Universitatea Transilvania din Brașov

Transilvania University of Brasov
FACULTY OF WOOD ENGINEERING

HABILITATION THESIS

SUSTAINABLE WOOD-BASED THERMAL INSULATION STRUCTURES AND SURFACE QUALITY ASSESSMENT

Domain: Forest Engineering

Commission: PLANT AND ANIMAL RESOURCE ENGINEERING

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Brasov: January 19, 2026

Content

(B-i) Scientific and professional achievements

Introduction

- The habilitation thesis "Sustainable wood-based thermal insulation structures and surface quality assessment" represents a synthesis of the research areas that the author has addressed since obtaining doctoral degree, representing a logical development of previous research, as well as research in related areas.

- The evolution of manufacturing technologies and the development of concepts such as sustainable materials, eco-composites, circular economy and carbon footprint reduction have led the author's research in this direction.

- Finding solutions whereby wood or wood-based panels can be replaced with composites containing sustainable materials derived from agricultural waste or from the wood processing process is an important goal that must be integrated into the circular design process.

Chapter 1. Performance of innovative sustainable structures

Literature:

Wood
is an essential ecological resource, but unsustainable exploitation threatens its availability, highlighting the need to conserve forests while developing sustainable alternatives

In the EU
production fell further in 2023. These trends underline the urgency of identifying alternative raw materials

Recent studies
indicate that sunflower stalks, used individually or with wood particles and pMDI adhesives, can be used to manufacture

In Romania,
crop wastes represent a valuable resource for producing ecological composite materials.

The stems and seed husks
represent an alternative raw material for the wood-based panel industry, offering ecological and economic benefits amid increasing pressure on forest resources

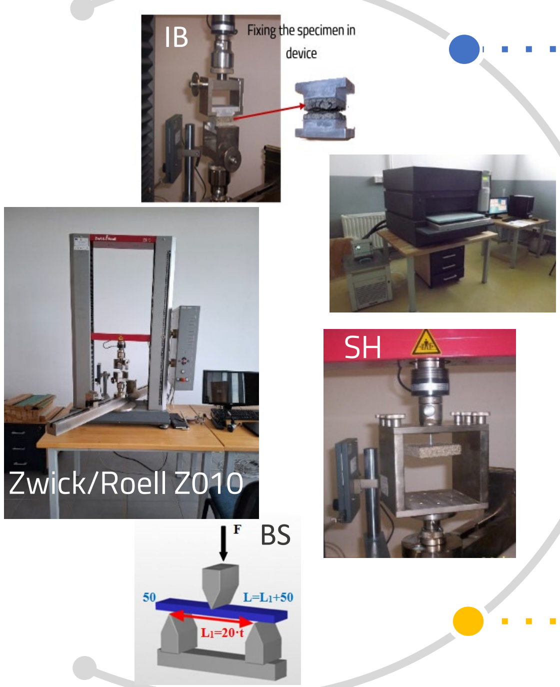
The literature
reports extensive research on composite materials derived from agricultural waste: rice husks, wheat, safflower, corn stalks, reeds, cotton stalks, nut shells, straws, coconut husks, miscanthus, kenaf, and sunflower stalks

Sunflower husks
contain cellulose, hemicellulose, and lignin in proportions comparable to hardwoods

These residues
have been combined with various binders and reinforcements to produce boards and hybrid composites. Sunflower stalks are among the most widely studied resources.

Chapter 1. Performance of innovative sustainable structures

1. Research on the effect of particle size and geometry on the performance of single-layer and three-layer particleboards made from sunflower seed husks



Objective

The main objective of this research was to produce chipboard made entirely from sunflower husks

Physical properties

Their performance was investigated by testing their density, water absorption (WA), thickness swelling (TS) after 24 hours of immersion in water, thermal properties (∆T = 30°C)

Mechanical properties

Among the mechanical properties were investigated by testing their bending strength (BS), modulus of elasticity (MOE), internal bond strength (IB) and screw holding strength (SH)

Experiments

The experiments were conducted under laboratory conditions. The composites and investigations were carried out on laboratories of Faculty of Furniture Design and Wood Engineering and ICDT

Chapter 1. Performance of innovative sustainable structures

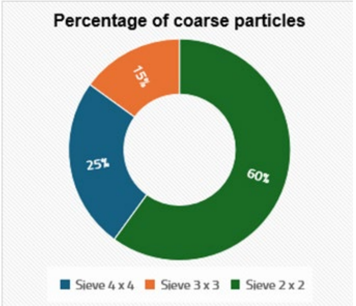
1. Research on the effect of particle size and geometry on the performance of single-layer and three-layer particleboards made from sunflower seed husks

Materials and raw materials

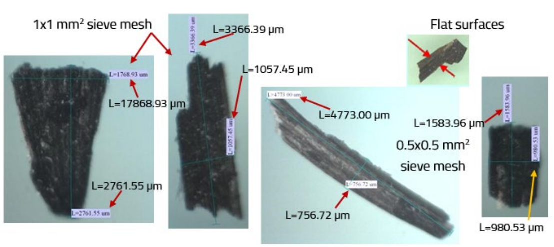
Two particle-size categories were used: coarse particles consisting of whole sunflower seed husks, and fine particles produced by grinding the coarse husks in a hammer mill. Both coarse and fine particles were sieved separately using a sieve system with defined mesh sizes.

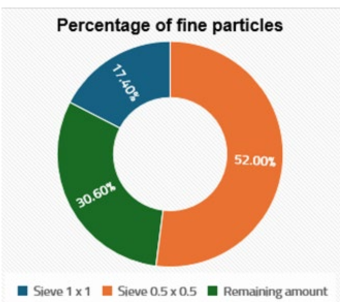
- 4x4 mm² Coarse particles
- 3x3 mm² Coarse particles
- 2x2 mm² Coarse particles
- 1x1 mm² Fine particles
- 0.5x0.5 mm² Fine particles

Coarse particles
Humidity: 8.6%
The length/width ratio was between 1.07 and 4.9



Fine particles
Humidity: 7.6%
The length/width ratio was between 1.03 and 6.3





Fine particles - Optika microscope (SMZ-2, Italy), equipped with a high-resolution Optika PRO 3 digital camera.

Chapter 1. Performance of innovative sustainable structures

1. Research on the effect of particle size and geometry on the performance of single-layer and three-layer particleboards made from sunflower seed husks

The boards manufacturing

Seven types of particleboards were produced with five boards of each type.

- **SLFP** — 100% fine particles – 1 layer, 16% amount of urea-formaldehyde (UF) resin
- **SLCP** — 100% coarse particles - 1 layer, 6% amount of urea-formaldehyde (UF) resin
- **TPL** — 30% fine particles (faces) and 70% coarse particles (core) – 3 layers. 16% for faces and 14% for core amount of urea-formaldehyde (UF) resin
- **½ SLC-FP** — 50% fine particles and 50% coarse particles – 1 layer, 16% amount of urea-formaldehyde (UF) resin
- **½ SLF-WP** — 50% fine particles and 50% wood particles – 1 layer, 16% amount of urea-formaldehyde (UF) resin
- **½ SLC-WP** — 50% coarse particles and 50% wood particles – 1 layer, 16% amount of urea-formaldehyde (UF) resin
- **WP** — 100% wood particle – 1 layer, 16% amount of urea-formaldehyde (UF) resin

Hot press, 180°C, 6 min, 30 bar. Conditioned 2 weeks at 20 °C and humidity of 65%.

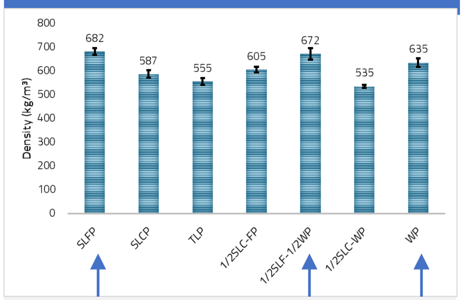
620 mm x 620 mm with a thickness ranging from 50 mm to 60 mm → of 600 mm x 600 mm x 16 mm

Chapter 1. Performance of innovative sustainable structures

1. Research on the effect of particle size and geometry on the performance of single-layer and three-layer particleboards made from sunflower seed husks

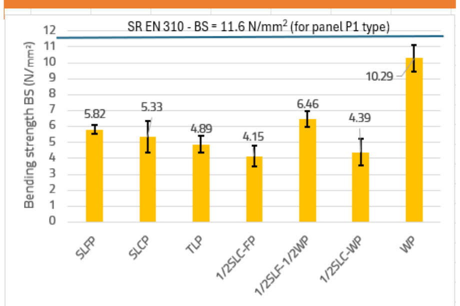
Results and discussions

Density



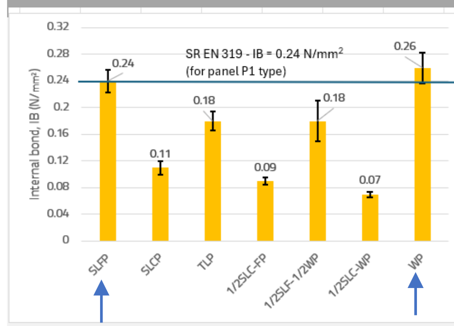
Highest values were obtained for:
- fine particleboard SLFP and 1/2SLF-WP (50% fine particles and 50% wood particles)
- For coarse particle boards, the density was lower due to the reduced degree of compaction

The bending strength - BS



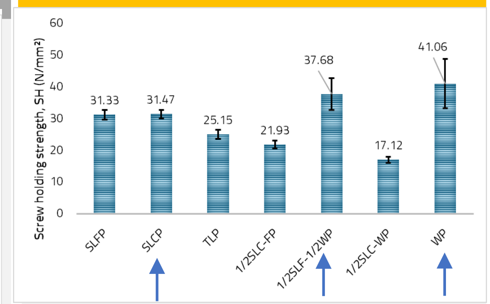
- The bending strength values (BS) were lower than the requirements of standard SR EN 312 (2011)

Internal bond - IB



- The particleboard with 100% fine sunflower husks (SLFP), meets the requirements of the SR EN 312 standard for general purpose boards used in dry environments of type P1
- **Particle size and geometry had a significant influence on IB**

Screw holding strength - SH



- **Particle size and geometry had a significant influence on SH.**

- Fine particles with flat surfaces and a fusiform shape allowed better adhesion between them, resulting in a more compact and homogeneous structure

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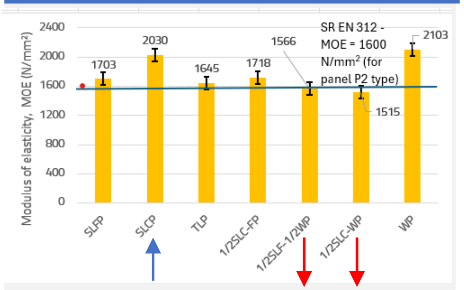
1. Research on the effect of particle size and geometry on the performance of single-layer and three-layer particleboards made from sunflower seed husks

Results and discussions

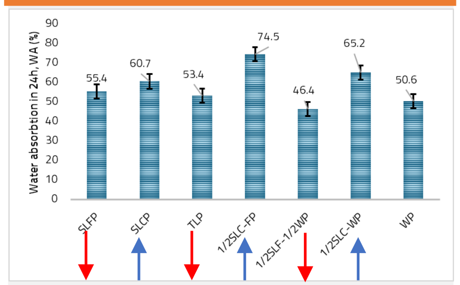
Modulus of elasticity - MOE



- The highest value of MOE for SLCP (coarse particles) lead to an increase in the rigidity of the panels.

