

Review

from

Prof. Dr. Stoyan Ivanov Gutzov,

Faculty of Chemistry and Pharmacy - Sofia University "St. Kliment Ohridski "

Department of Physical Chemistry

Subject: competition for associate professor in a professional field 4.2. Chemical Sciences (Inorganic Chemistry), SG no. 21 of March 13, 2020; Order RD 38-161 / 10.04.2020 SU "St. Kliment Ohridski "and decision of FS - FHF, protocol N 21 / 30. 03. 2020

The documents for participation in the competition of the candidate meet the requirements of the Regulations of Sofia University "St. Kliment Ohridski "and the Law for the Development of the Academic Staff in the Republic of Bulgaria (ZRASRB), all necessary diplomas, employment contracts and documents are attached, as well as a detailed scientometric reference in tabular form. From the attached reference it is clear that the scientific production of Dr. Martin Petrov Tsvetkov exceeds:

- a) the minimum national requirements for an associate professor in the professional field 4.2. Chemical sciences
- b) the additional requirements FHF - Sofia University "St. Kliment Ohridski ".

Dr. Martin Tsvetkov also presented a detailed summary reference from the information system "Authors" of Sofia University "St. Kliment Ohridski ", containing his scientific publications and his project activities. A separate document with the citations of the candidate is presented, 95 in number, from all publications, there is also a summary of the scientific contributions of the candidate. In addition to his overall scientific contributions, the candidate participates in the competition for associate professor with a habilitation thesis on the topic: "Improved oxidative processes (AOP) for the removal of organic contaminations in water."

The scientific and educational profile of the candidate are in accordance with the requirements for Associate professor in the professional field 4.2. Chemical sciences (Inorganic chemistry). Dr. Martin Petrov Tsvetkov has a Bachelor's degree in Nuclear Chemistry (2010), a Master's degree in Nuclear Chemistry (2011), and in 2016 he defended his dissertation on the topic: "MIXED OXIDES OF THE TYPE MFe_2O_4 ($M = Zn(II), Ni(II), Co(II)$) - SYNTHESIS, CHARACTERIZATION, CATALYTIC PROPERTIES" in the Department of Inorganic Chemistry - at Sofia University St. Kliment Ohridski, under the guidance of Prof. M. Milanova. The results of the dissertation are summarized in 2 publications, which are not included in the list of publications submitted for this competition in accordance with the current Law for the Development of the Academic Staff in the Republic of Bulgaria (ZRASRB).

The candidate is a Ch. Assistant Professor in Inorganic Chemistry at Faculty of Chemistry and Pharmacy - Sofia University "St. Kliment Ohridski" since 2017. He has worked at IPC-BAS as a chemist, and has specialized in solid state chemistry at the Laboratory of Nuclear Problems, Dubna, Russia and at the National Institute of Chemistry, Ljubljana, Slovenia.

Dr. Martin Tsvetkov is a co-author of a total of 23 scientific publications, 17 of which are referenced in the SCOPUS information system, including one publication in a conference proceedings (Author ID: 566 242 05 100). The publications are mainly in the fields of chemistry and materials science, following the classification of SCOPUS and are in journals with impact factor, such as: Materials Letters, Journal of Solid State Chemistry, Journal of Molecular Structure, Proceedings of SPIE-The International Society for Optical Engineering, Catalysis Today, Chemical Papers and others. It can be seen that Dr. Martin Tsvetkov is an established researcher with interests in the field of photocatalytic processes and materials, the structural characterization of catalyst materials and the physicochemical description of systems with catalytic properties. His publishing activity is impressive, especially after obtaining the educational and scientific degree "Doctor" in 2016.

Dr. Martin Tsvetkov participated in the competition for associate professor of Inorganic Chemistry with the following scientific production: 19 scientific publications visible in the SCOPUS information system, 80 citations noticed after receiving the ONS "Doctor" (2016) and 17 section reports of international conference. In 7 of the publications the candidate is the first author, as I have already noted, they are in prestigious magazines (Q1-Q3). It makes a good impression

that the candidate for associate professor has his own scientific field, obtaining and researching catalyst materials, which he has been developing since the beginning of his scientific activity. The candidate's personal involvement includes finding physicochemical constants of various catalytic and photocatalytic processes, the precise characterization of materials in heterogeneous catalysis by diffraction methods (including the Rietveld method), a combination of spectroscopy and diffraction methods to describe the active centers of heterogeneous bonds with obtaining the rate constants of various catalytic processes. The object of the research conducted in the period 2012 - 2020 are catalyst materials known in the literature, new scientific facts related to their catalytic activity and properties have been found and published.

Following the document "Contributions" presented by Dr. Tsvetkov, two main directions in his research can be outlined:

- (a) synthesis, characterization and (photo) catalytic properties of transition metal oxides
- b) structural characterization of lanthanide ion modified materials.

