REPORT

by competition for the acquisition of the educational and scientific degree "doctor"
professional direction 4.2. Chemical Sciences (Electrochemistry)

with candidate: eng. Veselina Petrova Chakarova, IPC - BAS

Dissertation topic: *Preparation and characterization of Ni-P coatings on different types of substrates*

Member of the scientific jury: Assoc. Dr. Angelina Konstantinova Popova, professional direction 4.2. Chemical Sciences (Physical Chemistry), UCTM, Department of Physical Chemistry

1. General characteristics of the candidate's scientific-research and scientific-applied activity.

Eng. Veselina Chakarova graduated from UCTM in 2014 as a master's degree in "Electrochemistry and corrosion protection". Since 2011 works at IPC - BAS. The dissertation is written on 111 pages and contains 64 figures and 35 tables. 120 literary sources are cited. The topic of the dissertation is "Preparation and characterization of Ni-P coatings on different types of substrates". Chemically deposited Ni-P coatings are widely used in a number of areas such as shipbuilding, aircraft construction, oil and gas industry, for wiring dielectrics, etc. There is a growing interest in Ni-P alloys as electrodes for obtaining hydrogen and oxygen. This makes the topic of the dissertation relevant both in a scientific and in a scientific-applied aspect.

The aim of the dissertation work is the study of chemical deposition of Ni-P and composite Ni-P coatings on different types of substrates (flexible and hard) and the characterization of their abrasive ability, corrosion resistance and electrocatalytic activity. To achieve this, a number of tasks related to establishing the optimal composition and mode of operation of a solution for chemical deposition of Ni-P coatings, chemical deposition of composite Ni-P coatings on polyethylene terephthalate (PET) using microdispersed particles, research of the corrosion behavior of Ni-P and composite Ni-P coatings on acrylonitrile-butadiene-styrene in sulfate and chloride media, study of the electro-catalytic properties of chemically deposited Ni-P coatings regarding the reaction of hydrogen and oxygen evolution in alkaline and acidic media. The possibility of preparing the ABS surface for metallization by chemical deposition of a Ni layer from a solution containing no reducing agent was also investigated. Various methods have been used and mastered to characterize the thickness of the coating, elemental composition and morphology, phase composition, surface condition, corrosion resistance, etc.

From the attached reference on the minimum requirements of the IFH for the scientific activity of the candidates for the acquisition of the educational and scientific degree "doctor" (according to the Rules of the ZRASRB, IPC-BAS), it can be seen that with minimum requirements of 30 points, eng. Chakarova has an asset of 79 points (a total of 5 articles included in the dissertation - 2 articles with Q2, one with Q1 and 2 with Q3).

Apart from them, the candidate has 8 more articles in refereed international journals and 2 in non-refereed ones. A total of 50 citations were noted, of which 8 were on dissertation works and. She has given 9 reports at conferences and 29 poster reports. In addition, it actively participates in projects and contracts (14 in number).

2. Basic scientific and scientific-applied contributions.

I accept the attached statement of the applicant's contributions. The scientific contributions are significant and have a scientific and scientific-applied nature.

Scientific works are in the field of the main thematic priorities of IFH, related to cutting-edge materials and technologies based on metal, alloy and modified coatings with protective, decorative and electrocatalytic properties, etc.

Contributions are systematized in five main areas:

1. Abrasive materials based on composite chemical Ni-P coatings on a flexible substrate made of polyethylene terephthalate were obtained. It has been proven through tribological tests that these materials can find practical application as abrasives for rock materials.
2. Working conditions have been established under which chemical Ni-P coatings are deposited with better electrocatalytic properties compared to electrodeposited nickel in terms of the hydrogen evolution reaction in alkaline and acidic media and the oxygen evolution reaction in alkaline media.
3. The corrosion properties of thin chemical Ni-P coatings with different phosphorus content in acidic, neutral and alkaline environments were investigated. The corrosion characteristics are determined and the changes in the composition and morphology of the coatings are shown.
4. An original method for wiring activated acrylonitrile-butadiene-styrene by processing in an alkaline solution containing nickel sulfate and citric acid at a temperature above 40°C is proposed - on the surface of the activated ABS, a non-dense nickel layer is deposited in an oxidized state with a thickness sufficient for subsequent electrodeposition of copper from a classic acidic electrolyte.

Contributions could relate to: proving by new means substantial new aspects of already existing scientific fields; enrichment of existing knowledge and theories; application of scientific achievements in practice with the aim of realizing an economic effect. The candidate's personal contribution is indisputable, in 4 of the dissertation publications she is the first author.

3. Reflection of the candidate's scientific publications in Bulgarian and foreign literature.

Eng. Vesselina Chakarova has presented a list of 50 citations, 8 of which are on the works included in the dissertation. This indicates that the candidate's scientific achievements have already been noticed and reflected in the literature.

4. Critical notes and recommendations to the candidate's scientific works. I don't have any.

CONCLUSION

My dissertation submitted for opinion is a complete, very well structured and competently interpreted scientific study. The dissertation contains scientific and scientific-applied results, which represent an original contribution to science and meet all the requirements of the Law on the Development of the Academic Staff in the Republic of Bulgaria (ZRASRB), the Regulations for the Implementation of ZRASRB and the Regulations of IPC - BAS.

The dissertation shows that the doctoral student possesses in-depth theoretical knowledge, demonstrating qualities and skills for independent conduct of scientific research.

Due to the above, I confidently give my positive assessment of the conducted research, presented with a dissertation work, abstract, achieved results and contributions, and I propose to the honorable scientific jury to award the educational and scientific degree "Doctor" to eng. Veselina Petrova Chakarova in scientific specialty 4.2. Chemical Sciences ("Electrochemistry").

14.01.2025 Angelina Popova