- The particleboards **1/2SLF-WP and 1/2SLC-WP** do not meet the limits of the standard for P2 type panels (SR EN 312 / 2011)

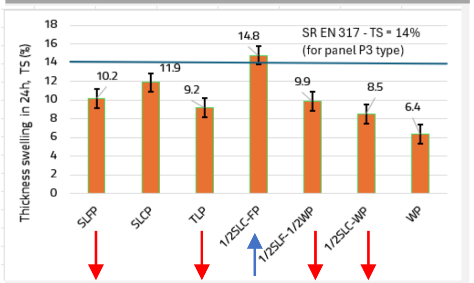
Water absorbtion - WA



- Structures with SLCP had the highest values for water absorption *due to the porosity caused by the concavity and variation in the shapes of the husks.*

- All boards with fine FP in the outer layers had low values, *due to their higher compactness and low wettability*

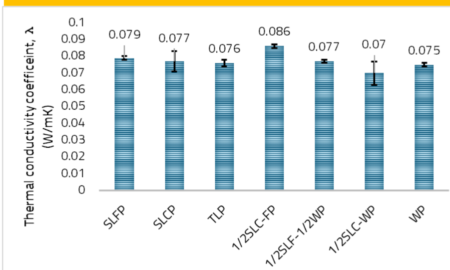
Thickness swelling - TS



- All boards with fine particles (FP) in the outer layers had low values, *due to their higher compactness and low wettability*

- 1/2SLC-FP meet the requirements of SR EN 317 for P3 type panel

Thermal conductivity



The thermal conductivity coefficients indicated good thermal insulation properties for all particleboards, compared to the normal range for insulation materials, *which, according to bibliographic references, is between 0.035 W/mK and 0.160 W/mK.*

Chapter 1. Performance of innovative sustainable structures

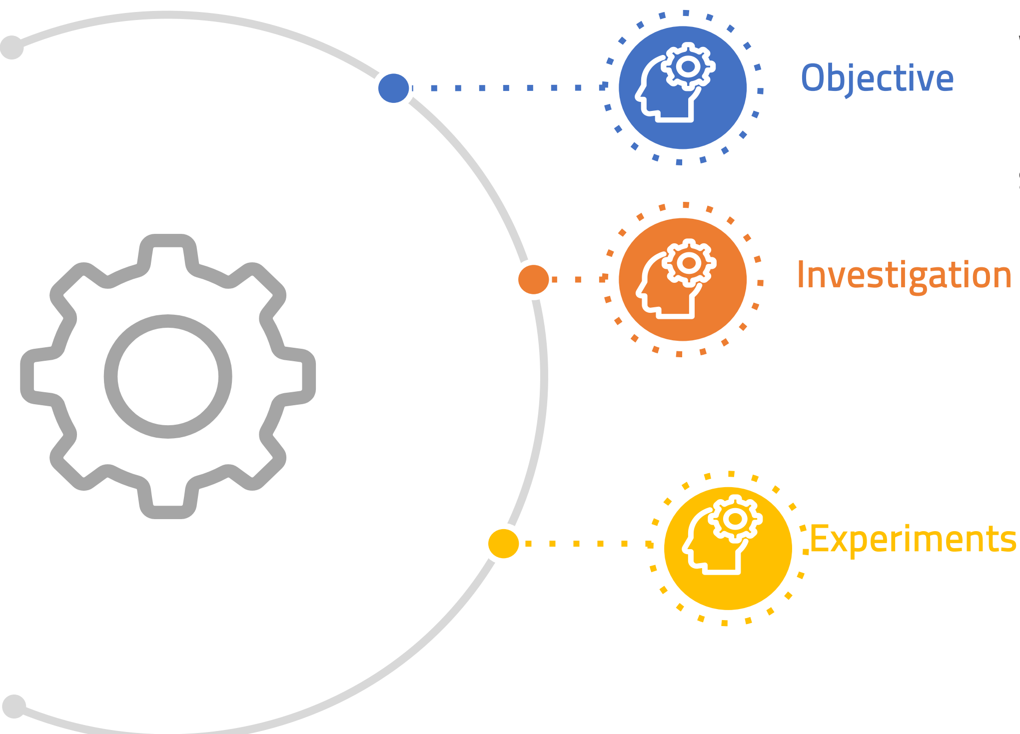
1. Research on the effect of particle size and geometry on the performance of single-layer and three-layer particleboards made from sunflower seed husks

Conclusions

1. The size and shape of the particles obtained from sunflower seed husks influenced the performance of the studied particleboards.
2. For boards made from coarse particles, due to their concave geometry, the structure obtained was much more porous, which affected water absorption at 24 hours (WA), as well as internal bond strength (IB).
3. The best performance was achieved for panels made from 100% fine particles (SLFP). These have a density approximately equal to that of panels made entirely from wood particles, 682 kg/m^3.
4. Due to the low density of the three-layer panels (TLP), the bending strength (BS) was negatively affected.
5. The particleboards manufactured in this research can be used for paneling structures and furniture components that are not subjected to bending stresses.

Chapter 1. Performance of innovative sustainable structures

2. RESEARCH ON THE INFLUENCE OF ADHESIVE TYPE AND CONTENT ON THE PROPERTIES OF PARTICLEBOARDS MADE FROM SUNFLOWER HUSKS



The main objective of this research was to manufacture innovative sustainable particleboards made from 100% sunflower husks, with physical and mechanical properties similar to those of particleboards (PAL).

The investigation also assessed how the use of different shares of adhesives affects the physical and mechanical properties of the resulting panels.

The experiments were conducted under laboratory conditions. The composites and investigations were carried out on laboratories of Faculty of Furniture Design and Wood Engineering and ICDT

Chapter 1. Performance of innovative sustainable structures

2. RESEARCH ON THE INFLUENCE OF ADHESIVE TYPE AND CONTENT ON THE PROPERTIES OF PARTICLEBOARDS MADE FROM SUNFLOWER HUSKS

Materials

Sunflower husks (Helianthus annuus L.)	The husks were sieved through sieves with mesh sizes ranging from 4 mm to 0.5 mm. *The fraction of particles was 2.55 mm to 4.76 mm in **length**, 1.05 mm to 2.3 mm in **width** and 0.2 mm in **thickness**.*
1 UREA-FORMALDEHYDE (UF)	Three commercial variants of urea-formaldehyde adhesives UCL (9%, 12%), **U96** (9%, 12%) and **AG**. *The difference consist in synthesis method and the formaldehyde/urea molar ratio*.
2 Phenol-formaldehyde (PF)	Phenol-formaldehyde (PF 9%. 12%)
3 POLYMERIC DIPHENYLMETHANE DIISOCYANATE (pMDI)	pMDI (3%, 6%) offers high bond strength, faster reaction time and superior water resistance
4 Mixtures of VM/AG = Modified Melamine-Formaldehyde	VM/AG (9%, 12%) - 20:80 by weight
5 PF/pMDI = Phenol-formaldehyde/ Polymeric Diphenylmethane Diisocyanate	PF/pMDI (9%) - 70:30 by weight

Chapter 1. Performance of innovative sustainable structures

2. RESEARCH ON THE INFLUENCE OF ADHESIVE TYPE AND CONTENT ON THE PROPERTIES OF PARTICLEBOARDS MADE FROM SUNFLOWER HUSKS

The bord manufacturing

01 The milled husk particles were weighed and mixed with the selected adhesive in a blender

02 Panels *(420 mm x 420 mm)* were formed manually with a homogeneous single-layer structure.

03 Panels were hot pressed at 2.5 N/mm² to achieve a target density of 600 kg/m³.
Pressing parameters: 7min (UCL, U96, VM/AG, PF, PF/pMDI).
4 min (pMDI)

04 The panels were conditioned at a 20°C and 65% relative humidity until they reached equilibrium moisture content

05 Panels were cut to their final dimensions *(400 mm x 400 mm, and thickness of 16 mm).*
2 replicates were made for each panel type

Chapter 1. Performance of innovative sustainable structures

2. RESEARCH ON THE INFLUENCE OF ADHESIVE TYPE AND CONTENT ON THE PROPERTIES OF PARTICLEBOARDS MADE FROM SUNFLOWER HUSKS

Panels testing

Physical properties

Density

The test was performed on specimens measuring 20 mm x 20 mm

Water absorption (WA) and thickness swelling (TS)

were tested 5 specimens (50mm x 50 mm) from each particleboard - 24 hours .The mass and thickness were measured.

