



## REVIEW

On the competition for the acquirement of the academic position of "Professor" in the field of higher education, 5. Technical sciences, professional field 5.1. machine engineering, scientific specialty „02.01.25 – Machines and equipment for the chemical, oil, gas and oil refining industries”,

**Announced in the State Gazette - issue 45/17.06.2022**

With the only applicant Assoc.Prof.PhD eng. **DIMITAR NEDKOV RUSEV**

**Reviewer:** Prof.Dr.Eng Mara Krumova Kandeveva-Ivanova

**Reason for the** elaboration of the opinion: Order № RD-293-19/09.2022 of the Rector of the University "Prof.Dr.Asen Zlatarov"- Burgas for appointment of scientific jury and Decision of the scientific jury (Protocol of the first meeting held on *07.10.2022 about the selection of reviewers*)

### **1. General information about the carrier development of the applicant**

Assoc.prof. PhD Eng. Dimitar Rusev Rusev completed his secondary education in he Technical School of electric engineering "Konstantin Fotinov"- Burgas in 1976, specialty "Controlling devices and automation".

In 1985 he graduated hire education in the Moscow University of Chemical engineering, specialty "Design of machines and devices for the chemical industry", Moscow, Russia with qualification of "Master-engineer designer".

In 1986, he was enrolled for regular PhD preparation at the University "Prof.Dr.Asen Zlatarov"- Burgas, Department of "Processes and apparatuses" with scientific tutor Prof.Dr. Dimitar Tomov Mitev.

In 1990, the applicant successfully defended his PhD thesis with topic "Study of some essential problems in the performance of fluidized bed under pressure different from the atmospheric one" in front of the scientific council of the Higher attestation commission on "Basic processes, devices and automation of the chemical and metallurgic production facilities" and obtained the scientific degree "Philosophy doctor" in the field of higher education, 5. Technical sciences, professional field 5.1. Machine engineering, scientific specialty „02.01.25- Machines and equipment for the chemical, oil, gas and oil refining industries“.

During the period from 1990 to 1992 he was research fellow III degree in production and scientific laboratory "Fluidized bed" at the University "Prof.Dr. Asen Zlatarov" – Burgas.

From 1992 to 1995 he was appointed as Deputy Director of ZMM – Burgas.

Since 1995 until now, Dimitar Rusev works as lecturer – Senior assistant (1995-2006) and associate professor (since 2005) in the Department of "Electronics, electrical engineering and

machine engineering of the University "Prof.Dr. Asen Zlatarov" – Burgas. During this period, he was twice appointed as Director of the Technical college at the University "Prof.Dr. Asen Zlatarov" – Burgas (2008-2012 and 2020 until now).

Assoc.Prof.PhD Eng Dimitar Rusev is member of the editorial board of the International information analytic journal IIAJ „Crede Experto“, ISSN 2312 – 1327 which is indexed in the international data bases: eLIBRARY.RU, Ulrichsweb, Pubicon Science Index, Scientific Indexing Service, Research Bible, Inno Space, Journal Index, Universal Impact Factor, Scholarsteer, Academic Keys, Turk Egitim Indeksi, etc.

The applicant participated in a number of scientific research and applied projects: 1 project financed by an European program, 1 project financed by the National scientific program EPLUS, 5 participations in national scientific projects financed by the Ministry of education and science, 3 projects financed by the Grant system of competitive project financing of scientific and creative activities of the University "Prof.Dr. Asen Zlatarov" – Burgas and 4 projects financed by the Scientific research Sector of the University "Prof.Dr. Asen Zlatarov" – Burgas. Assoc.Prof.PhD Eng. Dimitar Rusev has been recognized as the author of three patents for invention, 1 submitted patent application and ` application for a useful model whih was granted an Decision for registration.

The submitted autobiographic data and documents indicate for very active scientific research and applied science work of the applicant, as well as for his capabilities for excellent performance in a team.

