

ATTITUDE OF REVIEWER

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on the materials submitted for participation in the competition for the occupation of the academic position "Associate Professor", announced at the Faculty of Chemistry and Pharmacy, Sofia University “St. Kliment Ohridski”, for the needs of the Department of Inorganic Chemistry, in the professional field 4.2 Chemical Sciences (Inorganic Chemistry).

1. General presentation

By order № ПД-38-161 dated 10.04.2020 of Sofia University Rector prof. Anastas Gerdjikov I was appointed as a member of the scientific jury of the competition for occupation of the academic position "Associate Professor" at the Faculty of Chemistry and Pharmacy, professional field 4.2. Chemical Sciences (Inorganic Chemistry).

The only candidate in the competition for the position "Associate Professor" announced in the State Gazette, issue 21 of 13.03.2020 for the needs of the Department of Inorganic Chemistry is **Dr. Martin Petrov Tsvetkov**, Assistant Professor in the same Department.

2. Short biography of the applicant

Assistant Professor Dr. Martin Tsvetkov graduated from the Faculty of Chemistry and Pharmacy at Sofia University "St. Kl. Ohridski". In 2010 he received a bachelor's degree, and in 2011 a master's degree, both in Nuclear Chemistry. He defended his doctoral dissertation in inorganic chemistry in 2016 at the same faculty of Sofia University.

In a period of 6 years, from 2011 to 2017, he has been appointed as a chemist in the Laboratory of X-ray Diffraction Methods and Computed Tomography of the Institute of Physical Chemistry, Bulgarian Academy of Sciences, and since 2017 he has held the position of Assistant Professor in the Department of Inorganic Chemistry of the Faculty of Chemistry and Pharmacy. During the years 2016 - 2019 he visited several times JINR in Dubna, Russia as a guest researcher and research associate in the Department of Neutron Physics and the Department of Nuclear Problems. He also conducted a one-month research activity at the National Institute of Chemistry in Ljubljana, Slovenia.

The main areas of research interest of Dr. Tsvetkov are solid state chemistry, inorganic synthesis, crystallographic characterization of materials, heterogeneous catalysis and photocatalysis.

3. Scientific research activities

The results of the research activity of Assistant Professor Dr. Martin Tsvetkov, with which he participated in the announced competition for the position of "Associate Professor" have been developed in the frame of 7 research projects with national funding, in 4 of which the candidate is the project leader. The results are presented and disseminated in 19 scientific publications, 15 of which are in journals with ISI "impact factor", and all journals possessing "impact rank". Among them are the renowned in the field of catalysis, crystallographic and physicochemical studies of materials: *Catalysis Today* (4.95 / 2019), *Catalysis Communications* (3.612 / 2012, 3.80 / 2020), *American Mineralogist* (2.019 / 2015, 2.518 / 2018-19) and *Materials chemistry and physics* (3.408 / 2020).

The selected for the competition publications, citations and participations in conferences and other scientific events, provide to Dr. Martin Tsvetkov the corresponding to the minimal national criteria points, according the Regulations for the implementation of the Act on Development of the Academic Staff in the Republic of Bulgaria, as well as in the Regulations of Sofia University "St. Kliment Ohridski" and even exceed them in most of the indicators.

Part of Dr. Tsvetkov's research, published in 5 articles in "impact factor" journals, is the basis of his habilitation thesis presented under the unifying title "Improved Oxidation Processes (AOP) for the removal of organic pollutants in water". This topic is undoubtedly of high importance for fundamental, as well as for applied research, being related with areas of activity as ecology, circular economy, human health and biodiversity. It is of top priority for the European Union government, as well as for many other governments in the world.

According to the subjects, the publications presented in the competition could generally be divided into the following 2 thematic groups and the respective contributions of the candidate are elucidated and presented by him in the reference for the author's contributions:

(1) Synthesis, characterization and (photo) catalytic properties of transition metal oxides

Experimental work in this topic includes the design, synthesis and characterization of a wide range of materials in order to apply them as catalysts and photocatalysts exhibiting improved oxidation processes suitable for the decomposition of organic pollutants in water.

The studies are focused on establishing the effect of gamma irradiation at doses of 8 to 60 kGy on commercially produced TiO₂ Degussa P25 (P1) as well as on synthesized TiO₂ by acid-catalyzed hydrolysis of titanium butoxide (P2). Studies were performed on nanocomposites of CeO₂-Co₃O₄ with different Co₃O₄ content (5, 10 and 15% by weight) with deposited gold nanoparticles (3% by weight) (P3). A series of catalysts based on magnetite deposited on activated carbon were synthesized and their catalytic activity was determined in a photo-Fenton process for decomposition of methylene blue in aqueous solutions (P4), also a series of zinc-substituted magnetite (Zn_xFe_{3-x}O₄ (x = 0.25, 0.5, 1)) for the decomposition of malachite green in aqueous solutions under UV light (P5).

