

OPINION

By Eng. Yanko Hristov, PhD, Assoc. Prof.,
Department of Technology, Materials and Materials Science,
University "Prof. Dr. Asen Zlatarov" - Burgas,
member of a scientific jury, formed by order № ПД-54 / 15.03.2022
of the Rector of the University "Prof. Dr. Asen Zlatarov" - Burgas

Regarding: Dissertation Work by **Eng. Dimitar Vasilev Georgiev** and Topic: "**Research on electrodes and dielectrics for super capacitors through the use of high porous silicate and carbon materials**", presented for the acquisition of educational and scientific degree "Doctor" in the Scientific field 5. Technical Sciences, Professional field 5.10 Chemical technologies, scientific specialty "Technology of silicates, binders and refractory non-metallic materials", code 02.10.12.

The materials presented for opinion by Eng. Dimitar Vassilev Georgiev on paper and electronic media, well described and arranged contain all the necessary information for evaluation. The required documents are structured in accordance with the requirements of the Regulations for the application of the LDAS on the Protection of the Rights of Persons with Disabilities and the Regulations on the Terms and Conditions for Acquisition of Scientific Degrees and Positions at the University "Prof. Dr. Asen Zlatarov" - Burgas.

The dissertation is 144 pages long and includes the sections: Introduction, Theoretical part, Experimental part, Scientific and scientific-applied contributions, Conclusions and Literature. The illustrative material, including 69 figures and 15 tables, is precisely made and shaped. 218 literature sources are cited, in the time interval 1955-2020, most of them from the last 10 years. This fact testifies to systematic research and multifaceted analysis of the publishing activity on the scientific problem. The abstract is structured in accordance with the established rules and reflects the most important moments of the dissertation.

The dissertation presented by Eng. Georgiev considers an important problem related to obtaining electrodes and dielectrics for super capacitors, which makes the work relevant and is closely related to the vision of the European Energy Union - building an "energy union as a sustainable, low carbon and environmentally friendly economy which is designed to be sustainable", and to achieve European goals „we must abandon a fossil fuel-based economy in which energy is based on a centralized and supply-oriented approach based on outdated technologies and business models”.

The research in the dissertation is aimed at developing the components for making a super capacitor from silicate and carbon materials and to construct a super capacitor cell based on them. The main focus of the work is the production of monolayer graphene and its application as a nanographene coating on electrodes for super capacitors.

An electrically conductive paint has also been developed to help attach the components to the metal surface of the electrode. A powdered dielectric of barium titanate having a high dielectric

constant was synthesized. For its preparation a method of solid-phase sintering is used, with the participation of precursors of BaCO₃ and TiO₂ powders, baked at temperatures of 1100 ° C. Pechini's modified sol gel method is also used, using chlorides, oxalic and boric acids as precursors. Experimental capacitor cells K1 and K2 were constructed and their main characteristics were determined using a software product.

Impressive knowledge of a number of instrumental methods for analysis of materials, including Raman and IR spectroscopy, scanning and transmission electron microscopy, X-ray diffraction analysis, cyclic voltmetry, electrochemical impedance spectroscopy, the method of galvanostatic charge and discharge tasks. in the dissertation. This set of applied methods shows good use and knowledge of their capabilities by the doctoral student. Data are skillfully analyzed on the basis of which conclusions are drawn and clear dependencies are defined. I define the work as dissertable, logically constructed and well readable with adequate analysis of the results obtained.

The scientific work is based on a total of 8 publications. Two of the publications are in journals, referenced and indexed in a global database Journal of the Balkan Tribological Association, 2020, Vol. 26, No. 3, p. 86–94 (SCOPUS cited, Im. F. 0,737, Q3) and Journal of Chemical Technology and Metallurgy, 2021, book 1, pp.161-166 (SCOPUS cited, SJR 0.220). One has been accepted for publication in a journal referenced and indexed in the World Database of the Balkan Tribological Association, 2022 (in press), (SCOPUS cited, Im. F. 0,544, Q3). Three of the publications are in unreferred journals with scientific review Annual of Assen Zlatarov University, 2019, volume XLVIII, book 1, p. 27-31 (Open Access), Proceedings of the University of Ruse “Angel Kanchev”, vol. 58, book 10.1, 2019, p. 69 - 76. (Open Access), Proceedings of the University of Ruse “Angel Kanchev”, vol. 59, book 10.1, 2020, p. 59-63 (Open Access). The doctoral student reported part of the dissertation work in two scientific sessions - Scientific session for students, doctoral students and young scientists "Natural and Technical Sciences", 2019, p. 15 and Scientific session for students, doctoral students and young scientists "Natural and Technical Sciences" ", 2020, p. 14. Patent № 112894 / 18.03.2019 was issued“ High-voltage technology for graphene production and its application as a surface coating on a metal substrate ”.

The main results, scientific and applied contributions of the dissertation could be summarized as follows:

Cheap and environmentally friendly technology for graphene production through a combined effect of electrolysis and ultrasound has been proposed.

A technology has been developed for coating graphene on a metal aluminum base using a high voltage generator. The proposed technology can be used to improve the efficiency and capacitive characteristics of capacitor electrodes. Based on this, a patent was issued with № 112894 / 18.03.2019.

An innovative electrically conductive solder is obtained, which is necessary for laying and attaching the active ingredients on the surface of the electrodes.

On the basis of the developed innovative coatings and the used electrolytes, a construction has been proposed and experimental capacitor cells have been made, on which their specific capacity has been determined.

A software product has been developed for processing the experimental data obtained from the research, which makes it possible to optimize the design of the capacitor plates.

This dissertation is in accordance with the requirements set out in the Regulations on the terms and conditions for obtaining scientific degrees and holding academic positions at the University „Prof. Dr. Asen Zlatarov”, and its essence corresponds to the scientific specialty „Technology of silicates, binders and refractory non-metallic materials”, code 02.10.12 I express my conviction that the scientific results reported in the dissertation are the result of many years of constant effort and work, which are the basis for the development of Eng. Georgiev as a scientist and researcher.

CONCLUSION

Considering the scientific and scientific and applied contributions, the value of the results obtained and the precision approach in their interpretation, I give a positive assessment of the dissertation on the topic „Studies on the obtaining electrodes and dielectrics for super capacitors using high porous silicate and carbon materials”. I recommend to the esteemed Scientific Jury to award to Eng. Dimitar Vassilev Georgiev the educational and scientific wall „DOCTOR” in the scientific specialty „Technology of silicates, binders and refractory non-metallic materials”, code 02.10.12, according to the Law for development of the academic staff in Republic of Bulgaria.

30.05.2022
Burgas

Gave an opinion:

Подпис заличен
Чл.2 от ЗЗЛД
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