## **2. General description of the submitted materials**

The applicant Assoc.prof.PhD Eng. Dimitar Rusev has submitted all the documentation required according to the LDASRB and the Regulations for the terms and conditions for acquirement of academic positions at the University "Prof.Dr. Asen Zlatarov" – Burgas. They are neatly arranged and their contents provides the opportunity to make clear estimation of the overall activities of the candidate – scientific research, applied science and lecturing ones which perfectly cover the competition requirements.

The materials submitted for reviewing on the competition for the academic position "Professor" include 1 monograph (Group G\*8) and 66 scientific publications within the nomenclature specialty, as follows:

- 10 publications in journals referred and indexed in world known databases with scientific information - Scopus; Web of Science (Group B);
- 6 publications in journals referred and indexed in world known databases with scientific information - Scopus; Web of Science (Group G7);
- 50 publications in non-referred journals with scientific reviewing or in redacted collective volumes (Group G8).

29 pcs of the submitted scientific publications have been published in collected proceedings of conferences and they are included in the National Referent list of contemporary scientific publications with scientific reviewing (4 items abroad and 25 items at international and national conferences in Bulgaria).



Author's abstract of the dissertation thesis for the acquirement of the scientific degree "PhD" (Group A) was also supplied and it is not subject of reviewing.

The documentation contains also Protocols for equal contribution of the candidate in the submitted collective publications.

### **3. Analysis for fulfillment of the minimum requirements**

The scientific works were classified according to NaCID into the following groups:

The applicant has defended a PhD thesis which covers the requirements in Group **A-1**.

In Group **B-4**, (*scientific publications in journals referred and indexed in world known databases with scientific information - Scopus; Web of Science*), 10 scientific papers were reviewed, of which in 9 items the candidate is co-author and 1 he was single author of 1 paper. Basically, the publications were in the following journals: Oxidation Communications - ISSN 0209-4541, Journal of Chemical Technology and Metallurgy - ISSN 1314-7471, Journal of the Balkan Tribological Association - ISSN 1310-4772.

*The total number of points in Group B-4 is 247 which is more than the minimum number of 200 required by the regulations of the university "Prof.Dr. Asen Zlatarov – Burgas.*

In Group **G-7** (*scientific publications in journals referred and indexed in world known databases with scientific information - Scopus; Web of Science*), 6 scientific publications were reviewed, among which 4 have the applicant as the single author and in 2 items he is co-author. Basically, the publications are in the following journals: Journal of Chemical Technology and Metallurgy - ISSN 1314-7471, Journal of the Balkan Tribological Association - ISSN 1310-4772.

In Group **G-5**, a monograph was presented entitled "Technological thermodynamics", Burgas, 2013, ISBN 978-954-8422-89-5.

In Group **G\*-8** (*scientific publications in non-referred scientific journals or redacted collections of works*), the applicant submitted 50 publications, among them 29 published in Proceedings of conferences and they were included in the National reference list of contemporary scientific publications with scientific reviewing (4 items abroad and 25 items at international and national conferences held in Bulgaria).

*The total number of points in Groups G -5-7-8 is 609.9 which is more than the minimum number of points 500 required by the regulations of the university "Prof.Dr. Asen Zlatarov – Burgas.*

In the information about the citations in Group D, 65 citations were listed, as follows:

- Indicator **D\*12** (*citations or reviews in scientific journals referred and indexed in world known databases with scientific information or in monographs and collected works (Scopus; Web of Science u ðp.)*) - 14 cited papers of the total of 59 citations.
- Indicator **D\*14** (*citations or reviews in non-referred journals with scientific reviewing*) - 5 cited papers with total of 6 citations.

*The total number of points in Group D is 602 which exceed the minimum number of points 200 required by the regulations of the university "Prof.Dr. Asen Zlatarov – Burgas.*

In Group E, the candidate presented a certificate (№ 1714/24.06.2022) stating that he has been the scientific tutor of 3 PhD applicants who successfully defended their theses.