Profile density

DPX300 X-ray equipment

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2. RESEARCH ON THE INFLUENCE OF ADHESIVE TYPE AND CONTENT ON THE PROPERTIES OF PARTICLEBOARDS MADE FROM SUNFLOWER HUSKS

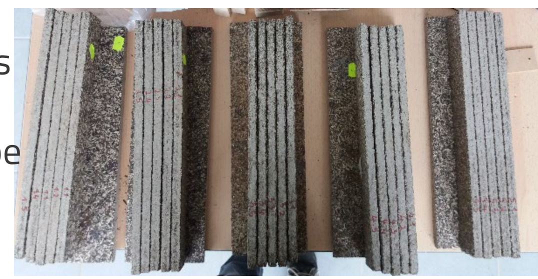
Panels testing

Mechanical properties

ANOVA test (one-way analysis of variance) was used to evaluate the effects of the type of adhesive and its content *(significance level of $p \leq 0.05$)*

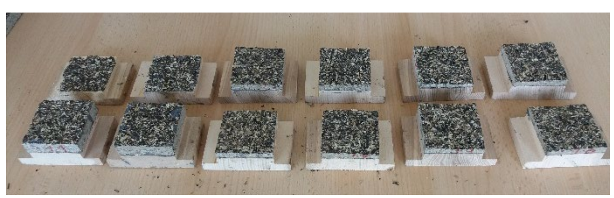
Modulus of rupture (MOR) and modulus of elasticity (MOE)

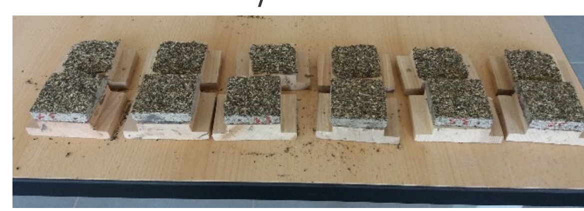
Specimens with width of 50 mm and length according with the thickness of the particleboards. 10 measurements were performed for each test



Internal bond strength (IB)

Perpendicular to the plane of the board - dimensions of specimen 50mm x 50mm. 10 measurements were performed for each test.





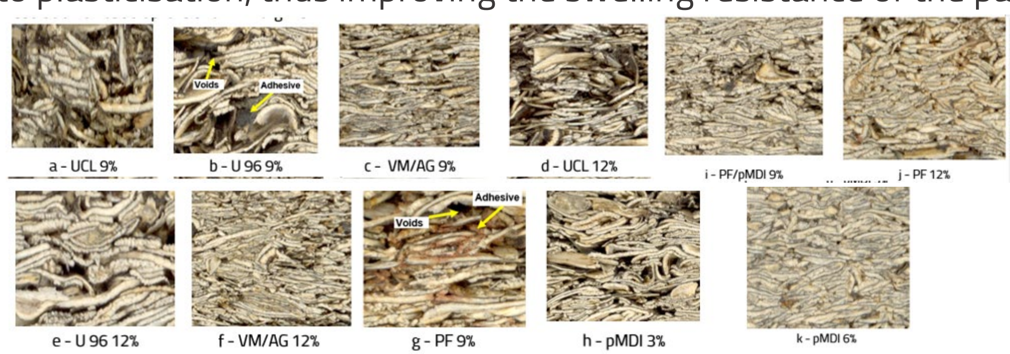
Testing equipment – Zwick/Roell Z010

Chapter 1. Performance of innovative sustainable structures

2. RESEARCH ON THE INFLUENCE OF ADHESIVE TYPE AND CONTENT ON THE PROPERTIES OF PARTICLEBOARDS MADE FROM SUNFLOWER HUSKS

Results and discussions – Morphological characteristics

- The panels made from sunflower husk particles appeared rigid and strong. The particles showed good cohesion and were not easily detached.
- For panels made with 6% pMDI, 12% PF and 12% VM/AG, more compact structures and uniform particles distribution were observed.
- The adhesives were evenly distributed over the surface of the particles and filled the gaps between them, thus ensuring adequate adhesion among the particles.
- Panels with 3% pMDI showed a less compact structure, with partial adhesive bonding causing particle agglomeration and localized voids when urea–formaldehyde adhesive was applied.
- pMDI penetrated the amorphous components of the cell wall of the sunflower seed husk at the molecular level, which led to plasticisation, thus improving the swelling resistance of the panels

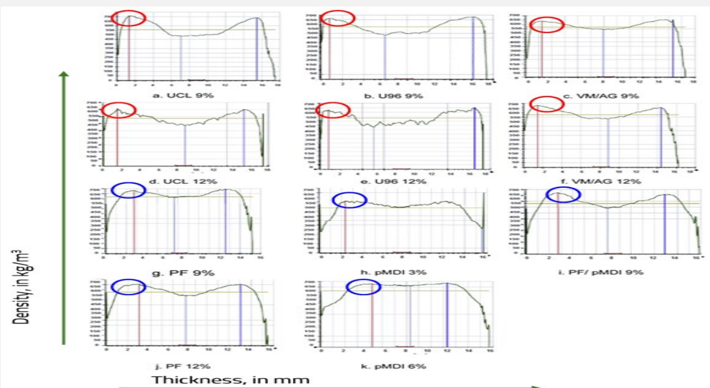


Chapter 1. Performance of innovative sustainable structures

2. RESEARCH ON THE INFLUENCE OF ADHESIVE TYPE AND CONTENT ON THE PROPERTIES OF PARTICLEBOARDS MADE FROM SUNFLOWER HUSKS

Results and discussions

Density



- A maximum density was recorded at 1 mm from the surface for UF panels (red), and at 3-4 mm from the surface for phenol-formaldehyde/ polymeric diphenylmethane diisocyanate (PF/pMDI) panels (blue).
- Density was app. 550 kg/m^3 and for pMDI panels around 490 kg/m^3

Boards with low density category

Physical properties

	Type of used adhesive	Adhesive content (%)	Density (kg/m^3)	Thickness swelling (TS) at 24h (%)	Water absorption (WA) at 24h (%)
UF	UCL	9	556 (27.8)	41.2 (6.1)	125.3 (11.6)
		12	573 (21.6)	38.4 (5.6)	110.5 (13.3)
	U96	9	577 (39.0)	44.5 (1.5)	140.2 (3.1)
		12	580 (21.0)	41.2 (6.1)	126.4 (10.1)
	VM/AG	9	570 (40.0)	40.3 (0.6)	124.9 (3.4)
		12	574 (23.8)	32.2 (1.2)	106.9 (15.4)
	PF	9	570 (16.7)	19.9 (3.3)	69.5 (6.2)
		12	524 (29.3)	20.8 (3.7)	68.7 (6.0)
	pMDI	3	495 (20.9)	56.0 (3.6)	131.7 (6.4)
		6	535 (19.3)	29.7 (1.6)	76.0 (14.4)
	PF/pMDI	9	520 (16.5)	31.4 (0.6)	81.3 (4.9)

The values in parentheses represent standard deviations

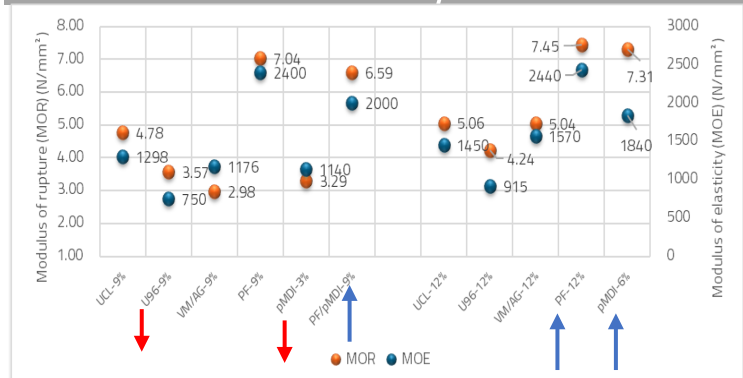
- All panels had thickness swelling TS values higher than limit recommended for P3 type panels
- **Type of adhesive has a significant influence on the TS and WA values**
- **The statistical impact of the adhesive content level was more evident for pMDI**

Chapter 1. Performance of innovative sustainable structures

2. RESEARCH ON THE INFLUENCE OF ADHESIVE TYPE AND CONTENT ON THE PROPERTIES OF PARTICLEBOARDS MADE FROM SUNFLOWER HUSKS

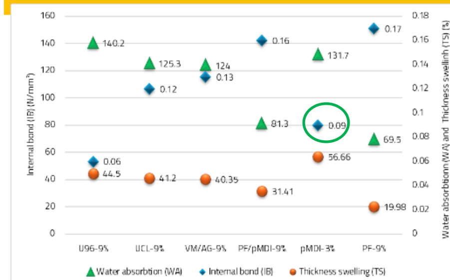
Results and discussions - Mechanical properties

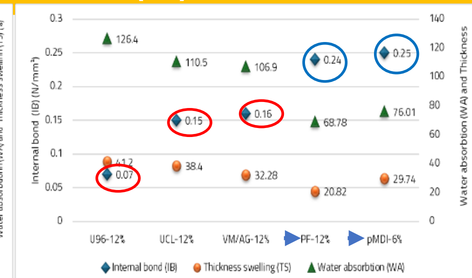
Modulus of rupture and Modulus of elasticity



- U96 adhesive panels had the poor performance for MOE and MOR
- The combination of UF and modified melamine-formaldehyde (VM/AG) - slightly improved mechanical properties
- All panels had values below the minimum modulus of rupture requirements of standard SR EN 312

Internal bound (IB)





- An increase in adhesive content from 9% to 12% improved IB for all panels
- All panels with UF adhesives had the lowest internal bond values at both adhesive content levels
- **Statistical analyses showed that the mechanical properties of the experimental panels (MOR, MOE and IB) were significantly influenced by the type of adhesive**

Chapter 1. Performance of innovative sustainable structures

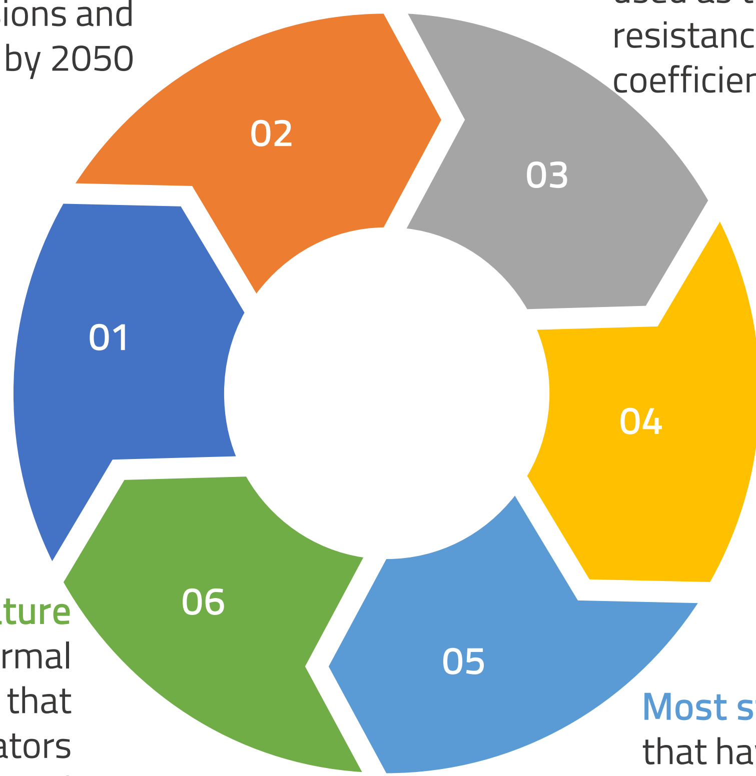
2. RESEARCH ON THE INFLUENCE OF ADHESIVE TYPE AND CONTENT ON THE PROPERTIES OF PARTICLEBOARDS MADE FROM SUNFLOWER HUSKS

Conclusions

1. Adhesive type and content significantly affected sunflower husk composite panel properties, with content influencing pMDI panels more than UF and PF.
2. Higher thickness swelling (TS) and water absorption (WA) values were observed for UF panels at the two adhesive content levels
3. The best dimensional stability and mechanical properties of the structures were observed for PF at both adhesive content levels, followed by PF/pMDI (9%) and pMDI (6%). PF and pMDI panels met EN 312 requirements standards for general use
4. In production of particleboards, sunflower husks are compatible with UF, PF and pMDI adhesives and represent an alternative material to wood for the manufacture of particleboards.
5. The experimental particleboard presents a potential for indoor use as light panels for paneling or other decorative products.

