

REVIEW

by competition for the academic position " Associate Professor "
in the scientific specialty "Applied mineralogy, innovative construction materials"
by professional direction 4.4. "Earth Sciences"
for the needs of the department "Structural Crystallography and Materials Science"
at the Institute of Mineralogy and Crystallography "Acad. Iv. Kostov" (IMK) - BAS,
announced in the "State Gazette", no. 56/19.07.2022

Reviewer: *Prof. Eng. Vilma Petkova Stoyanova PhD, IMK-BAS,*
member of the scientific jury under Order No. 373 RD-09/09/08/2022

In the competition for the academic position (AP) " Associate Professor " in the scientific specialty "Applied mineralogy, innovative construction materials" by professional direction 4.4. "Earth Sciences" ("State Gazette" issue 56/19.07.2022) has one candidate Assist. Prof. eng. Aleksandar Nikolaev Nikolov PhD from the department "Structural Crystallography and Materials Science" at the Institute of Mineralogy and Crystallography "Acad. Iv. Kostov" (IMK) - BAS.

1. Short biographical data on the applicant

Assist. Prof. Eng. Aleksandar Nikolaev Nikolov PhD was graduated in 2011 from the University of Architecture, Civil Engineering and Geodesy (UACEG), Sofia (Diploma, Series UACEG-2011, Registration number 40475/2011) as a master's degree in the specialty "Construction of buildings and facilities" with professional qualification "construction engineer". In 2016, he received the educational and scientific degree " PhD " in the scientific specialty "Construction materials and products and technology for their production" (Diploma No. 118/10.02.2016) after successfully defending a dissertation on the topic: " Geopolymers based on zeolite for use in construction, composition, structure, properties" as a full-time PhD student in the Department of "Construction Materials and Insulation" at UACEG, Sofia. During the training for the period January 2015 to May 2015, he was a visiting scientist at the Technical University in the city of Delft, Holland, today - the Netherlands, in connection with research work on the dissertation. From June 2017, he started working as a technologist at the Institute of Mineralogy and Crystallography (IMK) of the Bulgarian Academy of Sciences, and later in 2018 he was appointed to the position of assistant professor at the Institute of Mineralogy and Crystallography (IMK-BAS), department "Structural crystallography and materials science", which he holds until now. The candidate Assist. Prof. eng. Aleksandar Nikolaev Nikolov PhD has 5 years of work experience in the last academic position of " assistant professor " (Certificate of work experience 575 JIC05/14.09.2022). In 2019 and 2020, he conducted training for employees under the Erasmus+ program at the Technical University in the city of Delft, the Netherlands.

2. Compliance of the documents submitted for the position of „Associate professor “

Protocol №581HO-05-06/20.09.2022 certifies the regularity and conformity of the documents.

1. Assist. Prof. Eng. Aleksandar Nikolaev Nikolov PhD has provided all required documents for the academic position "Associate Professor" in accordance with Art. 19, item 1-7 of the Law on the Development of Academic Staff in the Republic of Bulgaria (in force as of 05.05.2018) and with Art. 53, para. 1 of its Implementing Regulations (effective as of 06.07.2018), as well as Art. 18 (4) of the PPZRAS of IMC-BAN (effective from 21.10.2021).

