Universitatea Transilvania din Brașov

SUMMARY

Habilitation thesis:

Modifications of the physical, mechanical and acoustic properties of wood and lignocellulosic materials subjected to different treatments

Domain: FORESTRY ENGINEERING

(INGINERIE FORESTIERĂ)

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The habilitation thesis entitled **"Modifications of the physical, mechanical and acoustic properties of wood and lignocellulosic materials subjected to different treatments"** contains the results of applied experimental research that were addressed by the author of the thesis within the research projects carried out/coordinated by the author, after completing the doctoral thesis, during the period 2016 - 2025 (*Project PN-III-P2-2.1-BG 85/2016 Integrative solutions for increasing economic performance by optimizing the rigid-elastic properties and structural stability of Romanian-made guitars - SINOPTIC*, Period 2016 - 2018; Funder: UEFISCDI, *PN-III-P2-2.1-PED-2019-2148, contract no. 568PED/2020, Innovative violin models acoustically and aesthetically comparable to heritage violins – MINOVIS* https://minovis.unitbv.ro/ Period: 2020-2022; Funder: UEFISCDI; *PN-III-P4-PCE-2021-0885, contract PCE 61/2022 Qualitative, dynamic and acoustic analysis of anisotropic systems with modified interfaces – ACADIA*, https://acadia.unitbv.ro/ Period: 2022 – 2024; Funder: UEFISCDI). The analysis of the effects of various treatments (physical, chemical, mechanical, acoustic) on the properties of wood and lignocellulosic materials has been a constant concern of the author as a result of constant collaborations with the scientific and industrial environment interested in the study of these aspects. Thus, the research presented in this habilitation thesis in the field of forestry engineering is a corollary of the interdisciplinary studies undertaken by the author, applying both classical and modern, advanced methods for investigating the properties of wood and lignocellulosic materials, constituting a valuable database for specialists in wood processing and forestry, for engineers who bring sustainable and innovative solutions in wood engineering. The habilitation thesis, **"Modifications of the physical, mechanical and acoustic properties of wood and lignocellulosic materials subjected to different treatments**", is structured in three chapters, each dedicated to a research direction.

Chapter 1, entitled ***Evaluation of the physical, mechanical and acoustic properties of wood subjected to artificial aging,*** aimed to study the effect of artificial aging on the physical, elastic, acoustic and chemical properties of wood to be used for musical instruments. The novelty of the study consisted in the multidimensional and multi-effect evaluation of the chemical, mechanical and acoustic changes produced by the artificial aging of the soundboard compared to the untreated wood. The results highlighted the fact that, although the penetration depth of UV radiation is reduced (below 2.5 mm), due to the small thicknesses of the boards of musical instruments, this treatment can be a method of improving the acoustic performance of the soundboard, before the final manufacture of the violin. **The results presented in this chapter have been disseminated in 3 ISI articles (Forests FI=2.9, Polymers FI=4.7, International Journal of Biological Macromolecules FI=7.7), 1 Springer book with the 2 chapters dedicated to this research, all published after the last advancement (2023 – 2025).**

Chapter 2, entitled *Influence of different types of finishes on the physical, dynamic and acoustic properties of soundboard* constitutes the second pillar of the habilitation thesis research. The studies in this chapter have highlighted aspects related to the correlation between the type of finish, the thickness of the varnish film and the possibility of enhancing the acoustic quality of wood through the rational and appropriate use of varnishes. **The results presented in this chapter were disseminated in 4 ISI articles (3 in Polymers FI=4.7, 1 in Advanced Materials Interfaces FI= 4.4), 5 BDI articles (Springer), 2 book chapters published by the international publishing house Springer.**

Chapter 3, entitled *Analysis of the viscoelastic properties of wood and lignocellulosic materials* represents the third research direction addressed in the habilitation thesis, being organized into two subdomains - the viscoelastic behavior of lignocellulosic materials (polymer composites reinforced with wood particles) and the behavior of softwood wood under axially - symmetric cyclic loads. This research highlights the predictability of wood and wood-based composites in long-term applications, under isothermal conditions or with temperature variation, having applicability in wooden constructions, the furniture industry and furniture design. The novelty of the research lies both in the advanced research methods, with reduced material consumption, and in the use of the finite element analysis method of softwood studied as a layered material (late wood and early wood), with orthotropic elastic properties. **The research presented in this chapter was disseminated in the form of 4 ISI articles (Wood Science & Technology, Journal of Mechanical Engineering and Polymers) and 2 BDI articles (Springer and Elsevier).**

Chapter 4 contains a corollary of scientific conclusions, original contributions and future research directions.

The last part of the habilitation thesis (**Chapters 5-6 – Teaching career development plan**) presents the chronological academic evolution of the author and the development directions envisaged. Among the teaching and scientific concerns, the most relevant are those related to the active involvement of students in fundamental research (the study of the properties of 3D printed lignocellulosic materials based on the scaling of the microscopic structure of different wood species and wood with improved mechanical and acoustic properties) and interdisciplinary applied research (the valorization of wood and biomechanical structures inspired by the structure of wood in various industrial applications), at all three levels of university training (bachelor, master, doctorate). Finally, the established teaching and scientific career development goals aim to attract funding sources, domestic and international collaborations, and increase international visibility.