Chapter 2. Sustainable thermal insulation structures

Literature:



Performance
At EU level, 85% of buildings were build before 2000 and 75% of these have low energy performance

Improving the energy performance
is essential for saving energy, achieving the goal of zero emissions and complete decarbonization by 2050

For materials
used as thermal insulators, high heat flow resistance and a low thermal conductivity coefficient are recommended.

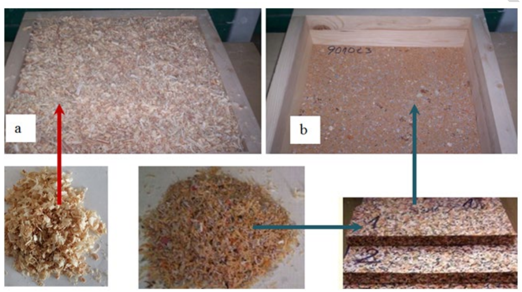
Raw materials
from renewable or recycled sources (environmentally friendly) for the manufacture of building structures is an important strategy for sustainable development.

Most studies
that have investigated thermal insulation materials (cork, bark, rice straw, hemp) have reported low densities and low thermal conductivity coefficients

The literature
presents research on the thermal insulation capacity of materials that can replace traditional insulators (polystyrene, mineral wool and glass wool, polyurethane and cellular glass)

Chapter 2. Sustainable thermal insulation structures

1. Thermal conductivity of sandwich structures for exterior walls of wooden houses



HFM436 Lambda equipment

Objective

The objective of this research
was to create, innovative sandwich structures for the exterior walls of wooden houses, with a thickness of 175 mm, with different types of core filling materials

Physical properties

The structures
were tested to measure thermal conductivity.

Materials

Sustainable materials
Acrylonitrile butadiene styrene (ABS); waste panels Wood shavings (WS); Mineral wool (RW) in bulk form; OSB panels; Gypsum boards; Polyethylene foil

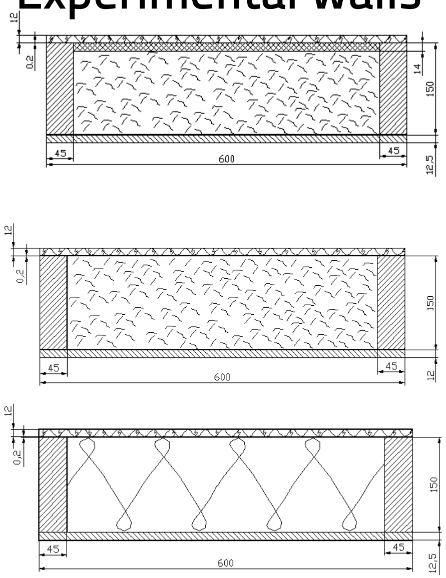
Experiments

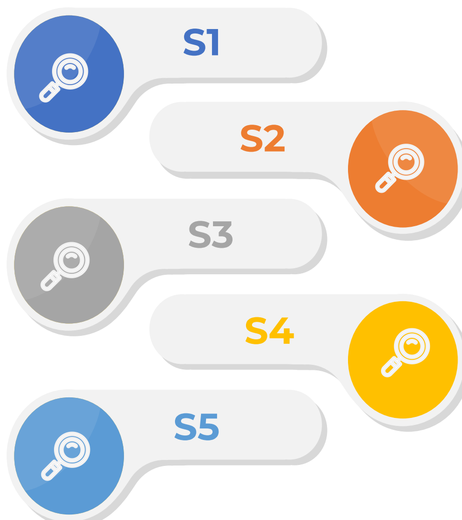
The experiments
were conducted under laboratory conditions. The structures and investigations were carried out on laboratories of Faculty of Furniture Design and Wood Engineering and ICDT

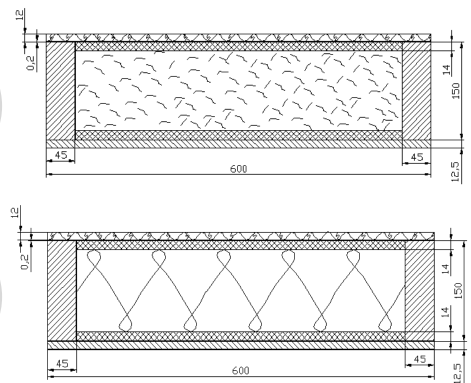
Chapter 2. Sustainable thermal insulation structures

1. Thermal conductivity of sandwich structures for exterior walls of wooden houses

Experimental walls







- Wood shaving had moisture content 8.2% - 8.7%
- Structures were conditioned at relative humidity of 65% and a temperature of 20 °C
- For each 5 structures, 2 specimens were made
- For testing the difference of temperature was $\Delta T = 20$ °C

Structures build	Inside face sheet		Core				Outer face sheet
	Gypsum board	polyethylene foil	ABS	Wood shaving	Rock wool	ABS	OSB
Structure 1 (S1)	x	x	-	x	-	x	x
Structure 2 (S2)	x	x	x	x	-	x	x
Structure 3 (S3)	x	x	-	x	-	-	x
Structure 4 (S4)	x	x	x	-	x	x	x
Structure 5 (S5)	x	x	-	-	x	-	x

x – raw material used in the structure

- Frame – spruce (*Picea abies*) 45 mm thickness
- Spruce shaving 80%, beech shaving 20%
- Rock wool (RW)
- Gypsum board – 12.5 mm
- OSB panel – 12 mm
- Polyethylene foil – vapor barrier
- Shaving length 12mm – 38.7 mm
- Particles thickness 0.2mm – 0.5 mm
- The ratio of flat chips and particles in the mixture was 25% and 75%, respectively

$\Delta T = T_1 - T_2$ in °C	$T_m = \frac{T_1 + T_2}{2}$ in °C													
	-5		0		5		10		15		20		25	
	T1	T2	T1	T2	T1	T2	T1	T2	T1	T2	T1	T2	T1	T2
10	0	-10	5	-5	7.5	2	15	5	20	10	25	15	30	20
15	2.5	-12.5	7.5	-7.5	12.5	-2.5	17.5	2.5	22.5	7.5	27.5	12.5	32.5	17.5
20	5	-15	10	-10	15	-5	20	0	25	5	30	10	35	15
25	7.5	-17.5	12.5	-12.5	17.5	-7.5	22.5	-2.5	27.5	2.5	32.5	7.5	37.5	12.5
30	10	-20	15	-15	20	-10	25	-5	30	0	35	5	40	10

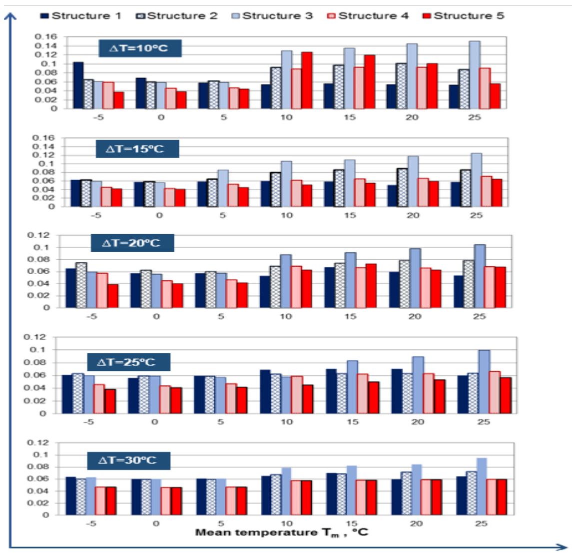
T_1 - upper plate temperature
T_2 - bottom plate temperature

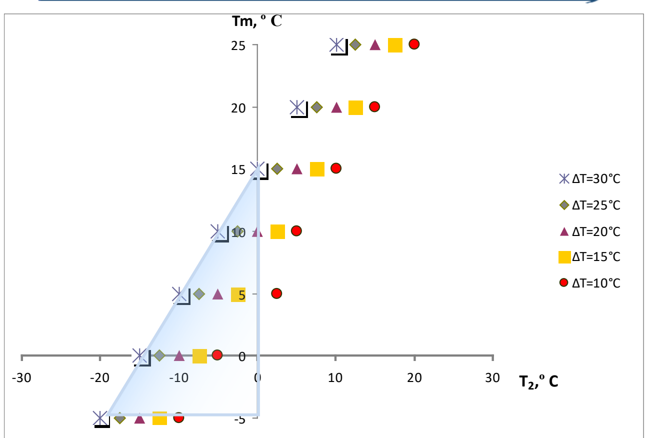
Parameters T2 and T1 simulated outdoor and indoor temperatures

Chapter 2. Sustainable thermal insulation structures

1. Research on the effect of particle size and geometry on the performance of single-layer and three-layer particleboards made from sunflower seed husks

Results and discussion





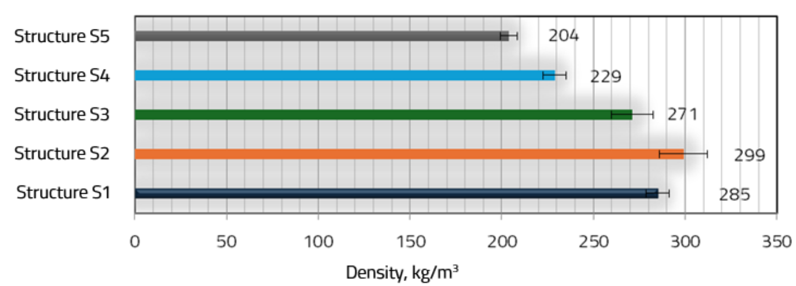
01. The mean temperature values were characterised by two ranges: Tm of -5 °C, 0 °C and 5 °C for the winter season and Tm (mean temperatures) of 15 °C, 20 °C and 25 °C for the summer season

02. The structures were subjected to successive cooling and heating processes, which influenced the thermal behavior of the core, leading to oscillatory variations of λ

03. S1 showed lowest thermal conductivity both seasons compared to S3 and S2. The gaps between flakes for S2 with loose bulk core shavings favor the heat flow, resulting in convective heat transfer and a higher λ

04. The S5 and S4 the lowest values of λ during the test cycle

05. It was found that ΔT and density have a significant influence on the measured thermal conductivity, while the influence of the mean temperature was not statistically significant.