2. Assist. Prof. Eng. Aleksandar Nikolaev Nikolov PhD is listed in the NACID (<https://ras.nacid.bg/dissertation-preview/43910>), with a recognized educational and scientific degree "PhD" on the basis of Diploma No 118/10.02.2016 r., issued by UACEG, Sofia.
3. According to the presented Certificate 575/14.09.2022, issued by IMC-BAN, the candidate has held the academic position "Assistant Professor" for 5 years and 2 months in the professional department of 4.4. Earth Sciences, which satisfies the requirement for more than 2 years of internship in the academic position "Assistant Professor", according to the requirements of art. 18, paragraph 2, item 2b of the PPZRAS of IMK-BAS.
4. The publications submitted for the competition shall not be duplicated with the publications for the acquisition of the Education Scientific Degree "PhD" and for the loan of academic position "Assistant Professor".
5. There is no evidence of plagiarism in the scientific papers of Assist. Prof. eng. Aleksandar Nikolaev Nikolov PhD for participation in this competition.
6. The applicant has applied a reference for implementation of the minimum national requirements under Art. 2b, para 2 and 3 of the Law on The Development of The Academic Staff in The Republic of Bulgaria, as well as the increased criteria under Art. 11 para. 6 of Regulations for application of the Law for the development of the academic staff in the Republic of Bulgaria in the Bulgarian Academy of Sciences (effective as of 29.10.2018) in connection with Art. 2b, para. 5 of the Law on The Development of The Academic Staff in The Republic of Bulgaria and under Art. 18, para 2 of Regulations for application of the Law for the development of the academic staff (effective as of 21.10.2021) of the Institute of Mineralogy and Crystallography, BAS.
7. The analysis of the provided data shows that Assist. Prof. Eng. Aleksandar Nikolaev Nikolov PhD covers and by some indicators exceeds the national requirements (the Law on The Development of The Academic Staff in The Republic of Bulgaria*), as well as the inflated criteria of the Bulgarian Academy of Sciences and the Institute of Mineralogy and Crystallography (BAS/IMC**) for the employment of academic position "Associate Professor" in professional field 4.4. Earth Sciences. The performance of the indicators by points shall be presented in the following table

Group by Groups	Indicators	PhD		Required points for academic position "Associate Professor" of Group		Points of applicant
		Min. requirements	Points achieved	Law on the Development of Academic Staff in the Republic of Bulgaria *	BAS/IMC**	BAS/IMC**
A	1. Dissertation on the award of an educational and scientific degree PhD	50	50	50	50	50

B	3. Habilitation work - scientific publications in publications that are referenced and indexed in WoS and Scopus			100	100	227
Г	7. Scientific publication in publications referenced and indexed in WoS and Scopus, outside of habilitation work	30	50	200	220	271.43
Д	11. Citations in scientific publications, monographs, collective volumes and patents referenced and indexed in WoS and Scopus			50	60	657
	Total				430	1205.43

* The Law on the Development of Academic Staff in the Republic of Bulgaria

** Rules for the terms and conditions for acquiring scientific degrees and for holding academic positions in the Bulgarian Academy of Sciences / Rules of Procedure for acquiring scientific degrees and for holding academic positions at IMC-BAS

3. Description and analysis of the submitted materials

The total number of publications of Assist. Prof. Eng. Aleksandar Nikolaev Nikolov PhD is 24 according to the full list of publications. For participation in the competition for academic position "Associate Professor" he presented 22 of them, which I will take into account when preparing the review. The detailed scient metric reference shows that 7 (32%) of the articles are in international journals, 15 (68%) in national journals. According to the list of publications Assist. Prof. Eng. Aleksandar Nikolaev Nikolov PhD is the co-author and co-author of 16 (73%) scientific papers visible in the world databases WoS and Scopus with scientific information, of which 9 (41%) articles are in journals with an impact factor, 3 (14%) - in journals with an impact rank and 6 (27%) - in full text in conference proceedings and in journals without an impact factor. The distribution of articles by quartiles of the WoS and Scopus journals in which the publications are located is as follows: 1 article is in a journal with Q1; 5 - in magazines with Q2; 1 - in a magazine with Q3 and 1 - in a magazine with Q4. Among the high-ranking journals are *Construction and Building Materials (Q1)*, *Materials (Q2)*, *Comptes rendus de l'Académie bulgare des Sciences (Q2)*, *Case Studies in Construction Materials (Q2)*, *Journal of Radioanalytical and Nuclear Chemistry (Q2)*, *Clay Minerals (Q3)* u *Bulgarian Chemical Communications (Q4)*.

