid-phase reactions depending on the experimental conditions, the origin of the samples, the conditions and the duration of activation, as well as the presence of composite additives.

The presented studies also have an applied focus, providing opportunities for increasing the degree of conversion of the non-absorbable into absorbable for the plants forms of  $P_2O_5$ , as the resulting end products can be used as slow acting balanced fertilizer components and soil improvers.

### 3. Critical comments and recommendations

I also have some small critical notes:

- It would be useful to note the participations in the scientific forums within the competition (after her election as an assoc. prof.), as well as the type of presentation, with emphasis on oral presentations.

- From my point of view, when works have been published with one of the same title, with the addition of only parts I, II and III after title (as is the case for publications N68, 81 and 69 under criterion "G"), it would be correct to publish these works in the same kind of journal and each parts should follow chronologically over time.

However, these small notes do not in any way affect the overall excellent impression of the presented scientific output.

### Conclusion

It is undisputed for me that Assoc. Prof. Dr. Vilma Petkova is a highly productive researcher with broad scientific interests and detailed knowledge of the capabilities of thermal methods. My personal impression is that she is a very competent and well-meaning colleague and a desirable partner for cooperation in many scientific institutions at home and abroad. Analyzing the candidate's scientific achievements, their response in the world literature, the relevance and perspective of the topics in her research activity, her active participation in research projects, I find that they significantly exceed the requirements of the Law on the Development of Academic Staff in the Republic of Bulgaria, the regulations of BAS for the Implementation of this Law and the Regulations of IMC-BAS.

In this way, I strongly recommend that the Scientific Council of IMC-BAS be awarded to

*Assoc. Professor Dr. Eng. Vilma Petkova Stoyanova*

the academic position of "**Professor**" in the field of science 4.2. Chemical Sciences ("Thermochemistry of Natural and Synthetic Inorganic Substances")

Sofia, 10.02.2020

Signature:

Assoc. Professor Dr. Nadia Petrova  
Institute of Mineralogy and Crystallography-  
BAS