Chapter 2. Sustainable thermal insulation structures

1. Research on the effect of particle size and geometry on the performance of single-layer and three-layer particleboards made from sunflower seed husks

Conclusions

1. S5 and S4 showed the best thermal performance due to low-density rock wool cores, achieving lower thermal conductivity than wood shaving structures.
2. S1, with a wood shaving core and external ABS board, showed stable thermal conductivity and better performance than S2 and S3.
3. Heating–cooling cycles caused oscillating thermal conductivity, reflecting combined heat transfer and moisture-related phenomena within the structures.
4. The ABS layer did not improve insulation in S2 and S4; density and temperature difference influenced thermal conductivity more than mean temperature.
5. Low-density compressed wood shavings are an eco-friendly, low-cost, and sustainable thermal insulation alternative to rock wool.

Chapter 2. Sustainable thermal insulation structures

2. Thermal insulation composites made from ecological materials

Objective

The objective of this research was to produce innovative composites from environmentally friendly materials

Materials

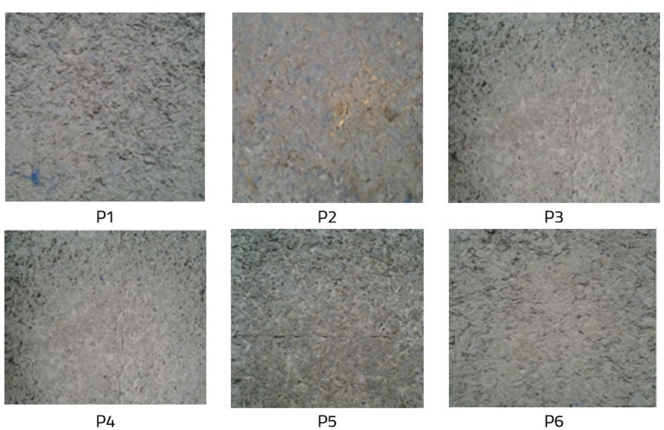
Cement-based composites Wood shavings and fibres, hemp particles, reeds wool, and cement as a binder were used

Physical properties

Their performance was investigated by thermal properties using HFM436 Lambda equipment

Experiments

The experiments were conducted under laboratory conditions. The composites and investigations were carried out on laboratories of Faculty of Furniture Design and Wood Engineering and ICDT



Composite code	Wood shavings (%)	Wood fibers (%)	Wool (%)	Hemp (%)	Reeds (%)	Cement (%)	Water (%)	Composite density (kg/m³)
P1	8.8%	-	4.4	-	-	47.3	39.5	729.16
P2	-	7.2	3.5	-	-	38.3	54.0	677.08
P3	4.4	-	4.4	4.4	-	47.3	39.5	733.33
P4	2.5	-	4.4	6.3	-	47.3	39.5	718.75
P5	6.3	-	4.4	2.5	-	47.3	39.5	708.33
P6	-	-	4.4	-	8.8	47.3	39.5	716.33

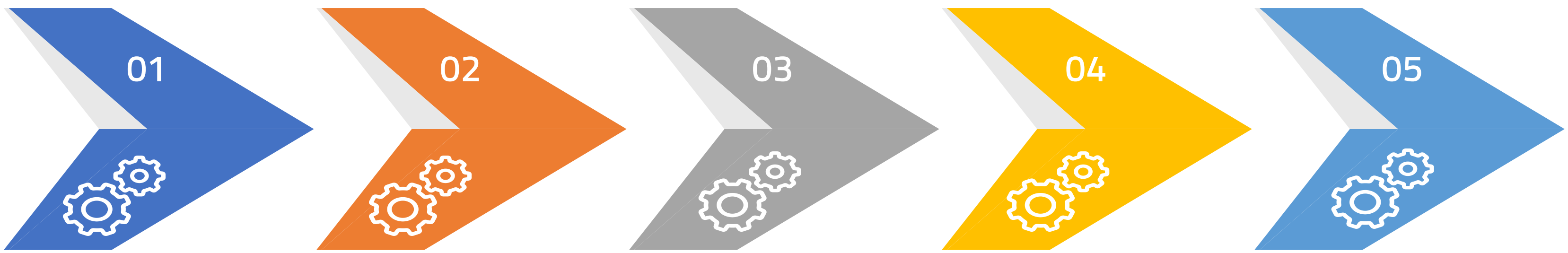
Chapter 2. Sustainable thermal insulation structures

2. Thermal insulation composites made from ecological materials

Composites manufacturing

The mixture was molded in wooden frames with internal dimensions of 450 mm x 450 mm x 30 mm

Composites were pressed into hot press at a temperature between 40°C and 50°C for five hours



Weighing materials
Mixing 10 min
Water added
Continuing mixing

Cold-pressed for 24 hours

Composites were conditioned at ambient temperature for 5 hours and then cut to their final dimensions of 400 mm x 400 mm x 30 mm

Chapter 2. Sustainable thermal insulation structures

2. Thermal insulation composites made from ecological materials

Results and discussions

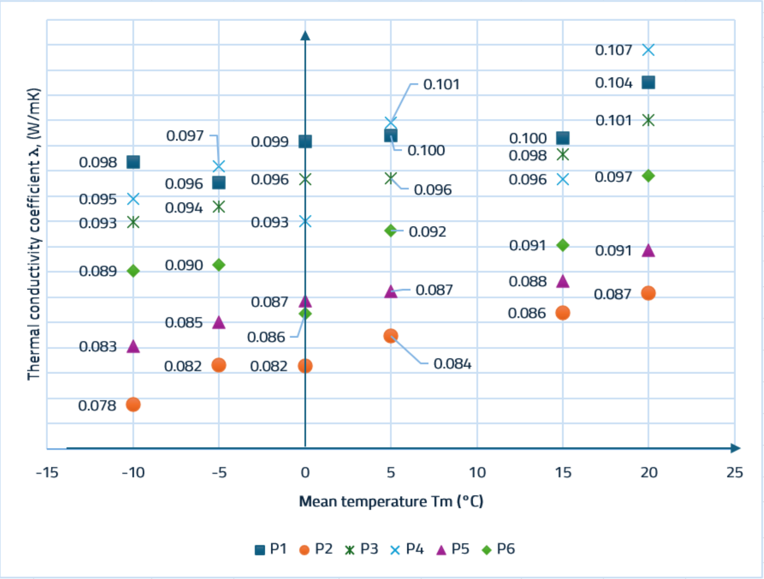
Thermal conductivity

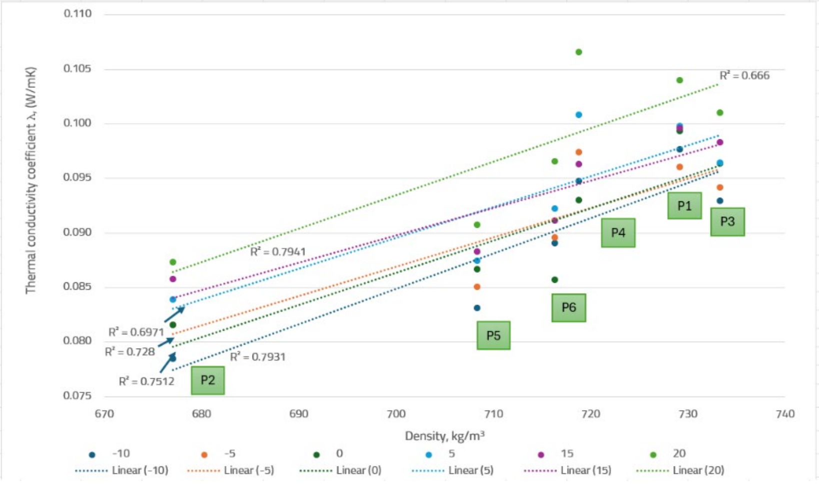
- The composite with wood fibers and wool (P2) recorded the lowest thermal conductivity values *ranging between 0.078 W/mK for an average temperature Tm= 10° C and 0.087 W/mK for Tm= 20° C.*

- The P5 composite made of wood particles, wool, and hemp also achieved good thermal conductivity coefficient values, *ranging between 0.083 W/mK and 0.090 W/mK.*

- The P5 composite has the highest amount of wood shavings (6.3%) compared to P4 (2.5%), which shows that the presence of this material contributes to improving the thermal performance of the panel.

- Lower composite density generally corresponded to reduced thermal conductivity across all mean temperatures, showing a good correlation between density and thermal conductivity





Chapter 2. Sustainable thermal insulation structures

2. Thermal insulation composites made from ecological materials

Conclusions

1. For all mean temperatures at which composites made from eco-friendly materials were tested, thermal conductivity coefficients ranging between 0.078÷0.107 W/mK were recorded
2. The composites produced contain environmentally friendly waste in their structure, which is in line with the guidelines of the circular economy concept of recycling these materials to obtain new products
3. The presence of wood fibres, wool and hemp in the composite structures (P2) led to good thermal conductivity coefficient results
4. The presence of reed in the composite structure led to lower thermal conductivity coefficient values compared to composites that had wood particles in their structure
5. The most efficient structure was composite P2, with thermal conductivity coefficient values ranging from 0.078 to 0.087 W/mK. With a density of 677.08 kg/m^3, composite P2 can be used as an insulating material for construction.