Dr Tsvetkov presents also a lot of experimental works in the field of materials for catalysis. They could be summarized as follows:

- A series of mixed cobalt and copper ferrites synthesized by co-precipitation, followed by mechanochemical activation and / or microwave treatment (P6),
- A series of nanosized copper ferrites with the general formula Cu_xFe_{3-x}O₄ (P7),
- A series of nickel-substituted magnetite – Ni_xFe_xO₄ (x = 0.25, 0.5, 1)) for decomposition of malachite green under UV light (P8),
- iron-containing catalysts obtained from *Leptothrix* bacteria in Liske medium, compared with abiotic material obtained by co-precipitation method (P9), mixed ferrite systems with general formula Co_xZn_{1-x}Fe₂O₄ (x = 0; 0.25; 0.5; 0.75; 1) obtained by high temperature treatment followed by mechanochemical treatment at two different grinding times (4 and 8 hours) (P10),
- 3D mesoporous composite of NiO/C₃N₄ synthesized by a new method (P11),
- modified with Hf (IV) CoFe₂O₄ to remove volatile organic compounds air pollutants (ethyl acetate was used as a model pollutant) (P14),
- composites of ferrites of the type MFe₂O₄ (M = Mg, Zn, Co) with silver nanoparticles (P15),
- ferrites modified with lanthanide ions (P17), NiFe₂O₄ and Ni_{0.5}Zn_{0.5}Fe₂O₄, obtained by sol method and modified with 1 and 5% Eu and Tb, tested for photocatalytic decomposition of malachite green under visible light irradiation,
- CuO/C₃N₄ composites, tested for photocatalytic action in natural sea water (Kavarna region) for decomposition of malachite green (P18) and 3D hierarchical CuO catalysts obtained by applying a dynamic Leidenfrost process (P19).

The candidate's contribution in all these studies is significant and it is mainly in the synthesis of catalysts, their structural and phase characterization using X-ray diffraction, application of Rietveld's method for extracting structural and microstructural information about the samples, performing sorption and photocatalytic experiments, determination of rate

constants of different reactions and others. A significant contribution of some of the presented publications are the mechanisms proposed by the authors for the catalytic reactions.

(2) Structural characterization of lanthanide ion modified materials.

In this direction are noted:

- Studies on the influence of the addition of Eu (III) on the coefficient of thermal expansion and the optical band gap of ZrW_2O_8 (P12).
- Synthesis of $CoFe_2O_4$ modified with lanthanide ions (Ce, Nd, Dy), structurally characterized by X-ray and neutron diffraction, by Mossbauer and Raman spectroscopy (P13).
- Studies on MFe_2O_4 (M = Ni, Zn, Co) by the method of disturbed angular $\gamma\gamma$ correlations (TDPAC) (P16).

The candidate's contributions consist of performing synthetic procedures (including neutron diffraction and procedures for incorporating the radioactive isotope into spinel matrices), extracting microstructural information from X-ray diffraction patterns using the Rietveld method, performing and processing TEM analyzes, and participating in by the TDPAC method.

4. Educational and pedagogical activity

In this type of activities the candidate has also been very active in the last 3 years. It includes the holding of 1 course "General Chemistry" for the specialty "Teacher of Natural Sciences" at the Faculty of Physics (30 hours) and 1 course "Methods for characterization of substances and materials" (X-ray structural analysis) for the master's program "Inorganic hybrid materials for modern technologies" (20 hours) from the mandatory courses of the students, as well as 2 lecture courses and the respective exercises from the elective ones: "Equilibrium physical properties of single crystals" (total 60 hours) and "Single crystals and materials for fiber optics" (total 60 hours). In addition, Dr. Tsvetkov has conducted exercises and seminars for the courses "General Chemistry" and "Inorganic Chemistry" for the specializations "Chemistry", "Nuclear Chemistry", "Biology", "Chemistry and English", "Biology and Chemistry", "Pharmacy" and he is the supervisor of 15 course works for the specialization "Chemistry" in "Teaching practice in inorganic chemistry".

CONCLUSION

Submitted by the candidate in the competition, Assistant Professor Dr. Martin Petrov Tsvetkov documents and materials fully comply with the Act on the Development of the Academic Staff in the Republic of Bulgaria, the Regulations for its implementation and the corresponding Regulations of Sofia University "St. Kliment Ohridski" and the topic of the announced competition for "Associate Professor".

I am fully convinced of the positive evaluation of the scientific papers and activities presented in the competition and I recommend to the honorable members of the Scientific Jury to prepare a report proposal to the Scientific Council of the Faculty of Chemistry and Pharmacy, Assistant Professor Dr. Martin Petrov Tsvetkov to be elected for the academic position of Assistant Professor at the Faculty of Chemistry and Pharmacy, in the professional field 4.2. Chemical Sciences (Inorganic Chemistry).

Date: 19.08.2020

Reviewer:

Associate Professor Dr. Daniela Karashanova