In Group **E-18** (*Participation in national scientific or educational project*), the following documents were presented:

- Participation in 1 project BG051PO001-3.1.09-0011 financed by the European Social fund of the EU and with the financial support of the Operational program "Development of human resources";
- 1 project (D01-214/2018-2022) financed by the National scientific program EPLUS;
- 5 participations in national scientific projects governed by MSE – Scientific research fund, namely projects: ДО-02-192/2008-2012, ДО-02-110/2008-2012, ВУ-ТН-909/2006-2008, ДДВУ-02-106 /2010-2014, КП-06-Н27/2018-2022;
- 3 projects financed by the Grant system for competitive financing of scientific and artistic activity of the University "Prof.Dr. Asen Zlatarov" - Burgas – ОУФ-НИ-02/2008, ОУФ-НИ-05/2011, ОУФ-НИ-04/2008,;
- 4 projects financed on topics set by the Scientific research Sector of the University "Prof.Dr. Asen Zlatarov" – Burgas, namely - НИХ-331/2014, НИХ-366/2016, НИХ-159/2008, НИХ-352/2015.

The applicant has been recognized as the author of 3 patents for inventions, 1 submitted patent application and 1 application for useful model.

In Group **E-23**, the applicant has published a textbook on "Technical documentation" (2013, ISBN 978-954-8422-91-8) and textbook „Machines and equipment in chemical industry“ electronic edition (2021, ISBN 978-619-91760-0-9).

In Group **E-25** (*published application for patent or useful model*), the following documents were presented:

1 submitted patent application

- Reg.№ BG/P/2022/113558 / 12.07.2022 „Technology and reservoir for storage of hydrogen in absorbed state“;

1 submitted application for useful model

- Reg № BG/P/2022/5555 / 12.07.2022 „Reservoir for storage of hydrogen in absorbed state“ with issued Decision of registration № 4308/22.08.2022 год.

In Group **E-26** the applicant has been recognized as the author of 3 invention patents:

- Reg. № 67400 B1/25.11.2021 г., „High voltage technology for preparation of graphene and its deposition as surface coating onto metal substrate“;
- Reg. № 66859 B1/29.03.2019 г. „Reactor for separation of emulsions using fractal systems“;
- Reg. № 67421 B1/15.03.2022 г. „Method for deposition of graphene coating onto polymer substrate by electric arc technique“.



*The total number of points in Group E is 350 which exceeds the minimum number of 200 required by the regulations of the University "Prof.Dr. Asen Zlatarov" - Burgas.*

*It can be concluded from the quantitative analysis carried out that the total number of points Assoc.prof. PhD Eng. Dimitar Rusev from all the groups of indicators is 1828.09 which is higher than the minimal number of points listed in the National requirements and these of the University "Prof.Dr. Asen Zlatarov" – Burgas – 1150 points for the academic position of "professor".*

*In conclusion, it can be summarized that the applicant complies with the minimal national requirements and the requirements of the University "Prof.Dr. Asen Zlatarov" - Burgas for acquiring the academic position of "Professor".*

#### **4. General characteristics of the scientific research, applied research and lecturing activities of the applicant**

The scientific research, applied research and the pedagogical activities of Assoc.Prof. PhD Eng. Dimitar Rusev are actually of interdisciplinary nature. It covers wide range of studies of characteristics, processes and equipment in fields related to the design of machines and other equipment, simulation studies of hydrodynamic and mechanical processes, deposition of surface coatings, energy efficiency and management, organization and optimization of the educational process. The overall activity of the candidate requires knowledge and experience in various fields – machine building, processes and equipment, hydrodynamics, energetics, mechanics, physical chemistry, tribology, statistical calculation and analysis of results, pedagogics, etc.

The evidence presented in the Information about the contributions is submitted clearly and in details and it has been summarized into 6 main fields:

1. Design of construction of machines and equipment and improvement of the energy efficiency and design turbines for ORC installations;
2. Hydromechanical studies and optimization of mechanical constructions;
3. Deposition and studies of the mechanical characteristics of surface coatings deposited onto metal and polymer materials;
4. Simulations studies and optimization of mechanical constructions and tensile properties of deposited coatings;
5. Synthesis of new materials;
6. Management, organization and optimization of the educational process.

The scientific research and applied research contributions in each field are described in detail.