Chapter 2. Sustainable thermal insulation structures

3. Ecological gypsum-based composites

Objective

The objective of this research was to determine the thermal conductivity coefficient (λ) for seven composites

Materials

Cement-based composites Wood shavings, hemp particles and gypsum as a binder were used

Physical properties

Their performance was investigated by thermal properties using HFM436 Lambda equipment

Experiments

The experiments were conducted under laboratory conditions. The composites and investigations were carried out on laboratories of Faculty of Furniture Design and Wood Engineering and ICDT

Composites code	Wood shavings (g)	Hemp particles (g)	Gypsum (g)	Water (g)	Density (kg/m³)
R1	240	240	1920	870	1044.00
R2	180	180	3240	1434	420.00
R3	240	240	1920	1400	866.67
R4	720	-	2880	2100	1100.00
R5	180	180	3240	2000	1200.00
R6	360	-	3240	2000	1255.00
R7	-	360	3240	2000	1066.00

Measurement points	Lower plate temperature T1 (° C)	Upper plate temperature T2 (° C)	ΔT=T2-T1 (° C)	Mean (T2+T1)/2 (° C)
1	-20	0	20	-10
2	-15	5	20	-5
3	-10	10	20	0
4	-5	15	20	5
5	0	20	20	10
6	5	25	20	15
7	10	30	20	20
8	15	35	20	25

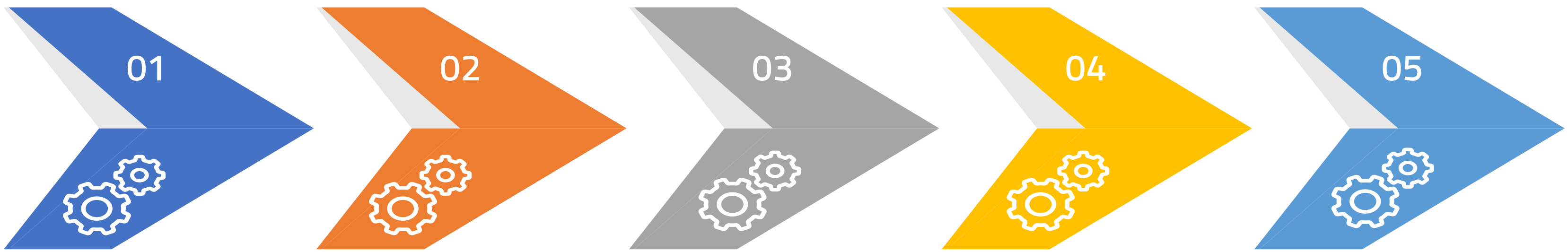
Chapter 2. Sustainable thermal insulation structures

3. Ecological gypsum-based composites

Composites manufacturing

The mixture was molded in wooden frames with internal dimensions of 350 mm x 350 mm x 20 mm

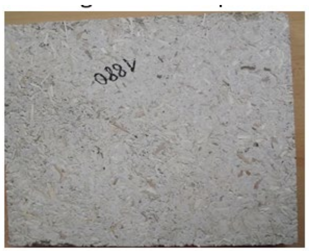
Composites were drying at the ambient temperature for five days



Weighing materials
Mechanical mixing

Cold-pressed for 10 min.

Composites were cut to their final dimensions of 300 mm x 300 mm.

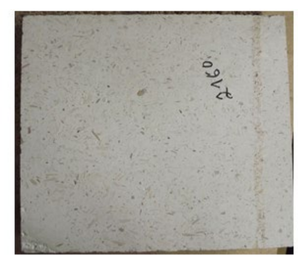


R1

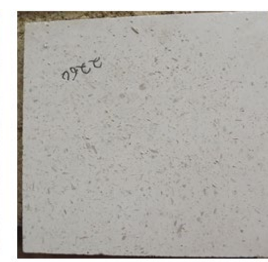
R2

R3

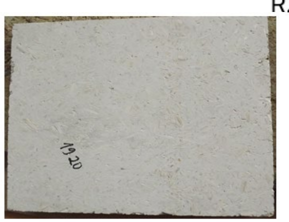
R4



R5



R6



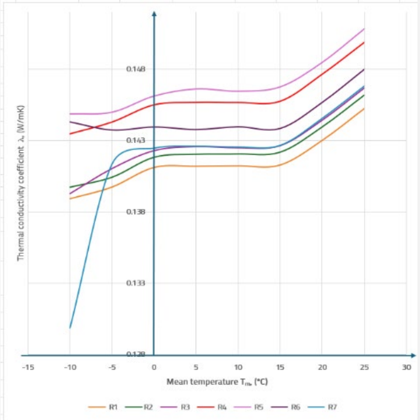
R7

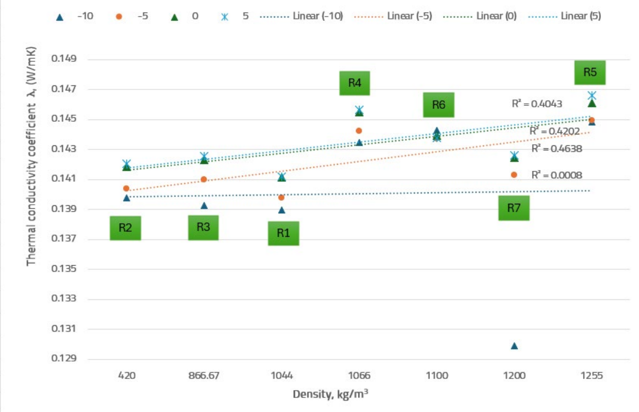
Chapter 2. Sustainable thermal insulation structures

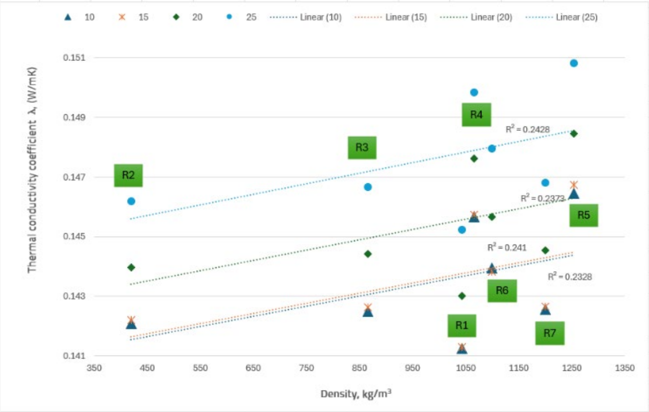
3. Ecological gypsum-based composites

Results and discussions

Thermal conductivity







- The measurements were taken at 8 temperature ranges (∆T = 20°C)
- Composite R1 had the lowest thermal conductivity coefficient values, while R5 had the opposite values
- R1 showed lower thermal conductivity than R2, indicating that higher proportions of ecological materials reduce thermal conductivity
- Excess water in panel R3 increased thermal conductivity compared to panel R1. The same situation was found in the case of panels R2 and R5
- The correlation between composite density and thermal performance was low at a mean temperature of ∆T = –5 °C indicating an acceptable relationship between the analyzed parameters
- In the case of low correlation, it cannot be stated that a decrease in density is followed by a decrease of the thermal conductivity coefficient.

Chapter 2. Sustainable thermal insulation structures

3. Ecological gypsum-based composites

Conclusions

1. Using wood shavings and hemp in insulation composites supports a circular economy, reusing waste and reducing the carbon footprint.
2. Structures R1 and R2, with equal wood and hemp shavings (240 g and 180 g), showed the lowest thermal conductivity values.
3. Despite identical wood and hemp content R3 and R1 composite (240 g), higher water in R3 (1400 g vs. 870 g) increased its thermal conductivity.
4. Higher hemp content in R7 reduced thermal conductivity compared to R6 with the same wood shavings amount.
5. Ecological-material composites showed thermal conductivity of 0.129–0.151 W/mK, slightly higher than wood fiber, wool, or wood/shavings–cement composites
6. The best thermal performance was recorded by the R1 composite, which had equal amounts of wood shavings and hemp particles. R1 is sustainable, aligns with circular economy principles, and can serve as construction insulation.

Chapter 3. Research on the quality of wood surfaces

Literature:

After mechanical processing
the quality of surfaces is defined by the set of irregularities with relatively small steps, which can often be seen in cross-section in the form of "peaks and valleys "

The processed surface
viewed in a normal plane consists of the roughness and waviness profile and the total profile, which also takes into account geometric form errors *(Gurău et al. 2006)*

Surface quality depends
on the machining process, including the machining type, cutting tool characteristics (tool type, cutting angle, and edge quality), and cutting parameters such as feed rate, tool speed, and cutting depth.

The roughness of the wood
surface represents an overlap of morphological characteristics (waviness, raised fibers, cutting tool marks, anatomical voids in the wood) and possible defects in the processing surface (material detached) *(Gurău 2004; Thibaut et al. 2016; Gurău and Irle 2017).*

Surface quality depends
on wood structure and is influenced by species, density, grain direction, anatomy, and moisture content.

To detect irregularities
in the wood surface and provide the most accurate data, using contact instruments is more effective than non-contact (laser) ones (*Gurău et al. 2001)*

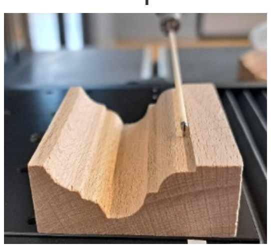
Research has identified
a set of roughness parameters for assessing the quality of wood and wood-based surfaces produced by various processing technologies, including turning, milling, sanding, laser cutting, and finishing
(Ra, Rz, Rt, Rv, Rq, Rsk, Wa, Rak, Rsm, Wa, Wt, Rk, Rpk, Rvk, A1, A2)

Measuring the roughness of wooden surfaces
requires an investigation length of 40–50 mm and a resolution of 5 μm *(Gurău and Irle 2017).* To eliminate waviness due to the processing process, it is recommended to use the Robust Gaussian Regression Filter

Chapter 3. Research on the quality of wood surfaces

1. Research on the quality of beech (*Fagus sylvatica* L.) surfaces processed by profile milling

MarSurf XT20 profilometer



Objective

The objective of this research was to analyse the quality of beech wood surfaces processed by profile milling with different cutting regimes and influence of milling cutter wear on the processed surfaces

Experiments

Their experiments were conducted under laboratory conditions. Investigation were carried out on laboratories of Faculty of Furniture Design and Wood Engineering and ICDT

Analyses

The applied roughness parameters enabled surface quality analysis across stratified levels of irregularities, distinguishing cutting tool marks, raised fibers, and accidental surface voids overlapping deep anatomical features such as earlywood pores.

