

## STANDPOINT

on the competition for professor in  
4.2. Chemical Sciences (Inorganic Chemistry)  
announced in SG, no. 96 of 19.11.2021  
with candidate Assoc. Prof. Dr. Penka Vasileva Tsanova

by Prof. Tony Georgiev Spassov  
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In the competition for Professor of Inorganic Chemistry at the Faculty of Chemistry and Pharmacy of Sofia University participates one candidate - assoc. prof. Dr. Penka Vasileva Tsanova. Penka Vasileva graduated from the Faculty of Chemistry at Sofia University "St. Kliment Ohridski ", specialty " Inorganic Chemistry " in 1981. In 2003 he defended his doctoral dissertation for the scientific and educational degree "Doctor " (01.05.02 - Inorganic Chemistry) on the topic "Synthesis of silicon tetrachloride and fine rectification purification of silicon tetrachloride and some organic solvents".

Penka Vasileva Tsanova has worked as a chemist at a Geological company, in the Laboratory for Highly Pure Substances at the Faculty of Chemistry and at the Institute for Pure and Highly Pure Substances at the Faculty of Chemistry of Sofia University. From 1996 to 2012 he worked at the Faculty of Chemistry of Sofia University consecutively as an assistant, senior and chief assistant in the Department of General and Inorganic Chemistry. In 2012, Dr. Vasileva was elected as associate professor at the same department.

The scientific activity of Assoc. Prof. Dr. Penka Vasileva includes: articles in scientific journals, chapters from books and collections of scientific forums - 66; textbooks, teaching and methodical textbooks - 14. In the current competition for professor participates with 36 papers (outside the publications in the dissertation and the competition for associate professor in FCP at Sofia University): 16 publications in scientific journals, quartile Q1-6, Q2 - 2 , Q3 - 4, Q4 -1, one publication with SJR, two - in Bulgarian journals or collections, cited by independent foreign authors (as a secondary document) in Scopus; 3 chapters from books; 3 publications in a peer-reviewed scientific journal, referenced in Chemical Abstracts (2), and in a collection of scientific forums (1 in Bulgarian); 3 publications related to the International Olympiad in Chemistry and Chemistry Education (in Bulgarian), in a peer-reviewed scientific journal, referenced in Scopus until 2017 (2-Q3, 1-Q4); 11 textbooks, teaching and methodical textbooks. She is the first author in 7 publications. 153 citations in Scopus have been noticed on the publications included in this competition. 16 publications were cited. The results of the candidate's research activities after the habilitation are presented as poster or section reports at 31 international and 6 national scientific forums.

A habilitation thesis on the topic: "Design and characterization of new nanomaterials for special analysis of mercury, chromium and iron" was also presented.

Penka Vasileva has participated in teams for the development of 6 technologies for the production of high purity substances, in 11 research projects with the Research Fund of Sofia University "St. Kliment Ohridski " (as a manager), 4 projects with the Ministry of Education and Science, 9 contracts for low-tonnage production of chemical reagents and substances of special purity, financed by Bulgarian companies.

In the period 2013-2021, under the guidance of Assoc. Prof. Vasileva, 7 diploma theses were defended. She was the supervisor of a dissertation as well.

Assoc. Prof. Vasileva is a lecturer in the following courses: General and Inorganic Chemistry for "Molecular Biology and Biotechnology"; Inorganic Chemistry for "Chemistry and English"; General Chemistry for the specialty Teacher of Natural Sciences, General Chemistry and Stoichiometric Calculations for the specialty Chemistry and English.

