

# R E P O R T

## **on the competition for the academic position Professor scientific direction 4.2. Chemical Sciences (Inorganic Chemistry)**

Institute of General and Inorganic Chemistry  
at the Bulgarian Academy of Sciences (IGIC-BAS)  
announced in ДБ, No 47 / 4.06. 2021

Applicant: **Assoc. Prof. Dr. Diana Rabadjieva** (IGIC-BAS)

Member of the Scientific Jury: Prof. Dr. Radostina Konstantinova Stoyanova (IGIC-BAS)

**A. Short professional biography.** Dr. Diana Rabadjieva is the only applicant in the competition announced by IGIC-BAS for the academic position Professor on Chemical Sciences (Inorganic Chemistry). She was a graduate of the University of Chemical Technology and Metallurgy, Sofia, where in 1986 she graduated as a chemical engineer with a degree in "Technology of Inorganic Substances". Since 1990 she has been entering IGIC-BAS, and in 2003 he successfully defended his dissertation on the crystallization processes in marine-related systems. In 2012 she was habilitated as an associate professor. The acquired profound knowledge in the field of inorganic chemistry is the basis for its successful realization in the Laboratory "Salt Systems and Natural Resources" at IGIC-BAS, and since 2017 she has been its head. This report reveals unequivocally that the candidacy of Dr. Rabadjieva is in full compliance with the requirements of the competition for a professor of Chemical Sciences (Inorganic Chemistry) announced at the IGIC-BAS.

**B. Report on the fulfillment of the minimal criteria of BAS.** Dr. Rabadjieva is a co-author of a total of 64 scientific papers. In the competition for professor on inorganic chemistry she participated with a habilitation thesis based on 6 scientific publications, which are dedicated to the examination of chemical processes in water-salt systems. Four of them (i.e. 67%) are published in international journals from the first quartile (Q1) the field of chemistry of biomedical materials. Along with them, Dr. Rabadjieva presents 14 scientific publications in which the knowledge on thermochemical and thermodynamic properties of multicomponent systems is directed towards solving specific practical requirements. It is worth to mention that five of these papers (i.e. 36 %) were published in international journals from the first quartile in the respective fields. Some of the results were presented in the period 2012 - 2021 at a total of 47 international and 21 national scientific events. So far, a total of 275 independent citations have been noticed on Dr. Rabadjieva's research, of which only 190 have been noted in the report on the minimum requirements (i.e. those that appeared after 2012). The total Hirsch index of the overall scientific output of Dr. Rabadjieva is 10.

The success of Dr. Rabadjieva's research is a consequence of her active participation in projects (27 in total) with various sources of funding, such as NSF, Operational Programs, MES, EBR, private companies and COST action. Moreover, after her habilitation in 2012, she participated in 10 projects, 3 of which she was a manager. It is of importance to outline the work of Dr. Rabadjieva, related with the implementation of the contract on "Chemistry of

water-salt systems for the utilization of natural mineral resources and waste products, in particular marine chemical resources", that is an essential for IGIC-BAS development.

Together with the research activity, Dr. Rabadjieva has an educational activities, expressed in the guidance of two doctoral students in the field "Chemical Sciences", one of which he successfully defended in 2018, and the other - is in the process of training.

The above report reveals that the scientific output of Dr. Rabadjieva is on the subject of the competition and meets the minimum national requirements for the academic position "Professor" in the field of "Natural Sciences, Mathematics and Informatics", direction on Chemical Sciences, specified in The Law for Development of the Academic Staff in Bulgaria, the Regulations for its application and the Regulations for the conditions and the order for acquiring scientific degrees and holding academic positions in BAS.

### **C. General features of the applicant's research activities**

***C1. Main scientific contributions presented in the habilitation thesis.*** Research on equilibrium and metastable phase transitions in multicomponent systems is a key topic in the chemistry, which in recent years has focused mainly on the creation of functional materials for a given purpose. In general, Dr. Rabadjieva's research falls into this area. The basis of these studies is the application of a thermodynamic approach for modeling and prediction of precipitation and crystallization processes in marine-related water-salt systems. As a result, an original technology has been developed for the production from marine brines of large crystalline  $\text{MgCO}_3 \cdot 3\text{H}_2\text{O}$  characterized with pharmacopoeia purity and good filtration characteristics. The same approach is successfully applied to describe the precipitation processes and phase transformations of phosphate systems in the electrolyte medium of simulated tissue fluids and, based on this, a bone-like carbonate apatite with potential application in orthopedic and dental medicine is obtained. In addition, it is shown that the thermodynamic approach can be used in the determination of the distribution of inorganic chemical forms of the elements in salt and hypersaline waters, which, on its turn, can be related to the ecological state of surface waters and soils. In conclusion, Dr. Rabadjieva's research contributes to enrichment of knowledge on chemical processes in complex water-salt systems.

***C2. Scientific contributions presented in the non-habilitation thesis.*** The research in this group is directed at finding chemical approaches for utilization of metallurgical slag, as well as determining the chemical forms of the elements in the phytoaccumulation processes. Solving these environmental tasks is only possible by building teams of scientists with knowledge in various fields. In this sense, the role of Dr. Rabadjieva is well defined: she participates both in the implementation of research tasks on thermochemical and thermodynamic characterization of multicomponent systems, and in the formulation of new guidelines in the development of relevant chemical technologies. Dr. Rabadjieva has an original contribution to the optimization of the oxidation process of copper pyrometallurgical slag, which is the first step in the technology for its utilization. Based on the systematic analysis of two agro-industrial zones in the Maglizh region with different types of pollution, the most probable chemical forms of distribution of transition metals (Al, Fe, Mn, Ni, Cu, Zn and Pb) in waters, soils and vegetation have been determined - data needed to clean up these areas.

## **D. Conclusion**

The main feature of the overall research activity of Dr. Diana Rabadjieva is the systematic exploration of the processes of crystallization and precipitation in water-salt systems. The research clearly outlines the contribution of Dr. Rabadjieva, namely the application of the thermodynamic approach in multicomponent systems beyond its standard use, and the results of these studies can serve to address some challenges in the utilization of chemical resources from natural and industrial sources. Dr. Rabadjieva's scientific output exceeds the minimal national requirements for holding the academic position of "Professor" in the field of "Natural Sciences, Mathematics and Informatics", Direction Chemical Sciences. Based on all mentioned criteria, I propose in a convinced way that the Scientific Jury to award Assoc. Prof. Dr. Diana Rabadjieva the academic position Professor on Inorganic Chemistry.

Prof. Dr. Radostina Stoyanova

Sofia, 05.09.2021