#### **5. Estimation of the pedagogical activity of the applicant**

Assoc.Ptof. PhD Eng. Dimitar Rusev has substantial pedagogical activity. As can be seen from the Information about his lecturing activities for the last three years, during the educational year 2019-2020 he has held lectures and exercises with students from the educational and qualification degrees (EQD) "Bachelor", EQD "Professional bachelor" and EQD

“Master” for 461, 51 and 407 hours, respectively; for 2020-2021 – 551, 36 and 482 hours and for 2021-2022 – 491, 36 and 287 hours.

The candidate has been the scientific tutor of three PhD applicants who successfully defended their theses and 12 diploma students from EQD “Master”.

The candidate has made 1 review of a diploma thesis, 1 review of a textbook of “Machine building” a review of “Handbook for solving problems in technical mechanics”.

He has developed 22 new educational curricula for the EQD “Bachelor”, regular and extramural forms of education on the disciplines: „Engineering graphics”, Computer technologies in transportation”, “Applied software”, Machines and equipment in chemical industry”, “Introduction to AutoCAD”, “Applied software in engineering chemistry”, “Processes and equipment in chemical industry – I part”, “Processes and equipment in chemical industry – II part”.

Assoc.Prof. PhD Eng. Dimitar Rusev developed 3 new curricula for the EQD “Professional bachelor”, regular and extramural forms of education for the disciplines: „Basics of design and CAD”, Applied CAD systems in electronics”, “Technical documentation”.

He developed 13 new curricula for the EQD “Master”, regular and extramural forms of education, for the disciplines: „CAD technologies in transportation”, Automation of design”, “Computer methods in design”, “Reservoirs and containers under pressure”, “ Computer graphical systems”, “Computer 3D design”, “Web design”, “Computer animation”, “Simulation design of electronic circuits”, “Computer design in electronics”, “Computer design of electric machines and equipment”, “Fluidized systems – technique and technology”.

Assoc.prof. PhD Dimitar Rusev developed 8 lecture courses for EQD “Bachelor”, regular and extramural forms of education, 5 lecture courses for EQD “Professional bachelor” and 12 lecture courses for EQD “Master”.

The candidate developed also 6 video lecture courses for the discipline “Engineering graphics” for EQD “Bachelor” regular and extramural forms of education, and 6 video exercises for the same discipline. The video lecture courses and exercises were made for the distant form of education of the students at the University “Prof.Dr. Asen Zlatarov” – Burgas.

Information is supplied where it is certified that the disciplines mentioned above have been incorporated in the curricula of University specialties which ensured the lecturing engagements of the candidate with these scientific specialties.

According to the submitted documents, the work experience of Assoc.prof PhD Eng. Dimirat Rusev at the University “Prof.Dr. Asen Zlatarov” – Burgas is 11 years as senior assistant and 16 years as associate professor.

All the information given above indicates for the extensive pedagogical activity of the applicant.

## **6. Main scientific and applied scientific contributions**

I accept the scientific and applied scientific contributions formulated by the candidate and I can summarize them as follows:



- Profound scientifically based studies have been carried out using modern computer systems for 3D design and simulation modelling and a method and mathematical model for description of the hydrodynamic processes in fluidized bed apparatuses were developed. New designs of meshes for granulation of finely dispersed materials were developed and the constructive characteristics of the device were optimized. New design of direct stream reverse vortex flow cyclone for cleaning the spent fluid was suggested (publications: B4(1,7), G7(2,3,4), G\*8(8,10,16,17,18,42,44)). Scientific research results obtained in this field have been implemented in practice.
- Reactor for separation of emulsions using fractal systems was designed and a mathematical model and method for description of the process of separation were developed (publications: B4(3), G\*8(39)).
- New type of disintegrator-cavitation pump for fine grinding of solid state materials and its dispersion in liquid phase to obtain stable suspensions was developed (publication: G\*8(32)).
- Scientifically based study of the performance of the ORC installations was carried out and the heat and hydrodynamic expansion processes in the turbine were optimized by computer modelling. New design of turbine working wheel blades was developed depending on the hydrodynamics and the Freon used. New type of turbine nozzle device was developed allowing polytropic expansion of Freon. Using simulation modelling, the performance of the shaft of generator turbine working with Freon was studied. Results were obtained about the distribution of the strain and deformations of the shaft and new shaft design was suggested (publications: G5, G7(4), G\*8(3,14,25,26,27,28,46,47)). Scientific research results obtained in this field have been implemented in practice.
- New approach towards the deposition of wear resistant coating of aluminium oxide  $Al_2O_3$  onto polyamide structures Polipa®PA6 and Polikes®PA6G using fluidized bed was suggested. The coating structure was analyzed and specific the optimal performance regimes were determined. It was proved that the substrate material has significant effect on the wear resistance and adhesion of the coating while the elastoplastic properties of the coating were affected by the technological conditions under which the coating was obtained (publications: B4(7), G7(5), G\*8(35,50)).
- A new technology for formation of SiC (silicon carbide) based metal complexes within metal structure using electric arc technology was suggested and the possibilities for optimization of the deposition process were studied. The influence of the technological regimes of preparation of the coatings on some basic characteristics (adhesion, hardness, wear resistance) of the multicomponent system was established (publications: B4(5), G\*8(22)).
- New approach for formation of metal matrix composites from stainless steels X2CrTi12, X5CrNi18-10 and X1NiCrMoCuN20-18-7 containing SiC and TiC was suggested, as well as the same steels with WC (tungsten carbide) and Stellite 6. The composites can be used in appliances with high wear resistance and they are especially suitable for the chemical industry since they have improved characteristics, e.g. microhardness, high elasticity modulus and high wear resistance compared to conventional metal alloys (publications: B4(6), G\*8(23,30,31)).

- New method for deposition of copper nano-coating onto polymer material Polikes®PA6G by high voltage technology was suggested. The regimes of copper coating deposition were established experimentally. The morphology of the deposited coating was determined. Specific optimal regimes of high voltage sputtering of copper were developed which can successfully be used for deposition of copper coatings onto various polymeric materials (publications: G7.(1,), G\*8(45)).
- New technology and optimal regimes for high voltage sputtering of graphene and deposition of graphene monolayer onto polymeric or metal substrate were developed aiming to obtain capacitive nano-coatig. For this purpose, high voltage sputtering of graphite electrode in vacuum was employed to deposit the layer onto polymer material PS/SB793 shockproof and aluminium substrate. The optimal regimes of graphene coating deposition were experimentally studied and established (publications: B4(10), G\*8(49)).
- New approach and method for simulation and prediction of the geometric, mechanical and tribological properties of the coating studied was suggested, as well as for optimization of the deposition regimes under certain selected main criteria: adhesion strength, microhardness and wear resistance. Simulations were carried out with complex external load of normal force, bending and torque applied on the system substrate-coating for which, after comparing to the physical experiments with coatings on X18H9T and Ti on PS/SB190 crystal, PS/SB793 shockproof **POLIPOM®POM**, the results obtained coincided very well. The methods allows shortening time and resources for experimental studies and determination of the desired thickness of the coating which is an expensive and quite long procedure (publications: B4(8), G\*8(33,41)).
- Method for simulation structural modelling and analysis of the strain in orifices mounted in spherical bottoms of pressure reservoirs and analysis of the pressure in thin-wall containers. Modern computer technologies were used to create 3D model and physical model for simulation of the equivalent stresses arising in the walls of the spherical bottom for different values of the angle  $\gamma$  and container body, on the basis of the finite elements method. Software programs for investigation and optimization of the design were developed (publications: G\*8(3,14,40)).
- Mathematical model for determination and prediction of ship viability after impact, where the possibilities for repairing the damaged systems are taken into account. Mathematical formulation for determination of the function of failure distribution is suggested, by which the probability of ship viability after impact can be assessed (publications: Г\*8(11,24)).
- Research study was carried out and a technology for granulation of volatile coal ash – industrial waste from thermal power stations (TPS), to produce sintered granules which are good heat insulation material and have certain absorption properties and can be used for clearing petroleum spills. Technology for granulation of soot and preparation of granules of required shape, size and density was suggested, which can be used in rubber industry. Technologies were also suggested for preparation of highly porous ceramic materials having high dielectric constant on the basis of  $\text{SiO}_2$ ,  $\text{Al}_2\text{O}_3$ , graphite,  $\text{CaCO}_3$  and barium titanate. The kinetics of oxidation of copper pyrometallurgical iron silicate (fayalite) slag was studied by TG-DTA, XRD and SEM – EDS analyses. The technological