It is extremely impressive that in the current competition Assist. Prof. Eng. Aleksandar Nikolaev Nikolov PhD participates in publications, in 10 of which he is the sole author (articles in group "B" - №2; group "Г" - №1, 3, 4, 5, 6, 8, 9, 10, 11). In other 9 of the publications is the first author (in group "B" - No. 1, 3, 5, 6, 7, 8, 9, 10; in group "Г" - No. 12), in a very small part of publications - only 3, Assist. Prof. Eng. Aleksandar Nikolaev Nikolov PhD is the 3rd, 6th and 7th co-author (in group "B" - №9; in group "Г" - №2 and №7). The total number of co-authors is small - 13. All articles were published after 2017, and the largest number were in 2019 (5 items) and 2020 (7 items).

The number of citations noticed on Assist. Prof. Eng. Aleksandar Nikolaev Nikolov PhD, presented in a separate list, is 135 according to the System for reporting scientific and expert

activity at the BAS - Sonix. Of these, 126 of them are in scientific publications, referenced and indexed in world-famous scientific information databases Scopus and WoS, and 9 are cited in other publications, dissertations or abstracts abroad. The Hirsch index (h) according to Scopus is 3, as for the publications of the competition, it is 4. The total number of points of citations in scientific publications referenced and indexed in the world-famous databases of scientific information Scopus and WoS, presented in the Reference for the implementation of the minimum criteria, is 657. This result exceeds the required 60 points according to the increased requirements under PPZRASRB of BAS and IMC-BAS.

The scientific results of the research of Assist. Prof. Eng. Aleksandar Nikolaev Nikolov PhD, received after acquiring the academic position of "assistant professor", have been promoted through participation in 23 scientific participations in 18 forums (after 2018), of which 21 in international scientific forums with 15 poster and 6 oral presentations, 2 - in national conferences with 1 poster participation and 1 report.

Assist. Prof. Eng. Aleksandar Nikolaev Nikolov PhD actively participates in 6 scientific projects, being the head of two of them financed by the National Research Institute and one funded by PMS No. 577 with a scientific theme similar to that of the announced competition for AP „Associate professor“. BGN 78,485 was attracted from external sources of funding in the projects under the leadership of the applicant. In the set of documents, the applicant is not presented with evidence of his participation in the projects, but only a list of the names of the projects.

The activity of Assist. Prof. Eng. Aleksandar Nikolaev Nikolov PhD has been well appreciated in the scientific community with awards for presentations given at scientific forums, awards for "Young Scientist" of the Bulgarian Geological Society for 2018 and "Professor Marin Drinov" of the BAS in the scientific direction "Nanoscience, new materials and technologies" for 2021.

4. Main scientific and/or scientific - applied contributions

The contribution nature of the publications with which the candidate participates in the competition is examined in the two main categories of materials according to the requirements of Art. 2b, para. 2 and 3 of ZRASRB and under Art. 18, para. 2, item 4 and para. 4, item 10 of the PPZRAS of IMK-BAS: category "B" - Habilitation author's reference for the contribution nature of the publications that are included in the Habilitation work and category "Г" - Author's reference for the contribution nature of the publications by indicator. The candidate Eng. Aleksandar Nikolaev Nikolov PhD did not submit his contributions to the publications separately for each of the categories "B" - group of articles 1-10 and "Г" - group of articles from 1-12, but in one general reference. One article - №2 of the general list of publications and a monograph on the dissertation work of Assist. Prof. Eng. Aleksandar Nikolaev Nikolov PhD are not included for consideration in the current competition for AP "Associate professor".

4.1. Summary of the presented publications

The scientific activity of Assist. Prof. Eng. Aleksandar Nikolaev Nikolov PhD is primarily related to developments in which the production of a new group of construction materials under the general name "geopolymers" is investigated. Their composition is determined by finely ground alumina-silicate material and an alkaline activator to stimulate the tendency of silicon atoms to form silicon chains or networks through covalent bonds. In the works of Assist. Prof. Eng. Aleksandar Nikolaev Nikolov PhD, the process of obtaining geopolymers based on silicate minerals (zeolite and meta zeolite) and alkaline activators (potassium base, potassium silicate, sodium aluminate - water glass, waste fayalite, "fly" ash) was studied. the influence of the type of