It can be summarized that the main part of Assoc. Prof. Vasileva's research is focused on the synthesis, characterization of the microstructure and properties of new materials, as well as their application. The synthesis of nanomaterials is the main focus of these studies. Dependencies between the conditions of synthesis, physicochemical and functional properties of different nanomaterials have been established. These include silver and gold nanoparticles, metal oxide nanoparticles (silver and gold nanoparticles on spherical silica), and hybrid organic-inorganic nanocomposites (silver nanoparticles embedded in the polymer matrix of biocompatible polymers chitosan and polyvinyl). The activity of the synthesized nanomaterials as sensors or extractants, selectivity for certain chemical forms of the elements, as well as biological activity and catalytic activity were studied. On this basis, new applications of nanomaterials obtained from the applicant have been found, such as sorbents/sensors for detection of toxic pollutants (Hg, Cr), as well as some essential elements (Fe) in water basins. It should be noted the ambition of Assoc. Prof. Vasileva to "close" the cycle in the development of a new material, from design/synthesis to its application. To prove this statement, it is sufficient to consider the completeness of the study of silver and gold nanoparticles in aqueous dispersions. An optimized environmentally compatible and reproducible synthesis of silver and gold nanoparticles, coated with starch and raffinose (for the first time) has been developed, a number of physicochemical properties of nanoparticles have been characterized and starch-coated silver nanoparticles have been shown to be used as LSPR-based optical sensor for selective determination of mercury (II) and iron (III) in aqueous samples from the environment. The mechanism of the selective sensor activity is clarified, which is based on a multi-stage interaction of silver nanoparticles with analytes, including an oxidation-reduction reaction controlled by the anionic medium between them. The biological activity of metal nanoparticles was also studied by in-vitro experiments on "isolated heart" of a frog and the influence of nanoparticle stabilizing agents (starch and raffinose) was established. For the first time, the biological activity of silver nanoparticles coated with raffinose on cellular and subcellular components (liver mitochondria and submitochondrial particles) was studied. Some mechanisms of toxicity of silver nanoparticles have been elucidated and the need for in-depth studies of the influence of surface modifications of metallic nanoparticles on their interaction with cellular components has been shown. In other studies of the candidate high catalytic activity of the synthesized gold nanoparticles stabilized with raffinose was found with respect to the reduction with sodium tetrahydroborate of the model contaminant dye Methylene blue.

The same complex and comprehensive approach, including design, synthesis, physicochemical characterization and application, has been used in the study of metal oxide nanocomposites and hybrid organic-inorganic nanocomposites. I will not discuss these scientific contributions, as they are also presented very clearly and comprehensively, and I have no doubt about their reliability and significance.

The studies on nanomaterials with the participation of Assoc. Prof. Vasileva was conducted in collaboration with colleagues from the Faculty of Chemistry and Pharmacy (SU), Faculty of Biology at Sofia University and the Faculty of Pharmacy of the Medical University. However, the candidate's contributions are correctly described in the Author's report for Scientific Contributions, there is no doubt that they are significant and in many publications can be described as basic, including the idea of research, methodology development, experimental work, analysis of the results and writing the article. Out of 22 publications in this field, in 13 Assoc. Prof. Vasileva is the author of correspondence or the first author, which proves her significant personal contribution.

Associate Professor Vasileva is also a co-author of publications in the field of chemical education. They can be divided into those related to the International Chemistry Olympiad and textbooks and teaching textbooks in chemistry and environmental protection for high school students. In these works, too, significant contributions of Vasileva can be outlined both in the appropriate structuring of the teaching material and achieving compliance between curriculum and interdisciplinary links, and in providing opportunities for self-preparation, assessment and self-assessment of students.

The habilitation thesis "Design and characterization of new nanomaterials for special analysis of mercury, chromium and iron" includes papers A1, A3, A4, A7, A12 from the list of publications (in which Assoc. Prof. Vasileva is the author of correspondence), summarizing the main scientific results and contributions of the candidate. In its most concise form, this includes the design and development of original synthetic procedures for the production of starch-coated monometallic and bimetallic nanoparticles of silver and gold in aqueous dispersion, mono- and bimetallic nanoparticles of silver and gold on spherical silica, hybrid organic-inorganic films by incorporating silver nanoparticles into the polymer matrix of biocompatible polymers chitosan and polyvinyl alcohol. The morphology, microstructure and properties of the obtained new materials are reliably characterized and on this basis their successful application in the control of environmental pollution has been proven. The possibilities for the development of this scientific and applied field are also indicated, in which Assoc. Prof. Penka Vasileva still has a lot to contribute.

Finally, I would like to share my appreciation of the achievements of Assoc. Prof. Vasileva both in research in an important practical field, such as the creation of new materials, and in methodological terms, where her knowledge and experience have led to the preparation of undoubtedly useful for high school teaching textbooks.

Based on the above, I propose Assoc. Prof. Dr. Penka Vasileva Tsanova to be elected as Professor of Inorganic Chemistry at the Faculty of Chemistry and Pharmacy, Sofia University "St. Kliment Ohridski".

14.03.2022

Prof. Dr. Tony G. Spassov