

**REPORT**

to occupy the academic position:

"Professor"	
"Associate Professor"	X
	one of the academic positions indicated shall be marked with the sign "X"

**Candidates to occupy the position:**

1	Senior Assistant	Dr	Chavdar	Petrov	Chilev	UCTM-Sofia
No	academic position	scientific degree	name	middle name	last name	workplace

**Scientific area:**

5	Technical Sciences
code	name

**Professional area:**

5.10.	Chemical Technologies
code	name

**Scientific specialty:**

Unit Operations in the Chemical and Biochemical Technology
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**The competition has been announced:**

74	21.08.2020	Chemical Engineering	Chemical and System Engineering
in SG issue	date	for the needs of the Department	Faculty

**The report was written by:**

prof	Dr	Iren	Hernani	Tzibranska-Tzvetkova	ICHE-BAS
academic position	scientific degree	name	middle name	last name	workplace

**1. Report for the candidate:**

Senior Assistant	Dr	Chavdar	Petrov	Chilev
academic position	scientific degree	name	middle name	last name

**1.1. Meeting the minimum requirements under the Regulations:**

A) The candidate meets the minimum requirements	20 points	X
B) The candidate doesn't meet the minimum requirements	0 points	
		one of the answers given is marked with the sign "X"

It must be filled in if answer B is marked. The publication activity of the candidate is analyzed. The response of the results achieved (quoted) is analyzed.

The candidate fulfills and exceeds the requirements according to the Regulations:

Indicator 1	required 50	completed 50
3	100	100
5-11	200	240
12-15	50	814
16 to the end	-	80

The big difference in the citation indicator is impressive, which is a good characteristic for the candidate, but it also speaks of underestimation of this indicator in the Regulations.

**1.2. Relevance of scientific and / or applied research:**

A) The research is relevant. Part of the research is pioneering (no results are known on the topic by other authors)	8 points	
B) Research is relevant. Results from other authors are known for each of the topics and / or applications studied.	6 points	X
C) Most of the research is relevant, but also some results are presented that have no scientific and / or applied value	4 points	
D) The smaller part of the research is relevant	2 points	
E) Research is not relevant	0 points	
		one of the answers given is marked with the sign "X"

The evaluation of the relevance of the research must be substantiated.

The author's research is in the following areas:

- Hydrogen technologies - new methods for storing hydrogen and application in the automotive industry. The topic is oriented towards the present and the future, and the author focuses on the method of adsorption under pressure. The publications are in a specialized journal *International Journal of Hydrogen Energy* with high IF = 3.2.

- Characterization of microporous adsorbents and mathematical modeling of gas adsorption on them. This topic is not new in science, but the author focuses on extreme conditions - supercritical gases at high pressures (up to 650 MPa), which is not only a topical issue, but the author also contributes by offering a new adsorption isotherm. Adding the research on the structure of the adsorbents, it can be concluded that in this area the author has the most results and resp. contributions.

- Extraction of biologically active substances from plant materials - experimental kinetics and modeling. This topic literally floods the scientific journals with publications and its relevance to date is obvious. The author used his modeling skills to make a systematic study of the influence of various factors on the extraction kinetics.

- Mathematical modeling and computer simulations of chemical technological objects. In this direction with a strong applied character the author has used his skills to work with ChemCAD 6.0. and ASPEN ONE software to solve problems related to the design of chemical flowsheets for: production of biodiesel from refined vegetable oil; separation of the acetic acid-water system using a hybrid liquid-liquid extraction and rectification scheme; production of ethyl acetate by esterification of ethanol and acetic acid; hydrogen production through gasification of waste biomass

The materials presented in the competition speak of a broad qualification of the author and a sense of current research areas.

### 1.3. Objectives of the research:

A) Realistic and of scientific and / or applied interest	8 points	X
B) Realistic, but not of scientific and / or applied interest	4 points	
C) Unattainable (unrealistic)	0 points	
		one of the answers given is marked with the sign "X"

Objectives must be specified. The type of the set objectives must be justified

In the field of "Hydrogen technologies and their application in automotive production" the aim is to store hydrogen by adsorption as a better solution than pure gas compression: physical adsorption on microporous sorbents (eg activated carbon) and

hemisorption with the formation of metal hydrides is in the focus of the authors' research.

In the field of "Characterization of microporous adsorbents and modeling of gas adsorption" the aim is to describe the adsorption equilibrium of supercritical gases at high pressures with the ability to describe the minimum occurring in the adsorption isotherms at very high pressures, as well as the concept of inflection point of the equilibrium curves proposed by the author.

Another goal is the quantification of porosity, pore size distribution etc., using scanning electron microscopy and processing using the ImageJ software.

