



MINISTRY OF EDUCATION
"VALAHIA" UNIVERSITY OF TĂRGOVISTE
IOSUD - DOCTORAL SCHOOL OF ENGINEERING SCIENCES
FUNDAMENTAL FIELD ELECTRICAL ENGINEERING

SUMMARY

HABILITATION THESIS:

*Studies on the impact of technologies and new
thermo-photo-electric devices on the environment*

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SUMMARY OF HABILITATION THESIS

The habilitation thesis *Studies on the impact of technologies and new thermo-photo-electric devices on the environment* synthesises the author's scientific, academic and professional achievements.

Since defending the doctoral thesis elaborated in 2011, professional activities in the field of research and then also in the field of education have included topics related to micro and nanomaterials and thermoelectric devices. Another important research direction for the author consisted of studying methods and techniques of physicochemical analysis for environmental protection.

The paper, structured in three chapters, opens with a concise introduction and ends with a list of selective bibliography.

Chapter I, Introduction, is divided into three sections.

The first of the sections, *The Context of the Habilitation Thesis*, presents the opinion regarding the career of a university professor in the widest sense of this profession.

The university professor should be a model for his students, carefully regarded by society and perceived as a connoisseur of numerous topics addressed in school. He or she possesses the qualities necessary to serve or become a role model for learners. Students imitate their teacher in virtually every way, including gestures and style. A student is touched by both the teacher's affection and devotion to him. To share these ideals, the teacher must have professional skills (psycho-didactic and methodical) and solid moral training. Teachers help students manage their careers and lay a solid foundation in many professions as the environment changes and their occupations become tougher. Students are very busy making their own judgments, and the teacher often serves as a guide for them.

The second section, *Professional Achievements*, presents the stages of development of the research and teaching career, as follows: research assistant (May 1, 2004 - December 31, 2009), scientific researcher (January 2010 to September 2018), lecturer (October 1, 2018 - September 30, 2023), associate professor (from October 1, 2023 until now). The results obtained by the author together with the research teams materialized through collaborations with national universities and research institutes (UPB¹, UOC,² IMT Bucharest³, NIMP Bucharest⁴, INCEMC Timisoara⁵, IFIN-HH⁶) and international (IUCN Dubna, Russia⁷) in the 19 years of activity, consisting of 4 books, 2-course materials, 4 laboratory guidance/applications all

¹ Polytechnic University of Bucharest

² Ovidius University of Constanta

³ National Institute for Microtechnology Bucharest

⁴ National Institute for Materials Physics Bucharest

⁵ National Institute for Research and Development for Electrochemistry and Condensed Matter Timisoara

⁶ National Institute of Research and Development for Physics and Nuclear Engineering – Horia Hulubei

⁷ Joint Institute of Nuclear Research-Dubna, Russia

these published in national publishing houses recognized by CNCSIS and ANCS, 40 papers in ISI journals and conferences listed/indexed, 21 articles published in journals and volumes of scientific events indexed in other international databases (BDI), 231 ISI citations and 26 BDI citations, 43 national and international research projects/grants (project manager for 5 international projects/grants and technical responsible for 1 national project).

The third section of Chapter One, *Research Directions and Competences*, presents four main research directions approached. According to the criterion of multidisciplinary, the concerns of the author of the habilitation thesis are: *D1: Study and realization of thin layers and thermoelectric devices; D2: Sensors, magnetic field and electromagnetic compatibility; D3: Study of photovoltaic cells and devices; D4: Methods of depollution and analysis of polluting elements in the environment*, for which the author listed the most representative scientific papers, books and research contracts.

The second chapter, entitled *Research activity and results obtained*, presents in detail the representative papers for each of the four research directions considered.

Regarding the first research direction (**D1**), research and analysis were made starting from volume thermoelectric materials on thermoelements made of a mixture of bismuth, antimony, tellurium and selenium by cold pressing (sintering). Another level studied consisted of the design, realisation and characterisation of thermoelectric devices with nanoscale films. For this research direction, studies have shown that a thermoelectric device's performance can be influenced by its material and thickness and by the design and geometry of the thermoelements used. The results obtained by the author of the thesis, together with the research teams he was part of: 6 articles in ISI/BDI journals, 2 books, 1 laboratory guide, 1 project as project director and 8 projects as a member of the research team.

The second research direction (**D2**) approached by the author, considered the study and realization of magnetic sensors from thin layers of Ni-Cu with giant magnetoresistance (GMR) and electromagnetic compatibility phenomena. Multilayer magnetic configurations are one of the essential aspects of this field because they take into account the uniqueness of the use of phenomena, micro-magnetic, magneto-optical and magneto-electronic types, which cannot be highlighted with conventional materials. In this research direction are briefly presented topics regarding the influence of the electromagnetic field on living organisms, as well as the migration of metal ions in insulators, but also a laboratory guide entitled "*Measurements and transducers*" that will be used in the laboratory with the same name.

The results obtained (within this research direction) together with the research teams he was part of were 11 articles in ISI/BDI journals, 2 books, 2 laboratory guides, 1 problem collection, 1 project as project director, and 1 project as a member of the research team.

The third research direction (**D3**) is based on the author's concerns in photovoltaics and energy storage. This direction started from the concept of "*sustainable development*", which sought to find new

and innovative methods of renewable energy sources. Thus, new photovoltaic devices and cells were researched and developed, which were characterised both qualitatively and quantitatively by different analytical methods, and the results obtained by the author, together with the research teams he was part of, were published in 6 specialised journals rated ISI/BDI, 7 research projects and 1 book.

The fourth research direction (**D4**) presents the author's interest in environmental protection and methods of decontamination. Significant results were obtained (1 book, 35 ISI/BDI articles, 3 projects as project director and 17 projects as research team member), approaching new and innovative methods of physicochemical analysis and environmental decontamination. Complementary to physicochemical methods that measure the degrees of concentration of pollutants and biological methods allow knowledge of the impact on the living world, taking into account the complexity of environmental phenomena: the cumulative effect of different pollutions; interactions between air, water and soil; diffusion of pollution through food webs linking species, including human linkage.

The third chapter, *Plans for the evolution and development of professional, scientific, and academic careers*, presents a set of principles that will underpin future activity, professional development directions, and future research directions, as well as concrete elements that will contribute to their future implementation. The future development directions are detailed by scientific fields, highlighting plans related to participation in research project competitions with national and international funding.

At the end of this paper is highlighted a selective bibliographic list with references from both own writings and references from specialised literature.