In the direction a) synthesis, characterization and (photo) catalytic properties of oxides of transition metals are published interesting results related to the relationship properties - structure of catalyst materials. This direction is clearly seen in the specialized literature, and has brought the main part of the citations of Dr. Martin Tsvetkov. The most important achievements related to the conducted research are:

- The structural characterization of TiO₂ Degussa P25 materials after gamma irradiation shows that the doses used lead to changes in the structural parameters of the material.
- In attempts for complete oxidation of benzene, high activity of the catalyst containing 10% Co₃O₄ was observed, and the activity of this catalyst is higher than the commonly used Au / CeO₂ composite.
- Catalysts based on magnetite deposited on activated carbon and their catalytic activity in the photo-Fenton process for the decomposition of methylene blue in aqueous solutions have been studied.
- High photocatalytic activity was found for ZnFe₂O₄ obtained by co-precipitation, as its rate constant is higher than the reference material Degussa P25, studied under the same conditions.
- The catalytic properties and structure of ferrite composites of the MFe₂O₄ type (M = Mg, Zn, Co) with silver nanoparticles and solid solutions of different d- and f- ions in this matrix were studied.

- The improved photocatalytic action of CuO / C₃N₄ type composites, as well as of hierarchical structures of CuO microcatalysts in different processes has been studied.

The combination of spectroscopic and diffraction methods makes a good impression, leading to a quantitative explanation of the catalytic activity of the materials. Here we see the most cited publication of Dr. Tsvetkov, P6 from the list of publications for participation in the competition.

Dr. Tsvetkov's research in the field of structural characterization of materials modified with lanthanide ions is obviously at an early stage, they are based on several publications. These materials are complex doped systems in which there is an influence of impurities and defects on the properties and structure of the obtained materials. The most important results obtained here are:

-The influence of Eu (III) impurity on the coefficient of thermal expansion and the optical band gap of ZrW₂O₈ is quantitatively described. The influence of the dosing impurity on the phase composition of the obtained materials is shown. In my opinion, the observations in this article need to be refined, as well as compared with the stabilization of metastable silicate and zirconium materials (cristobalite, tetragonal and cubic zirconia) by doping.

-The structure of CoFe₂O₄ modified with lanthanide ions (Ce, Nd, Dy) was studied, the structural characterization was performed by X-ray and neutron diffraction and by Mossbauer and Raman spectroscopy. It has been found that the addition of lanthanide ions leads to a reduction in the average crystallite size of the ferrite matrix, similar to many other cases of donated ceramic oxides described and discussed in the literature.

- The structure of spinel matrices of the type MFe₂O₄ (M = Ni, Zn, Co) was studied by the method of disturbed angular $\gamma\gamma$ correlations (TDPAC). The research is aimed at establishing the possibility of substitution of Fe³⁺ by lanthanide ions, as the formation of solid substitution solutions is associated with the ionic radii in the dosing component, and possibly with the formation of defects.

Here, too, modern physical methods have been used, which have led to new scientific facts about the structural features of materials known in the specialized literature.

From the attached reference it is clear that Dr. Martin Tsvetkov has the necessary teaching experience to hold the academic position of associate professor in professional field 4.2. Chemical sciences (Inorganic chemistry). Dr. Tsvetkov has lectured on "General Chemistry" for the specialty "Teacher of Natural Sciences" at Physical faculty (30 hours), "Methods for characterization of

substances and materials" (X-ray structural analysis) for the master's program "Inorganic hybrid materials for modern technologies "(20 hours), as well as led seminars and exercises in Inorganic Chemistry.

The research of Dr. Martin Tsvetkov has been part of various international and national research projects, he is a member of the research teams of 13 projects and a project leader of one project.

Dr. Tsvetkov's habilitation thesis is written on 25 pages. The introduction has a popular science character, further the author has managed to demonstrate his more important results in the field of synthesis, characterization and (photo) catalytic properties of oxides of transition metals. The habilitation thesis ends with a summary and presents the future scientific plans of the candidate. 11 literature sources are cited, some of them are own publications. The abstracts of the publications of Dr. Martin Tsvetkov are presented in a separate document.

In conclusion, I believe that Ch. Assistant Professor Dr. Martin Petrov Tsvetkov meets all the requirements of the Academic Staff Development Act in the Republic of Bulgaria (RASRB) and the Regulations on the terms and conditions for acquiring the academic position of "Associate Professor" at the Faculty of Chemistry and Pharmacy at Sofia University "St. Kliment Ohridski ". The publications presented for participation in the competition are at a high scientific level and coincide with the professional field 4.2. Chemical sciences (Inorganic chemistry).

I recommend Dr. Martin Petrov Tsvetkov to take the academic position of "Associate Professor" in the professional field 4.2. Chemical sciences (Inorganic chemistry).

Sofia, 17.08. 2020

Prof. Dr. Stoyan Ivanov Gutzov