In the field of "Extraction of biologically active substances from plant materials" the aim is experimental research of the solid-liquid extraction process and modeling of the extraction kinetics. The latter involves the study of appropriate functions approximating the variable nature of the effective diffusion coefficient with time and temperature.

In the field of "Mathematical modeling and computer simulations of chemical technology objects" the goal is to solve specific problems related to the chemical industry, using the capabilities of specialized software.

The set objectives of the research are realistic and related to a wide range of scientific and applied tasks.

#### 1.4. Candidate research contributions:

A) With lasting scientific and / or applied response, they form the basis for new research and applications	20 points	X
B) They are of significant scientific and / or applied interest, complete and / or summarize previous research	16 points	
C) They are of scientific and / or applied interest	12 points	
D) Lack of significant contributions	8 points	
E) Lack of contributions	0 points	
		one of the answers given is marked with the sign "X"

Contributions must be specified. The type of results achieved must be justified.

I accept the reference for the main results and contributions of the research, which the candidate has presented.

The applicant's contributions can be summarized as follows:

- Creation of a new type of adsorption isotherm, suitable for describing the gas adsorption equilibrium in a wide range of pressures; The author offers a thermodynamic explanation for the appearance of a minimum in the adsorption isotherms of supercritical

gases on microporous adsorbents. Experimental studies were performed with adsorption of hydrogen, methane, ethylene.

- A hybrid method for hydrogen storage under pressure using physical adsorption and hemisorption in activated carbon with implanted metal particles is proposed;
- Procedure for determining the morphological characteristics of solid porous materials;
- Investigation of the influence of various factors on the extraction kinetics (effective diffusion coefficient) by means of mathematical modeling;
- Development of technological schemes for a series of current productions, using the capabilities of the software for chemical-technological objects.

### 1.5. Participation of the candidate in the achievement of the presented results:

A) The candidate has at least an equal participation in the submitted papers	8 points	X
B) The candidate has at least an equal participation in most of the submitted papers	7 points	
C) The candidate has a secondary participation in most of the submitted papers	4 points	
D) The candidate participation is unnoticeable	0 points	
		one of the answers given is marked with the sign "X"

Critical notes must be provided if one of the items C or D is marked.

### 1.6 Pedagogical activity:

A) The candidate has effective and sufficient pedagogical activity at the university. The textbooks issued are modern and useful (they meet the requirements of the Regulations). The work with undergraduate and doctoral students is at a high professional level.	8 points	X
B) The candidate has sufficient pedagogical activity at the university. The textbooks issued satisfy the requirements of the Regulations.	6 points	
C) The pedagogical activity and / or textbooks issued are insufficient (do not meet the requirements of the Regulations)	0 points	
		one of the answers given is marked with

		the sign "X"
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Critical notes must be provided if one of the items B or C is marked.

### 1.7. Critical notes:

A) Lack of critical notes	8 points	X
B) Critical notes of a technical nature	7 points	
C) Critical notes that would partially improve the results achieved in a small part of the research	5 points	
D) Critical notes that would partially improve the results achieved in most of the research	3 points	
E) Significant critical notes	0 points	
		one of the answers given is marked with the sign "X"

Critical notes must be provided if one of the answers C, D or E is marked.

### 1.8. Conclusion

A) The evaluation of the candidate's activity is <b>POSITIVE</b>	This evaluation is assigned to a total number of at least 50 points	X
B) The evaluation of the candidate's activity is <b>NEGATIVE</b>	This evaluation is assigned to a total number below 50 points	
		one of the answers given is marked with the sign "X"

To be filled in if requested by the member of the scientific jury
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The sum of the points according to the above criteria is 78.

The candidate exceeds the requirements for associate professor in Technical Sciences at UCTM according to the Law on the Development of the Academic Staff in the Republic of Bulgaria and the Rules for the Implementation of the aforementioned law.

His scientific activity comprises 23 publications other than those in the doctoral dissertation. 15 of them are in journals with IF or SJR. The published works have received a good citation in the world scientific literature (95 citations in total). The H-index of the candidate according to Scopus is 5. The presented materials show a good balance between teaching, publishing and research activities, incl. international (11 times Dr. Chilev was a guest lecturer or a guest researcher at the University of Paris 13). He is the author of a monograph: "Modern Trends in Distillation Processes" and a textbook "Separation of Multicomponent Systems" (2017). He has an impressive teaching activity - a list of 17 lecture courses for students of Engineering Chemistry (including specialties in German and French) in a wide range of topics. He has lectured abroad six times (at the University of Paris 13).

I strongly support Dr. Chavdar Chilev for the academic position of Associate Professor in the Department of "Chemical Engineering" at the University of Chemical Technology and Metallurgy, Sofia.

	The report was written by:	
07.12.2020	<b>Iren Tzibranska</b>	signature