

(A) ABSTRACT

The development of a solid research grounding in the field of materials engineering, supported by the teaching foundation of the modern technologies applied for materials making and processing, is a very topical issue in the contemporary society, and this could be primarily achieved through the professional and academic experience of the professors involved in this field.

The habilitation thesis is a summary of the scientific concerns and activities carried out after sustaining the PhD Thesis at Politehnica University of Timișoara, in 2004, entitled “*Contributions to improve the quality of steel parts obtained by forging large ingots*”, under the guidance of professor dr. eng. Ioan ILCA, when I obtained a doctoral degree in the field of fundamental engineering sciences, Ph.D. field *Materials Science and Engineering*, confirmed by the Ministerial Order no. 4450 issued on 02.08.2004.

The general objective of the habilitation thesis is the logically argued and documented presentation of the scientific achievements obtained after sustaining the doctorate thesis. The paper is conceived in order to clearly delineate the major research directions.

The results of scientific work falls in the field of materials engineering, being approached the following research directions:

- ***Modern methods and technologies applied in steelmaking;***
- ***Technologies used to recover the ferrous waste and scrap for greening the industrial environment.***

The scientific work carried out led to the development of competencies in:

- Technologies used for making and casting metal alloys;
- Metal materials testing;
- Optimization of steel making and casting;
- Modelling and simulation of steel solidification processes;
- Application of greening technologies on bulk ferrous waste recovery;
- Processing and interpretation of the research results.

The habilitation thesis is divided into three main parts:

(B-i) Scientific, professional and academic achievements;

(B-ii) Plan of career evolution and development;

(B-iii) References.

The first part of the habilitation thesis presents the most important scientific results obtained after granting the title of Doctor of Engineering, and it is divided into three chapters.

The first chapter of the habilitation thesis presents the results of postdoctoral work carried out since 2004 within the Department of Metallurgy, subsequently the Department of Engineering and Management of the Engineering Faculty of Hunedoara. In terms of professional activity, I have taught, as Course Instructor, the following academic disciplines: *Materials science, Energy and raw materials base, Steel refining and remelting, Metal wastes recovery and utilisation, Theory of steelmaking processes, Steel metallurgy, Modern technologies for the manufacture of metal alloys, Engineering and environmental management, Technologies for making special steels, Pollutants, Quality, environment, and recycling of road vehicle components*, as well as license degree programmes, master's degree and postgraduate training and continuous professional development.

I was a coordinator of undergraduate & dissertation projects, committee member mentoring doctoral students, and referent in committees for sustaining doctoral theses in the *Materials Engineering* field.

I coordinated the undergraduate curriculum entitled *Engineering of making metal materials*.

I was part of the teams that have established the following curricula:

- License degree: *Economic engineering in chemical and materials industry and Waste management engineering*;
- Master's degree: *Engineering and Management of Sustainable Development in Materials Industry and Materials and Advanced Technologies for Automotive Industry*.

I am the board chairman for the master's programme *Materials and Advanced Technologies for Automotive Industry* and board member for the study programmes in the fields *Materials Engineering* and *Engineering and management* in the faculty.

It is also presented the involvement in the implementation of some projects aimed to develop the competencies of students in the academic management. As a short term expert involved in the POSDRU/2/1.2/S/2 project "*The development of an operational system of qualifications in higher education in Romania*", I have created:

- For the *Materials Engineering* field: Grid 1 and Grid 2, containing the description of the field / study programme by identifying the professional and transversal competences at the undergraduate curriculum entitled *Engineering of making metal materials*.
- For the *Materials Engineering* field: Grid 1, containing the description of the field / study programme by identifying the professional and transversal competences at the master's degree curriculum entitled *Advanced manufacturing processes for obtained metal materials*.

Also, it is shown the involvement in projects, grants and research contracts as a director or collaborator, and the main professional achievements, i.e. evaluator for research projects, organizer or member of the editorial or scientific boards of some scientific journals or conferences, member of various professional associations.

In the 12 years of post-doctoral activity, I have accumulated a rich experience, and the research directions include either theoretical or practical research. Mainly, I pursued the research results to have practical applicability or utility.

Chapter 2 is devoted to the most relevant contributions that targeted ***Modern methods and technologies in steel-making***.

The research in this field was directed towards:

- Optimisation of metal charge at EAFs;
- Optimization of steel making and casting;
- Improving the casting structure of steel semi-finished products by using micro coolers;
- Modelling and simulation of steel solidification processes;
- Obtaining composite materials with superior tribological properties, for making brake pads.

In the context of sustainable development, in **Chapter 3** referring to the research direction ***Ferrous waste and scrap recovery technologies for greening the industrial environment***, the research activity approached the following topics:

- Identification and qualitative analysis of scrap powders;
- Processing of small & bulk ferrous waste by using environmentally friendly or unconventional technologies;

- Introduction of efficient and clean technologies, based on the sustainable development and environmental protection principles;
- Obtaining by-products (micro pellets, pellets, briquettes, sponge iron, Carbofer product), used as raw material in the iron & steel industry.

The research conducted along with the research team of the Department of Engineering and Management, after obtaining the Ph.D. title, has been materialised by creating, sustaining and publishing of:

- 37 ISI papers, of which 25 in ISI-ranked journals (6 in journals with JIF > 0.5) and 12 at ISI Conference Proceedings;
- 50 papers in BDI-ranked journals or BDI Conference Proceedings;
- 8 books at recognized publishing houses (CNCSIS);
- Coordination of 5 research grants, and member of research teams at 3 grants;
- 2 invention patents.

The concerns about research have expanded towards the educational side, where in some master's degree programmes we developed disciplines on the approached research topics. The topics of the research contracts correspond to the research areas of interest and are the result of interactions with other universities, research centers, as well as economic operators from the country and abroad. An important point of the involvement in research is the inventics, which was materialized by obtaining a national patent and the filing of a patent application, the latter being currently in the evaluation process.

The career development plan is presented in the **second part** of the habilitation thesis. Given the results obtained so far, the research will continue in the areas of research presented above, this research being intended to complement the existing achievements and focusing on two strategic approaches, i.e. *education* and *research*.

The specific targets are established for each future research directions, which may be the approach of future doctoral theses. Here is the summary of the strategies adopted to implement each objective:

- Developing new research topics related to obtaining composite materials and advanced materials applicable in the industrial practice;
- Including of the future doctoral students into the research team;
- Training of nationally and internationally competitive young researchers;
- Participation in new competitions for obtaining grants;
- Maintaining of existing relationships with universities and companies in the field, and development of new collaborations;
- Publishing the results in ISI-ranked journals with impact factor or indexed in international databases, as well as at international conferences in the field;
- Publishing of book chapters or specialty books;
- Increasing visibility of research results.

Regarding the plan of evolution and development in teaching, the general objective will be the continuous improvement of the activities and applied techniques, i.e. incorporation of the research results into the teaching programmes, especially for master's degree. The derived objectives and the strategies to achieve them are also included in the presentation.

The references are found in the **third part** of the habilitation thesis. Each chapter includes the references associated with each approached research direction, containing articles, patents and published books, as well as articles and reference books in the field.