

HABILITATION THESIS

ACHIEVEMENTS IN THE MICROELECTRONICS FIELD

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Part A. HABILITATION THESIS ABSTRACT

A.1. English Thesis Abstract

Habilitation thesis “Achievements in the Microelectronics Field” presents the main results of scientific and educational activities during the author's evolution from PhD thesis sustained in 2000. PhD thesis topic was in the field of the Micro-Electro-Mechanical Systems-MEMS, processes for achieving resonant microsensors on silicon semiconductor substrates, starting from basic technological processes of CMOS integrated circuits manufacture. This area was continued in further research, summarized in a chapter of the thesis.

Postdoctoral, scientific research was focused on modeling, simulation, optimization and design of processes and resulting semiconductor devices in integrated environments such as TCAD tools package from Synopsys or Silvaco. The engine of research activity was the research projects won by competition, most recently: MEDICY, ELOTRANSP, ELECTROCELL, BIOFET, ELECTROCEL, NANOXI, NEUROSENSE, MODEH, FBMOS, etc.

Activity in these projects and results, was the main source of dissemination through articles published in the main stream of information in the field journals, with high impact factor as such: Elsevier Journal of Alloys and Compounds, Procedia Technology Elsevier, Journal Rev. Roum. Sci. Techn. Électrotechn. et Énerg., American Journal of Bioscience and Bioengineering, Wulfenia Journal, Journal of Online Engineering, Journal of Nanomaterials, Digest Journal of Nanomaterials and Biostructures, European Platform for Photodynamic Medicine: Photodiagnosis and Photodynamic Therapy Elsevier, Journal Materials Science and Engineering B: Advanced Functional Solid-State Materials, Romanian Journal of Information Science and Technology, Journal Solar Energy Materials & Solar Cells.

Dissemination was made at international conferences: Diamond, CAS, New Trends on Sensing-Monitoring-Telediagnosis for Life Sciences, International Conference Interdisciplinarity in Engineering, Remote Engineering and Virtual Instrumentation, International Conference on Data Compression, Communications and Processing, IASTED, European Modeling & Simulation Symposium, Interactive Computer Aided Learning, MEDICON, International Conference on Nanosciences & Nanotechnologies, Multi-Material Micro Manufacture 4M, etc. Were published books in UEFISCDI recognized publishing and chapters in books with international editors and publishers such as Lambert Academic Publisher or Intechweb and patents was accorded by OSIM.

The main research topics and publications from his doctoral studies presented can be divided into the following areas: Nano-Micro-Bio-Transparent Electronics (CMOS Manufacturing Processes Modelling and Simulation; DO and RSM Techniques for New Processes and Devices Development; MOS Transistor Compact Modelling; MOS Transistor Modeling for Distortions Analyzing; High-k Dielectric Semiconductor Interface Analysis; Breakdown Voltage and Other Parameters of LDD Structure Comparison; Kink Effect, C-V Technique; Bio-FET; Enzymes Immobilization; Capacitive Electrodes for Electrophysiological Signals Recording), MEMS (Laser Technologies, SOI and Volume Etching), Solar Cells (Surface Micromachining Efficiency Optimization), e-Learning (Actively and Collaboratively Environment; Implementing a course and laboratory; Remote Silvaco TCAD-Omni).

Habilitation thesis in chapter B1.5 presents significant issues of academic progress in accordance with the criteria imposed by the enabling empowerment methodology approved by the PUB.

Chapter B2 presents a vision of scientific, professional and teaching development, transfer of knowledge and research results to economic environment, upgrading courses and laboratories, EDIL Microelectronics R&D Centre collaboration with other private entities or research institutes and international expertise recognition to increasing the visibility of the Faculty and University.

A.2. Romanian Thesis Abstract

Teza de abilitare "Contribuții în domeniul microelectronicii" prezintă principalele rezultate ale activităților științifice și didactice pe perioada evoluției autorului de la susținerea doctoratului în anul 2000. Subiectul tezei de doctorat a fost în domeniul sistemelor micro-electro-mecanice MEMS, respectiv procese tehnologice de realizare a microsenzorilor rezonanți pe substraturi semiconductoare din siliciu, pornind de la procesele tehnologice de bază ale fabricației circuitelor integrate CMOS. Acest domeniu a fost continuat în cercetările ulterioare prezentate pe scurt într-un capitol din teză.