alkaline activators, different module ratios was tracked ($\text{SiO}_2/\text{Al}_2\text{O}_3$, $\text{Al}_2\text{O}_3/\text{M}_2\text{O}$, $\text{H}_2\text{O}/\text{M}_2\text{O}$, $\text{M}=\text{Na, K}$), concentration dependences, the time connection and other important parameters for the development of the geopolymerization process. The microstructure and properties of the obtained new building materials were investigated by X-ray powder diffraction, X-ray fluorescence, laser diffraction, low-temperature gas absorption, computed tomography, scanning electron microscopy, thermogravimetry with differential scanning calorimetry, infrared spectroscopy, etc.

4.2. Scientific contributions

Scientific contributions can be grouped into several thematically groups:

- Preparation of geopolymers from natural zeolite and alkaline activators;
- Preparation of geopolymers using wastes – fayalite, fly ash, metakaolin;
- Preparation of quick-hardening one-component cement, a prototype of pavement pave.

The scientific contributions of Assist. Prof. Eng. Aleksandar Nikolaev Nikolov PhD in these studies are briefly presented below, within the defined thematic groups:

Preparation of geopolymers from natural zeolite and alkaline activators (B-3, 5, 7, 9, 10, Γ -1, 11). The conducted research is a continuation of Nikolov's dissertation ("Geopolymers based on natural zeolite for use in construction, composition, structure, properties"). The obtained results of the dissertation are supplemented with new studies on the influence of an alkaline activator on the process of formation of geopolymers based on natural zeolite. Sodium metasilicate with a higher water glass modulus (~ 3) was used as a suitable alkaline activator in order to accelerate the achievement of a higher 90-day strength (B-9). The effect of adding polypropylene monofilament fibers to increase the pore content was also investigated (B-10, Γ -11). A significant pore content has been demonstrated - 80% with a size between 60 μm to 1 mm. The influence of the concentration of the alkaline solution of the activator on the flexural strength and adhesion of concrete (B-3) was also investigated, and the optimal concentration, at which the highest values of flexural strength and adhesion were obtained, was determined. In this research group, a study was conducted to replace natural zeolite with metakaolin to reduce drying and to determine the effect of using aluminum instead of silicate activators (B-7, Γ -1). A 4-fold reduction in desiccation and phillipsite formation in aluminate-activated geopolymers has been demonstrated. The influence of the effect of calcination of zeolite on the properties of the geopolymer was investigated and it was proved that at 900°C an amorphous zeolite structure "metakaolin" is obtained, the use of which increases the compressive strength by more than 3 times and reduces drying (B-5).

The candidate's scientific contributions in this group of publications is related to the study of the geopolymerization process by modifying the zeolite-metazeolite compositions, the type and concentration of the alkaline activator to increase strength characteristics and reduce drying.

Obtaining geopolymers using waste (B-1, 2, 3, Γ -3, 5, 6, 8, 9, 10, 12). This group of publications investigates the production of geopolymer by the polymerization of fayalite waste from the mining plant of the German company Aurubis, with alkaline activators of water glass and potassium hydroxide (Γ -5). Improvement of the geopolymerization process is achieved by adding metakaolin in a ratio of 5:1 fayalite to metakaolin. Good strength indicators were achieved with reduced water absorption (Γ -5). The influence of the ratio of water to dry matter on the consistency of a fresh geopolymer mixture was investigated, and the formation of high-strength

geopolymers (B-2) was proven. When heated to 1150°C, the fayalite geopolymers increase the strength, but it has an oxidation of the iron from the fayalite (Г-6, B-3).

In this group of publications (B-1), the preparation of a composite of waste plastic and a geopolymer protective coating based on fayalite waste was investigated. The composite was used for a prototype pavement.

Experiments were carried out on acid activation of fayalite waste with phosphoric acid solution to obtain a new geopolymer (B-8). It has been proven to perform a fast-hardening reaction, and high strength indicators have been achieved.