Chapter 3. Research on the quality of wood surfaces

1. Research on the quality of beech (*Fagus sylvatica* L.) surfaces processed by profile milling

Research methodology

Beech wood – Was processed by profile milling in two passes to obtain profiles with a maximum depth of 16 mm. Milling was performed along the grain, obtaining test pieces with dimensions of 1000 mm x 50 mm x 20 mm

Milling process – The beech wood pieces were processed on a vertical spindle milling machine, using a milling cutterhead with four profiled blades

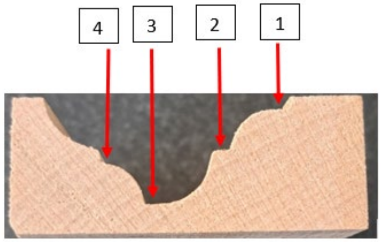
Milling parameters – Two rotation speeds (3308 rpm - n1 and 6594 rpm - n2) and two feed speeds (vf1 = 6.53 m/min and vf2 = 23.74 m/min)

Parameters combinations – Four combination between rotation speed and feed speed were used (n1-vf1; n1-vf2; n2-vf1; n2-vf2)

Tool wear – A second set of samples was prepared, by using the same cutting parameter combinations, but after the tool milled 600 m of beech wood

Samples – The strips, of each cutting case combination were cut to 60 mm x 50 mm x 20 mm. From the first set (sharpened tool): 3 samples. Second set (wear tool): 2 samples

Measuring points – For measuring only the straight zones were considered. Four point with different depth were investigated (point 1 – 2mm, point 2-8mm, point 3-16mm, point 4-10mm)

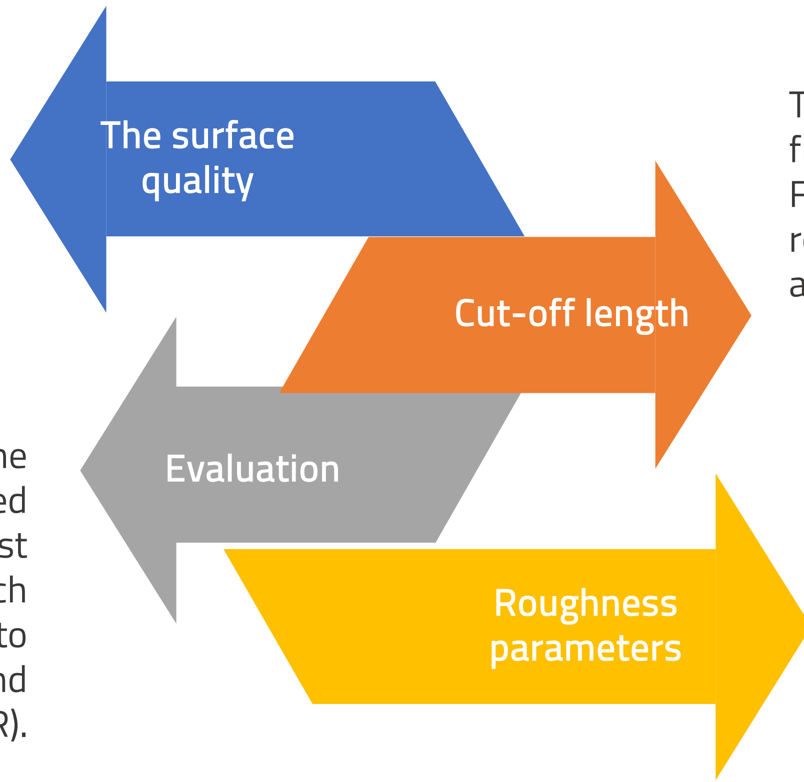


Chapter 3. Research on the quality of wood surfaces

1. Research on the quality of beech (Fagus sylvatica L.) surfaces processed by profile milling

Research methodology

The surface quality parameters were tested for their significance for all processing combinations (rotation speed-feed speed).



The cut-off length used for filtering was 2.5 mm.
For the first and second set 48 respectively 32 measurement along the grain were made.

Data evaluation began with the removal of form errors, followed by filtering using a Robust Gaussian Regression Filter, which separated measured data into waviness profiles (W) and roughness profiles (R).

Ra (arithmetic mean deviation of the profile)
Rv (largest absolute profile valley depth)
Rsk (skewness of the profile)
Wa (arithmetic mean deviation of the waviness)
Rk (core roughness depth)
Rpk (the reduced peak height)
Rvk (reduced valley depth)
A1 (upper area)
A2 (valley area)

Chapter 3. Research on the quality of wood surfaces

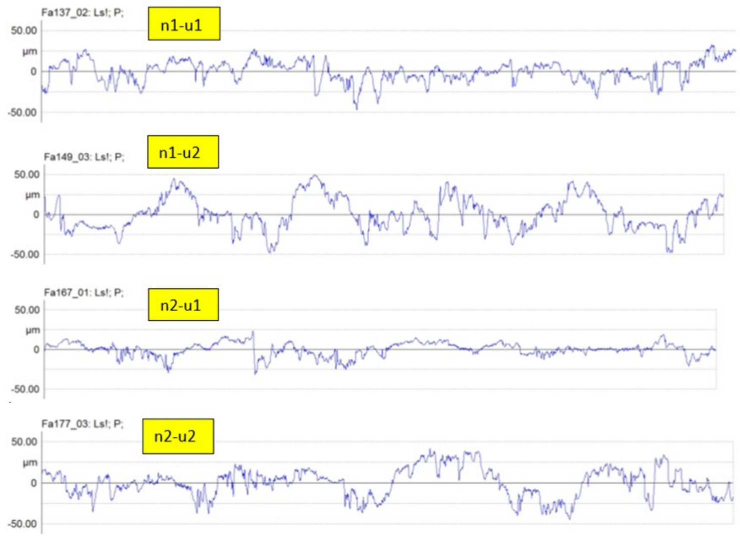
1. Research on the quality of beech (Fagus sylvatica L.) surfaces processed by profile milling

Results and discussion

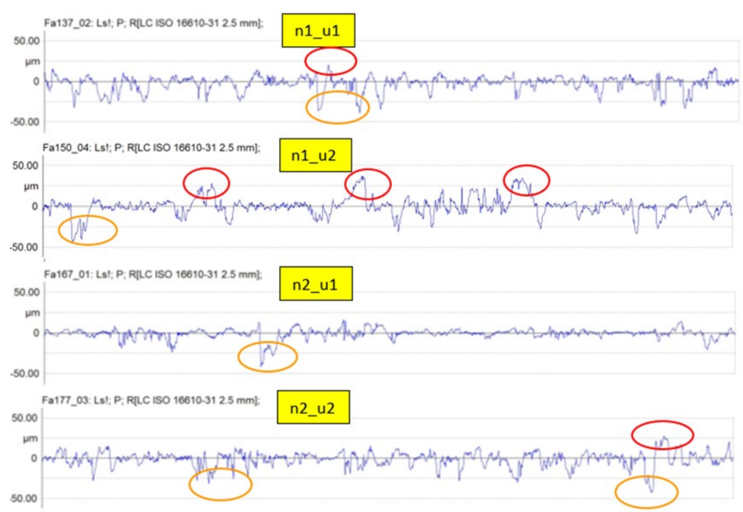
Surface roughness - Wa, Ra, Rk

- An increase in the feed speed from feed speed vf1 to vf2 (3.6 times) **has increased surface waviness**, *in the primary profiles*
- **Wa** parameter doubled in case of both rotation speeds
- **This result was statistically significant** *(for p<0.05 test ANOVA, followed by Dunnett T3 multiple comparisons)*
- an increase in the feed speed is increasing tool vibration, which leaves deeper waves in the surface

- **Rk increased when the feed speed increased**, by 24% for rotation speed (n1) and by 57% for n2 *(from 10.19 µm to 16.02 µm)*
- **Rk decreasing** when the feed speed was kept constant while the rotation speed increased
- Increasing the feed speed significantly **increased Ra**, no matter which rotation speed was used.



Primary profiles of waviness and roughness for all combinations of rotation speeds and feed speeds (sharpened tool)



Roughness profiles of each group combination, rotation speed-feed speed.

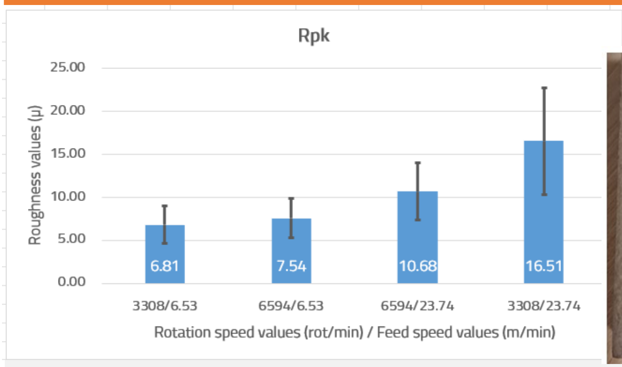
Raised fibers - marked in red
Deep isolated valleys - marked in yellow

Chapter 3. Research on the quality of wood surfaces

1. Research on the quality of beech (Fagus sylvatica L.) surfaces processed by profile milling

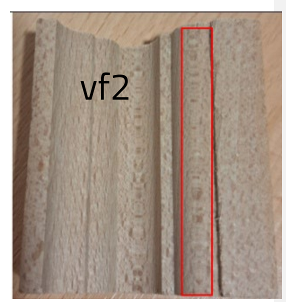
Results and discussion

Surface roughness - raised fibers Rpk

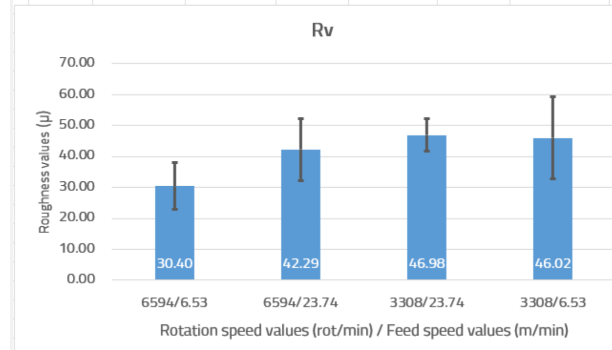


- The increase of feed speed (from vf1=6.53 m/min to vf2=23.74 m/min) has caused Rpk to increase for 2.4 times *(from 6.81 µm to 16.51 µm)* which was statistically significant

- For rotation speed (n2), a higher feed speed led to a 42% increase in Rpk and visible raised fibers, but these changes were not statistically significant.
- Overall, increasing rotation speed had no significant effect on fuzziness or raised fibers.



