

# R E P O R T

on the materials submitted for participation in the competition to  
award the academic position "Professor" in the professional field  
4.2 "Chemical Sciences" (Inorganic Chemistry)  
announced by Sofia University "St. Kliment Ohridski"  
in State Gazette No 96/ 19.11.2021 г.

candidate: Assoc. Prof. Dr. Penka Vasileva Tsanova

Member of Scientific Jury: Prof. DSc Martin Slavchev Bojinov, UCTM

## **1 Overview of the scientific research activities of the candidate**

The research activities of Dr. Vasileva are dedicated to the enrichment of knowledge in nano-chemistry and nano-materials technology, including development and optimization of new methods of green chemistry for synthesis of nano-particles and composite nano-structures with pre-defined properties. The applications of this type of materials in analytical chemistry as sensors and sorbents, in the field of bio-active materials and photo-catalysis – have also been thoroughly studied. In this respect, their scientific scope perfectly coincides with the professional field for which the competition for professor is announced – Chemical Sciences (Inorganic Chemistry). The scientific endeavor of P. Vasileva is based on a thorough and targeted application, and in many cases creative further development, of a number of modern methods of synthesis and characterization of nano-materials and nano-composite structures, focusing on their sensory activity, selectivity and sensitivity with regard to certain chemical species, biological activity, catalytic and photo-catalytic efficiency. The studies related to the above mentioned modern and dynamic areas of application of nano-materials highlight the inter-disciplinarity of the scientific research of the candidate, situated at the intersection between nano-sensorics in analytical chemistry, the importance of nano-particles and nano-structures for different biological objects, and photo-catalysis with nano-sized materials. An essential part of the research of Assoc. Prof. Vasileva constitutes a systematic study of the relationship synthesis – composition – structure – properties during production of several inorganic nano-materials and the relationship chemical species – biocompatibility when examining a range of naturally important systems.

## **2 Main scientific contributions**

The main original contributions to the scientific production of Assoc Prof. Vasileva, presented for participation in the competition for professor in the field 4.2. Chemical sciences (Inorganic chemistry), can be grouped as follows: enrichment of existing knowledge and methods (progress in the field of interconnection between composition / structure / properties of nano-sized objects and nano-chemical systems) and applied scientific contributions (development of methods and technologies for synthesis of new nano-materials and composite nano-structures).

## 2.1 Enrichment of existing knowledge and theories

- An innovative method for selective determination of Cr(VI) in aqueous solutions with silver nano-particles encased in raffinose as active material for an optical sensor. Studies in the presence of various metal ions show a very good selectivity of the method.
- The physicochemical characteristics of a number of optical nano-sensors and nano-sorbents for solid phase extraction have been studied, characterizing their analytical applicability for selective analysis of chemical forms of Hg, Cr and Fe.
- A new two-stage (liquid-solid-phase) method for the synthesis of nano-crystals ZnO and Au/ZnO nano-composites in a starch matrix has been developed and optimized. The synthesized nano-crystals are demonstrated to be active photo-catalysts for the degradation of model pollutants under UV light irradiation.
- An optical sensor for sensitive and selective iron detection (III) based on the oxidative reduction reaction of Fe(III) ions with silver nano particles wrapped in starch has ± been developed in salt-acid solutions. The silver nano-particles with a mean diameter of  $15,4 \pm 3,9$  nm are synthesized via a green method using D-glucose as reducing agent and soluble starch as protective polymer.

## 2.2 Applied science contributions

- Development and validation of innovative applications of synthesized nano-materials in analytical procedures for sensory detection and quantification of toxic pollutants (Hg, Cr) as well as bio-available forms of essential impurities (Fe) in aquatic environmental samples. materials for designing new innovative approaches for special analysis are systematized and summarized in the overview article "Nanomaterials for elemental speciation" (J. Atomic Absorption Spectrom.) and a chapter of a book entitled "Smart Materials in Speciation Analysis".
- A quick, simple and sensitive method for separating chemical forms of Cr and speciation analysis of Cr by solid-phase extraction has been developed. Selective determination of toxic Cr(VI) is carried out after separation of Cr(III) by sorption on a free-standing chitosan film impregnated with silver nano-particles synthesized using green technology with D-(+) raffinose as a non-toxic reducing and protective agent in alkaline environments. Effective separation of the chemical forms of Cr between the solid and liquid phases by adjusting the pH of the solution is successfully achieved.
- The morphology and degree of polymerization of photo-polymerizing dental composites are characterized in order to quantify the part of unacted monomers separated in aqueous solution. Micro-hybrid and condensable composites exhibit a relatively smooth surface and homogeneous structure with irregular-shaped ZrO<sub>2</sub> and SiO<sub>2</sub> particles, while the micro-filled composite is characterized by significant surface roughness, possibly due to incorporation of large SiO<sub>2</sub> micro-filler aggregates in the polymerized organic matrix.

## 3 Publication activity of the candidate and its international significance

The candidate participates in the competition with 25 scientific publications (6-Q1, 2-Q2, 4-Q3, 1-Q4, 1-SJR, 3 book chapters), as well as 11 textbooks and teaching tools. The scientific activities of Assoc. Prof. Vasileva is very well received in the field of an important and dynamically developing

field of inorganic material science, namely nano-chemistry and nanotechnology. Her publications have been cited more than 416 times in international scientific literature since 1995 (according to Scopus based on her Hirsch index is 10), and a number of her works have been cited repeatedly, e.g. Colloids and Surfaces A: PEA 382(2011) 203 – 210 (191 times), Carbohydrate Polymers 147 (2016) 45 – 52 (33 times), Journal of Chemistry (2017)6897960 (30 times), Journal of Materials Science 46 (2011) 7134 –7143 (30 times), Analyst 139 (2014)1532 – 1540 (28 times), etc. The works of P. Vasileva has been commented on when quoted, and the quantitative characteristics of the composition-properties relationships for a number of nano-materials and nano-composite structures have been used to interpret experimental results and/or to develop new approaches for obtaining comparable compounds with applications in a number of important fields of science and practice. that the candidate's audience activity has its significant place in scientific literature concerning nano-chemistry and nano-technologies and their application in the field of analytical chemistry, chemistry of bio-active systems, catalysis and photo-catalysis.

## **CONCLUSION**

The scientific field in which the main research works of Penka Vasileva are published is one of the leading and most promising for modern inorganic chemistry. The scientific contributions of Assoc. Prof. Dr. Vasileva are substantial and have received a high international rating. Its key metrics are at a high level, which is a criterion for the level of research carried out and the results obtained. P. Vasileva skillfully integrates the results of research on a whole range of problems in the field studied for the purpose of synthesis, characterization and application of nano-materials and composite nano-structures in analytics, biochemistry and catalysis. Her scientific and pedagogical activity, participation in international events, contributions, science-metric indicators (impact factor, Hirsch index, citation index) fully meet the high requirements of the Rules of Procedure for academic positions in the Faculty of Chemistry and Pharmacy of Sofia University "St. Kliment Ohridski".

Based on all these facts, I strongly recommend to the Honorable Scientific Jury to vote for the award of the academic position PROFESSOR in the professional field 4.2 Chemical Sciences (Inorganic Chemistry) to Assoc. Prof. Dr. Penka Vasileva Tsanova.

Sofia, 13.03.2022 г.

Member of the Scientific Jury:

(Prof. Martin Bojinov, DSc)