In addition to fayalite waste, experiments were conducted to obtain geopolymers based on fly ash and alkaline activating solutions. The influence of the concentration of the activating solutions was studied, as the resulting geopolymers have a relatively high-water absorption and density. Lightweight geopolymers were obtained using hydrogen peroxide as a gas-forming agent (Г-8, 9, 12). Crystallization and change in compressive strength with temperature change at 400, 800 and 1150°C were monitored. An increase in strength indicators with increasing temperature up to 1150°C after an initial decrease at 400°C has been demonstrated.

Nikolov's scientific contributions are related to the study of the geopolymerization process based on fayalite waste, fly ash, acid activation, conducting physico-mechanical and physico-chemical studies on the strength indicators and the microstructure of the obtained materials. The importance of the concentration of the activating solutions on the geopolymerization process has also been proven.

Obtaining other building materials (B-4, 11Г-2, Г7). In this group of publications, other series of samples from the Chala deposit, Eastern Rhodopes, where minerals of the turquoise group have been proven; the ion exchange properties of natural zeolite from the Beli Plast deposit, Kardzhali region with bication solutions containing Cs⁺ and Sr²⁺. The results prove a reduced sorption of Sr²⁺ in the presence of Cs⁺. The experimental data are well described by the Langmuir adsorption isotherm.

In large part in the submitted publications for the competition Assist. Prof. Eng. Aleksandar Nikolaev Nikolov PhD is the first author, which proves his leading role in the planning and conduct of the experiments, the analysis of the obtained results and the preparation of the publications in which these results are presented. It is a complex and time-consuming process, requiring specific knowledge and precise experimental work, which Assist. Prof. Eng. Aleksandar Nikolaev Nikolov PhD has successfully carried out his research.

5. Critical notes and recommendations

After consideration with the materials of the Assist. Prof. Eng. Aleksandar Nikolaev Nikolov PhD I could make some remarks to the candidate. To participate in the competition, she submits a small number of publications, which are divided into categories "B" and "Г". It was unclear to me how the allocation was made, as mutually related posts were split into the two categories. I am with the impression that this was done according to formal technical characteristics, and not according to the consistency and coherence of conducted research. This makes it difficult to evaluate them. In some articles, repetitions of the objects of study and of the same results and texts are noticeable. The scientific value of the publications is good, most of them are printed in prestigious international specialized journals, but to realize a potential economic effect, it is necessary to replace expensive raw materials and chemical reagents with anthropogenic products or industrial waste.

I would recommend to Assist. Prof. Eng. Aleksandar Nikolaev Nikolov PhD when presenting the results of his future research, pay attention to the terminology which is used. If it is acceptable

for a young scientist to use imprecise or outdated terminology, it is unacceptable for a qualified scientist to lack accurate and precise statement, critical analysis of results and tracing of cause-and-effect relationships rather than just listing findings.

6. Conclusion

Presented by Assist. Prof. Eng. Aleksandar Nikolaev Nikolov PhD documentation for participation in the competition covers the requirements the Law on the Development of Academic Staff in the Republic of Bulgaria and the Rules for the terms and conditions for acquiring scientific degrees and for holding academic positions in the Bulgarian Academy of Sciences / Rules of Procedure for acquiring scientific degrees and for holding academic positions at IMC-BAS under the competition and correspond to the theme of the announced competition for academic position "Associate professor". The evidence is the material cover 1205 points and exceeds the minimum requirements of the normative documents.

I positively evaluate the materials presented in the competition and recommend the Scientific Jury to propose the candidate to the Scientific Council of IMC-BAS Assist. Prof. Eng. Aleksandar Nikolaev Nikolov PhD to be elected to the academic position „Associate professor “of IMC-BAS by professional direction 4.4. Earth Sciences (Applied Mineralogy, Innovative Building Materials) for the needs of the "Structural Crystallography and Materials Science" department at IMK-BAS.

Sofia

4.11.2022

Reviewer: (π)

(prof. Eng. V. Petkova PhD)