OPINION

by Prof. Dr. Rositsa Hristova Titorenkova

Institute of Mineralogy and Crystallography – BAS

regarding the competition for the academic position of "Associate Professor" in 4.4 "Earth Sciences" ("Mineralogy and Crystallography") at the "Acad. Ivan Kostov" Institute of Mineralogy and Crystallography – BAS,

for the needs of the department "Experimental Mineralogy and Crystallography", announced in the “State Gazette”, Issue 56 of June 19, 2026.

Candidate: Chief Assistant Professor Dr. Liliya Tsvetanova (IMC-BAS)

1. General characteristics of the submitted materials

Dr. Liliya Tsvetanova is applying for the academic position of "Associate Professor" in 4.4 "Earth Sciences" ("Mineralogy and Crystallography") at the "Acad. Ivan Kostov" Institute of Mineralogy and Crystallography, with a total 21 publications in journals indexed in the international databases Web of Science and Scopus. These publications are distributed by quartile as follows: 6 publications in Q1journals) 5 in Q2 journals, 4 in Q3 journals, 5 in Q4 journals, and one publication classified under the category "Other." The candidate is the first author of one publication and a co-author of the remaining 20 publications.

The candidate has authored or co-authored a total 37 publications. Her h-index in Scopus is 5.

According to the attached report assessing compliance with the national minimum requirments for professional field 4.4 "Earth Sciences" (as amended by Decree No. 17 of March 14, 2025, and published in the State Gazette No. 23/March 18, 2025), as well as with the additional requirements of the Bulgarian Academy of Sciences (BAS) for the academic position of "Associate Professor" in 4.4 "Earth Sciences," the candidate`s scores for the respective indicators are as follows: Indicator A – 50 points; Indicator B4 – 100 points (required: 100 points); Indicator G – 276 points (required: 220 points); Indicator D – 135 points (required: 60 points). The metric indicators of the materials submitted for the competition meet the minimum quantitative requirements for acquiring the academic position of "Associate Professor" at the Institute of Mineralogy and Crystallography (IMC-BAS).

2. Main scientific contributions of the candidate

Under Indicator B4 (equivalent to a habilitation thesis), four publications are presented, focusing on the development, modification, and characterization of functional inorganic materials based on zeolites and titanosilicates. These materials exhibit adsorption, photocatalytic, and antimicrobial properties, with potential applications in environmental

protection. In these studies, Dr. Liliya Tsvetanova is the lead author of one publication and has made active contributions to the synthesis and characterization of the materials reported in the remaining publications.

The main scientific and applied scientific contributions from these publications can be summarized as follows: 1) Synthesis and modification of titanosilicate and zeolitic materials aimed at improving their ion-exchange and sorption properties. Relationships have been established between structural features, cation-exchange capacity, and the efficiency of removing toxic heavy metals from aqueous media [B4.1]; 2) Development of Zr-modified titanosilicates with increased specific surface area and enhanced photocatalytic activity. It has been established that modification with approximately 6 wt.% zirconium yields the highest efficiency in the photocatalytic degradation of the organic dyes methylene blue and crystal violet [B4.2]; 3) Development of functional antimicrobial geopolymer coatings based on natural clinoptilolite, modified with silver and copper ions. The resulting materials exhibit good adhesion to various construction substrates and high surface coverage. It has been demonstrated that their antimicrobial activity is retained even after accelerated carbonation, despite a decrease in pH. Furthermore, the biocidal effect has been attributed primarily to the release of Ag^{+} and Cu^{2+} ions rather than to the the alkalinity of the geopolymer matrix [B4.3]; 4) Developed of sodium-exchanged clinoptilolite, subjected to additional mechanochemical activation to enhance its cation-exchange capacity and sorption efficiency for Cd(II). For the first time, “in vivo” studies have demonstrated that the modified natural clinoptilolite reduces cadmium bioaccumulation in the liver and kidneys and facilitates its elimination from the body [B4.4].

In the publications listed under indicator G7, the contributions of Dr. Liliya Tsvetanova can be summarized into the following groups:

II.2 Investigation of natural and synthetic materials with sorption, catalytic, and biological properties (Items G7.1, G7.5, G7.11, G7.16, G7.10, and G7.17).

This group of publications is thematically closely related to the research presented under Group B, focusing on natural and synthetic zeolites and titanosilicates, their chemical modification, and the investigation of their functional properties for environmental and biological applications. At the same time, the scope of research is broadened to include research on the catalytic decomposition of ozone, the geochemical characterization of natural raw materials, the biological application of mineral additives, and the development of composite materials with catalytic properties.

II. 3. Characterization and utilization of natural and technogenic raw materials for the production of geopolymer, ceramic, and cementitious materials – Nos. G7.8, G7.9, G7.7, G7.12, G7.13, and G7.14. This group of publications focuses on the synthesis and characterization of geopolymers, ceramics, and cementitious materials derived from natural and technogenic raw materials. The contribution of Dr. Liliya Tsvetanova involved the characterization of the starting materials and final products, including and determination of their chemical and phase composition.

II. 4. Mineralogical, crystal-chemical, and analytical studies – Nos. G7.2, G7.3, G7.4, G7.6, and G7.15. This category primarily includes publications on natural minerals (pyrite, marcasite, serpierite), one publication dedicated to natural raw materials for ceramic synthesis, and one publication concerning a bioelectrochemical approach for the simultaneous extraction of gold and silver using a microbial fuel cell - a topic distinct from the scope of the other publications.

In the co-authored publications, the candidate made a significant personal contribution, which included participating in the synthesis and modification of a substantial portion of the materials studied, conducting ion-exchange experiments, and characterizing the materials using wavelength-dispersive X-ray fluorescence (WDXRF) and powder X-ray diffraction (XRD). The contribution also includes the interpretation of experimental results and a synthesis of the established relationships between composition, structure, and properties.

Regarding the fulfillment of indicator D, 27 citations in refereed and indexed publications are included, which are equivalent to 135 points.

Regarding the fulfillment of indicator E, 7 projects are presented; she serves as the principal investigator for one of them.

3. Critical Remarks

I have no significant critical remarks.

4. Conclusion

The submitted documentation concerning the research activities and science metric indicators of Dr. Liliya Tsvetanova, meets the minimum quantitative requirements stipulated in the Act on the Development of the Academic Staff in the Republic of Bulgaria and the Regulations for its implementation at the Institute of Mineralogy and Crystallography (IMC) – BAS, for the academic position of "Associate Professor" in the Professional Field 4.4. Earth Sciences.

In conclusion, as my capacity as a member of the Scientific Jury, I recommend that Chief Assistant Professor Dr. Liliya Tsvetanova be elected to the academic position of "Associate Professor" in Professional Field 4.4. Earth Sciences, within the department "Experimental Mineralogy and Crystallography" at the Institute of Mineralogy and Crystallography – BAS.

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