După doctorat cercetarea științifică a fost orientată pe modelare, simulare, optimizare și proiectare a proceselor tehnologice și dispozitivelor semiconductoare rezultate, în medii integrate de tip TCAD precum cele de la Synopsys sau Silvaco. Motorul activității de cercetare l-au constituit proiectele de cercetare câștigate prin competiție, cele mai recente fiind MEDICY, ELOTRANSP, ELECTROCELL, BIOFET, ELECTROCEL, NANOXI, NEUROSENSE, MODEH, FB MOS, etc.

Activitatea desfășurată în acestea și rezultatele a fost principala sursă de diseminare prin articole publicate la principalele jurnale din fluxul principal de informație din domeniu, cu factor mare de impact precum: Elsevier Journal of Alloys and Compounds, Procedia Technology Elsevier, Journal Rev. Roum. Sci. Techn. Électrotechn. et Énerg., American Journal of Bioscience and Bioengineering, Wulfenia Journal, Journal of Online Engineering, Journal of Nanomaterials, Digest Journal of Nanomaterials and Biostructures, European Platform for Photodynamic Medicine: Photodiagnosis and Photodynamic Therapy Elsevier, Journal Materials Science and Engineering B: Advanced Functional Solid-State Materials, Romanian Journal of Information Science and Technology, Journal Solar Energy Materials & Solar Cells.

Diseminarea s-a făcut la conferințele internaționale: Diamond, CAS, New Trends on Sensing-Monitoring- Telediagnosis for Life Sciences, International Conference Interdisciplinarity in Engineering, Remote Engineering and Virtual Instrumentation, International Conference on Data Compression, Communications and Processing, IASTED, European Modeling & Simulation Symposium, Interactive Computer Aided Learning, MEDICON, International Conference on Nanosciences & Nanotechnologies, Multi-Material Micro Manufacture 4M, etc. Au fost publicate cărți la edituri recunoscute UEFISCDI și capitole în cărți cu editori și edituri internaționale precum Lambert Academic Publisher, Intechweb și au fost acordate brevete naționale de către OSIM.

Principalele teme de cercetare și lucrări publicate de la susținerea doctoratului care sunt prezentate în lucrare se pot împărți în următoarele domenii: *Electronică nano-micro-bio-transparentă* (Modelarea și simularea proceselor tehnologice de fabricație CMOS; Dezvoltarea de noi procese și dispozitive folosind tehnicile DO și RSM; Modelarea compactă a tranzistorului MOS; Modelarea tranzistorului MOS pentru analiza distorsiunilor; Analiza interfeței dielectric semiconductor pentru straturi dielectrice high-k; Compararea tensiunii de străpungere și a celorlalți parametri ai structurii LDD; Efectul Kink; Tehnica C-V; Bio-FET; Imobilizarea enzimelor; Înregistrarea semnalelor electrofiziologice cu electrozi capacitivi), *MEMS* (Tehnologii laser, SOI și Corodare de volum), *Celule Solare* (Optimizarea eficienței prin microprelucrarea suprafeței), *e-Learning* (Realizarea unui mediu activ și colaborativ; Implementarea unui curs și a unui laborator; Utilizarea remote a Silvaco TCAD-Omni).

Teza de abilitare prezintă în capitolul B1.5 aspectele semnificative din evoluția academică în conformitate cu criteriile de abilitare impuse de metodologia de abilitare aprobată de UPB.

Capitolul B2 prezintă viziunea asupra dezvoltării științifice, profesionale și didactice pe termen lung privind transferul cunoștințelor și rezultatelor cercetării către mediul economic, modernizarea cursurilor și laboratoarelor, colaborarea Centrului de Cercetare Dezvoltare în Microelectronică EDIL cu alte entități private sau institute de cercetare și recunoașterea internațională a expertizei Centrului pentru creșterea vizibilității Facultății și a Universității.