

STANDPOINT

by Assoc. Prof. Dr. Ivanka Spassova, Institute of General and Inorganic Chemistry, Bulgarian Academy of Sciences, on the materials submitted for participation in the competition for awarding the academic position "*Professor*" in the professional field 4.2 "Chemical Sciences" (Chemical kinetics and catalysis) for the needs of lab. "New Heterogeneous Catalysts for Clean Energy Production and Environmental Protection" at IC-BAS, announced in State Gazette, issue no. 77 of 01.10.2019.

Assoc. Prof. Margarita Valentinova Gabrovska, PhD is the only candidate in the competition announced for the academic position "Professor" in the laboratory "New heterogeneous catalysts for clean energy and environmental protection" of IC- BAS. The submitted materials for participation in the competition are in accordance with the Regulations for the Terms and Procedure for Acquisition of Academic Degrees and for Occupation of Academic Positions in IC- BAS and include all necessary documents. Assoc. Prof. Margarita Gabrovska is registered in NACID (<https://ras.nacid.bg/dissertation-preview/28376>), where her doctoral degree and academic position as Associate Professor are recognized.

Brief details of the applicant

Assoc. Prof. Dr. Margarita Gabrovska graduated from the Higher Institute of Chemical Technology "Prof. Dr. Assen Zlatarov", Burgas with a specialty "Technology of Organic Synthesis and Fuels" in 1981. In 2001 she defended her PhD thesis at IC-BAS, and in 2010 she was elected as Associate Professor at the same Institute. The candidate is the head of the thematic group "Synthesis and activity of metal and metal oxide catalysts" at the Laboratory "New heterogeneous catalysts for clean energy and environmental protection".

Scientific research activities

Assoc. Prof. Dr. Margarita Gabrovska exceeds the required minimum requirements recommended by the Bulgarian Academy of Sciences and Institute of Catalysis, in accordance with the Regulations for the Terms and Procedure for Acquisition of Academic Degrees and for Occupation of Academic Positions at IC-BAS. The actual points in the group of indicators D are 66 more than the candidate estimated.

Assoc. Prof. M. Gabrovska is co-author of 73 scientific papers, and in this competition she participates with 34 of them, all after her habilitation in 2010. Four of the publications are in journals indexed by quartile Q1, 1 in Q2, 6 in Q3, 10 in Q4, and 10 publications are in the proceedings of international conferences. 150 citations have been observed on the publications for the competition. The results of the research with the participation of Dr. Gabrovska were presented at 77 national and international scientific forums, 21 of which were oral reports.

The project activity of the candidate in the competition is also impressive. Assoc. Prof. Margarita Gabrovska was the leader of 9 and participant in 6 projects with national funding. Over 175,000 BGN have been received in the Institute from the projects she led.

Scientific contributions

Dr. Gabrovska's habilitation report is based on the results of 8 scientific publications, thematically integrating the development of new effective catalysts for CO oxidation, for conversion of CO with water vapor and for hydrogenation of CO₂ to methane, representing a complex catalytic purification cycle of CO and CO₂ gas mixtures aiming at the production of pure hydrogen for different applications. The contributions can be summarized as:

- Co-Al and Ni-Al catalysts for complete oxidation of CO at low temperatures have been developed and studied. The catalyst activation/deactivation processes are associated with the formation of surface active complex consisting of oxygen ion radicals adsorbed and stabilized on Al³⁺ ions (O₂^{x-}/Al³⁺) and linked to the redox pair by Me²⁺/Me³⁺ via anionic vacancies in vicinity to Al³⁺.
- Co-precipitated Ni-Al catalysts prepared from layered double hydroxides are active up to 300°C in water gas-shift reaction (WGSR). Doping with gold has led to the creation of active and cost-effective catalyst that allows the process to proceed in one step. The reaction mechanism of the WGSR, including the redox transition of Ni²⁺ ↔ Ni³⁺, accompanied by adsorption and activation of CO on the gold particles, has been confirmed.
- Re₂O₇/γ-Al₂O₃ with suitable additives is an active catalyst when using acid syngas for WGSR, which helps to increase the flexibility of the process for the production of pure hydrogen.
- Ni-Al catalysts with varying composition (Ni²⁺/Al³⁺), modifiers and appropriate heat treatment, exhibit high catalytic activity in the fine purification of CO₂ by methanation of hydrogen-rich gas mixtures. Nickel-rich modified with Mg catalyst is promising in low-temperature methanation, where the magnesium helps to preserve the dispersion of metallic nickel after high-temperature reduction.

The studies presented in the habilitation report show that effective catalysts with desired structure and specific properties applicable to the purification of CO and CO₂ gas mixtures could be obtained by adjusting the composition, the type of the modifiers and the appropriate heat treatment.

The report for the contribution of Assoc. Prof. Dr. Gabrovska on the non-habilitation publications for participation in the competition is built on 26 scientific papers. These studies are related to the selection and design of a wide range of nanoscale metal and oxide materials with appropriate structure and reaction properties intended for hydrogen energetics, environmental protection, human health and for improving quality of life. Among these studies, I would like to emphasize the development of a new Ni-containing anode catalyst for fuel cells, implemented in regular production and incorporated into the G5 generator system, a commercial product of the Israeli company Gen Cell Ltd. I believe that any researcher could be proud of the actual application of his scientific achievements in practice.

CONCLUSION

The documents and materials submitted by Assoc. Prof. Dr. Gabrovska, meet all the requirements of the Law for the Development of the Academic Staff in the Republic of Bulgaria (LDASRB), the Regulations for its Implementation and the relevant Regulations of the Institute of Catalysis, BAS. A sufficient number of scientific papers published after her habilitation have been presented. The research work of Assoc. Prof. Dr. Margarita Gabrovska reveal her as a scientist with a clear outline related to the design of materials for various catalytic applications. As a long-time successful leader of a scientific group, she has proven her ability to lead, develop and deepen the scientific topics of the laboratory.

Therefore, I strongly recommend to the members of the Scientific Jury and to the Scientific Council of IC- BAS to award to Assoc. Prof. Dr. Margarita Gabrovska the academic position "*Professor*" in the field 4.2. Chemical Sciences (Chemical kinetics and catalysis).

15.01.2020

Member of the Scientific Jury:

(Assoc. Prof. Dr. Ivanka Spasova)