regimes were optimized and a method for oxidation of fine iron silicates in high temperature fluidized bed was suggested. Technology for preparation of glass ceramics from natural materials was suggested, as well as from industrial wastes (ash from TPS, metallurgical slag, etc.) containing oxides. Technology for preparation of lightweight ceramic materials with clay matrix and biowaste fillers (rice husks, rye thatch, etc.) as pore-forming materials was suggested; the materials can be used in modern building construction. Research work was carried out and a technology for synthesis of wollastonite ceramics by two-stage technique was suggested. The initial materials used were  $\text{Ca}(\text{NO}_3)_2 \cdot 4\text{H}_2\text{O}$  and  $\text{Na}_2\text{SiO}_3 \cdot 9\text{H}_2\text{O}$ , as well as  $\text{Na}_2\text{SiO}_3$  and  $\text{CaCl}_2$ . The calcium silicate powders were synthesized by the method of chemical co-precipitation so they were very finely dispersed. Technology for preparation of graphite based electro-conductive paste (publications: B4(1,4,9), G7(6), G\*8(6, 8, 9, 10, 12, 13, 18, 19, 20, 21, 36, 37, 38, 48).

- Technology for preparation of glass microspheres sized from 100 to 50  $\mu\text{m}$  in hydrodynamic flow of high temperature gas was developed. The initial material used as ground waste glass from households and industry. Technological scheme and installation design of the installation was elaborated. Mathematic apparatus and software product for optimization of the performance regimes were suggested (publications: B4(2), G\*8(7). The results obtained from the research work have been implemented in practice.
- Scientifically based research was carried out on the new requirements for the methods of teaching of students and a new educational system was implemented for the regular and extramural students in the disciplines Engineering graphics, Technical documentation and Mechanics. The system was made in accordance with the new requirements of BDS ISO and BDS EN ISO, modern means of remote education were also included (publications: G\*8(1,2,4,5,15,29).

### **7. Critical remarks and recommendations**

I have no critical remarks on both the essence and the technical presentation of the materials for the competition.

### **8. Personal impression and opinion of the reviewer**

I do not know Assoc.prof. PhD Eng. Dimitar Rusev personally. Considering the materials for his application and reviewing his scientific works, iam very impressed by the grate volume and versatility of his scientific production.

His research work is in promising and interesting scientific and applied science fields, there are modern innovative ideas and solutions in them. The information I obtain about the contents and quantity of his scientific production from the materials presented for the competition formed my opinion that Assoc.prof. PhD Eng. Dimitar Rusev is very well organized man, well-formed and recognized scientist and specialist in his field; he possesses creative thinking and can work in a team, very good university lecturer. His works are known to the Bulgarian and international scientific community.

## CONCLUSION

Based on the analysis of the scientific, applied science and pedagogical activities of the applicant, my opinion is that **Assoc.prof. PhD Eng. Dimitar Rusev** complies with the requirements of LDASRB, Rules of application of LDASRB and the Regulations of the University "Prof. Dr. Asen Zlatarov" – Burgas for acquiring the academic position of "Professor".

I am deeply convinced recommend the honorable members of the scientific jury to vote positively and award the academic position of "Professor" to **Assoc.prof. PhD Eng. Dimitar Rusev** in the field of higher education, 5. Technical sciences, professional field 5.1. machine engineering, scientific specialty „02.01.25 – Machines and equipment for the chemical, oil, gas and oil refining industries ”

Sofia, 25.10.2022 r.

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/Prof. Dr. Eng. Mara Kandeveva-Ivanova /