Surface roughness - deepest valley Rv



- Depending on the local wood anatomy Rv had a high standard deviation in comparison with the core roughness Rk

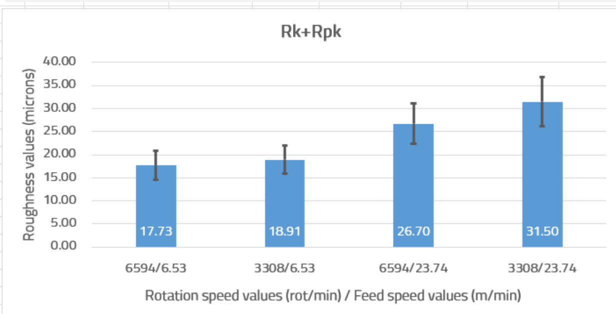
- Deep valleys in roughness profiles are mainly due to natural wood anatomy; however, cutting radial surfaces causes ray tissue detachment, increasing Rv by about 40% at feed speed vf2 compared with feed speed vf1.

Chapter 3. Research on the quality of wood surfaces

1. Research on the quality of beech (Fagus sylvatica L.) surfaces processed by profile milling

Results and discussion

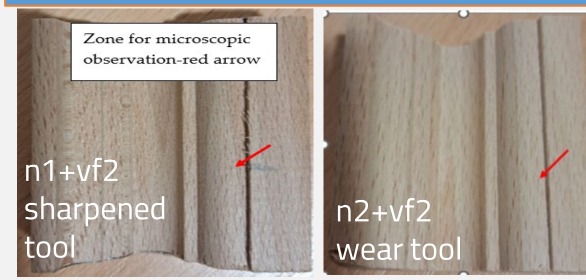
Surface roughness - Rk+Rpk



- The best surface quality was obtained when combining rotation speed n2 (6594 rot/min) + feed speed vf1 (6.53 m/min)

- The worst surface quality was obtained when combining rotation speed n1 (3308 rot/min) + feed speed vf2 (23.74 m/min)

Surface roughness - Tool wear



- after milling 600 linear meters of material, the surface quality improved

- The improvement was quantified to 30% roughness decrease for the rotation speed n2 and to 34% when the rotation speed n1 was used.

- surface quality is not only depending on the wood material and the processing parameters, but also by the tool working load, which is expected to vary with the milling parameters, as well as with the species types

Chapter 3. Research on the quality of wood surfaces

1. Research on the quality of beech (Fagus sylvatica L.) surfaces processed by profile milling

Conclusions

1. The surface quality should be analyzed on stratified levels of irregularities differentiating between, waviness, tool marks, fuzzy grain, and accidental surface gaps overlapped onto the wood deep anatomical cavities, such as pores from earlywood.
2. An increase in the feed speed is increasing tool vibration, which leaves deeper waves in the surface.
3. An increase in the feed speed is rising the wood fiber. Therefore, the Rpk parameter increased 2.4 times when the **feed speed increased** 3.6 times.
4. The smoothest beech surface is obtained when the smallest feed speed (6.53 m/min) is used. Including the surface gaps in the analysis (Rk+Rpk+Rvk) - the higher rotation speed (6594 rot/min) is also contributing to the surface quality improvement.
5. The statistical analysis helped to understand the hierarchy of influence factors and of their significance. Thus, the most important factor affecting the surface quality was the **feed speed**.
6. Measuring the surface roughness - immediately after sharpening or after a working period, influences the result of surface quality. Measurements of surface quality after the tool processed 600 m of beech material improved the surface quality by 30%.

Chapter 3. Research on the quality of wood surfaces

2. Experimental research on the roughness of ash and oak veneers obtained by slicing

Objective

The objective of the research
was to establish if the compression force applied by the pressure bar during planing would lead to significant differences between the roughness measured on the surface of veneer on which the bar is applied and the surface veneer cut by the cutters

Roughness parameters

To assess the roughness surfaces
Abbot curve parameters: Rk, Rpk, Rvk were used in investigation

Experiments

Their experiments
were conducted in the Wood Industry Manufacturing Precision Testing Laboratory at the Faculty of Furniture Design and Wood Engineering.

Materials

The research analysed
two wood species, namely ash veneer (*Fraxinus Excelsior*) and oak veneer (*Quercus Robur* L.) obtained industrially by slicing.
15 veneers from each species were investigate.


MicroProfFRT equipment

Scanning speed: 750 μm/s
Number of points scanned per line: 10000
Length investigated: 50 mm
Light spot diameter: 2 μm
Measurement resolution: 5 μm
Cut-off length: Lc = 2.5 mm

Veneer species	Veneer thickness (mm)	Moisture content of veneers (%)	Dimensions L x W (mm)
Ash	0.6	8.5	550 x 150
Oak	0.6	9.3	550 x 150

Chapter 3. Research on the quality of wood surfaces

2. Experimental research on the roughness of ash and oak veneers obtained by slicing

Results and discussion

Surface roughness – Rk, Rpk, Rvk

- After measuring the roughness parameters, the equipment software automatically applied a Gaussian filter on the recorded values

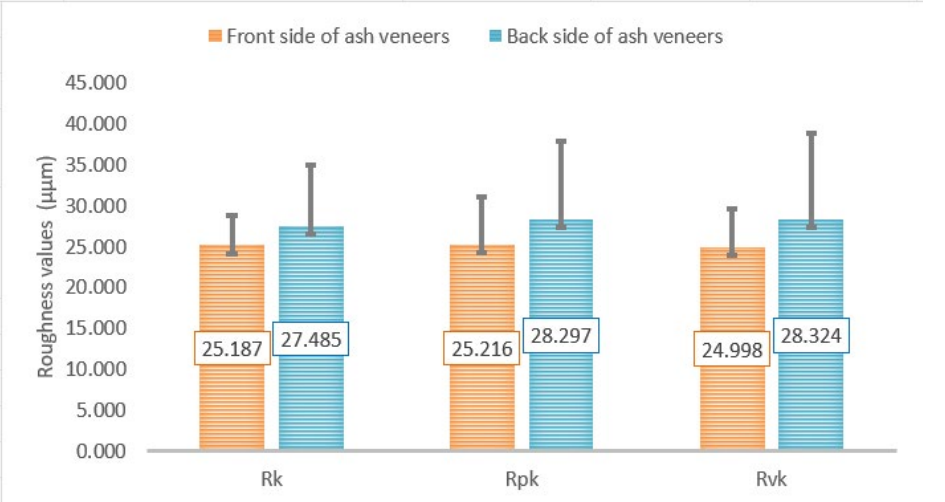
- To analyze the surface roughness and the influence of the press bar on it, the data were statistically evaluated using the Student's t-test

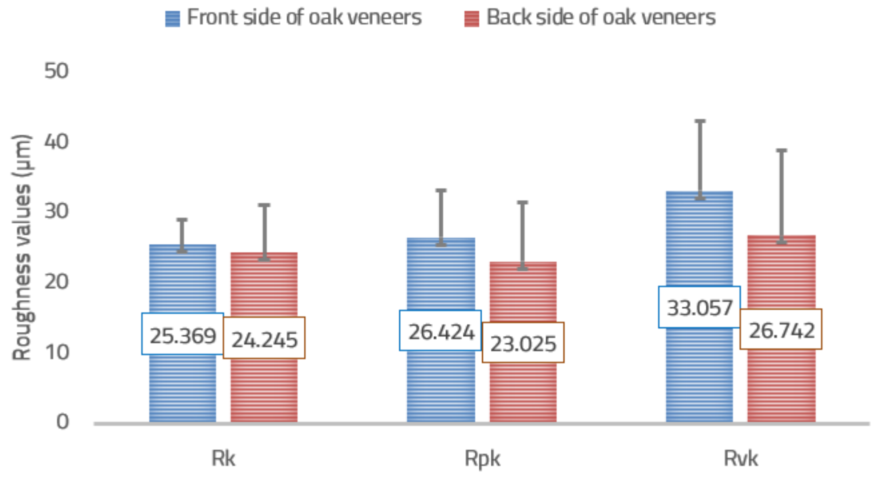
- The null hypothesis (H0) assumes that there are no significant differences between the mean roughness values measured on the front of the veneer (μ1) and on the back of the veneers (μ2)

- In the ash case, the roughness values on the front of the veneer are lower than the values recorded on the back of the veneer, where the pressing bar was applied.

- In the oak case all the roughness parameters investigated had higher values on the front of the veneer than on the back.

- Based on statistical analysis, it can be stated that the differences between the mean roughness parameters measured on the front and back of the veneers are not significant





Chapter 3. Research on the quality of wood surfaces

2. Experimental research on the roughness of ash and oak veneers obtained by slicing

Conclusions

1. The presence of raised fibres, measured by the Rpk roughness parameter, was recorded on both species of veneer, both on the front and back.

2. Compression of the veneer in the contact area due to the pressure bar led to the covering of the wood pores, so that in the case of oak veneers, higher roughness values were obtained on its surface.

3. In the case of ash, it is possible that the wear of the cutting edge led to higher roughness values on the front of the veneer in comparison with the values obtained on the back, even if the pressure bar on the back of the veneer compressed the wood and covered its pores.

4. The statistical analysis showed no significant differences for the roughness parameters means (Rk, Rpk, and Rvk) between both sides of ash and oak veneers, confirming that the working conditions were set correctly.

Chapter 3. Research on the quality of wood surfaces

3. Experimental research upon the quality of sanded surfaces of some decorative composite panels

The investigations
was carried out at the of Laboratory of Testing the Processing Accuracy in Wood Industry, within the Faculty of Furniture Design and Wood Engineering

The recovery of wood
waste from technological processes and its reuse in the manufacturing of new composite panels is part of the concept of circularity of wood raw materials.

1-The objective of the research
was to investigate the surfaces obtained after sanding using four grit sizes: 50 (*specific to calibration operation*), 80, 120 and 150 (*for final sanding operations*), of some decorative composite panels with a cross-section

After the adhesive had dried
the core was cross-cut to obtain panels with transversal wood structure of on their faces

The materials that used to
made decorative composite panels were: poplar (Populus nigra) and spruce (*Picea abies* L.) lamellas, and cherry (*Prunus avium*) and walnut (*Juglans regia* L.) lamellas

After gluing and calibrating
the panels are glued on their faces for obtaining the "reconstructed block"

Panels manufacturing
consisted in lamellas that were finger-jointed on length and edge-jointed on width

Chapter 3. Research on the quality of wood surfaces

3. Experimental research upon the quality of sanded surfaces of some decorative composite panels

Roughness measurement

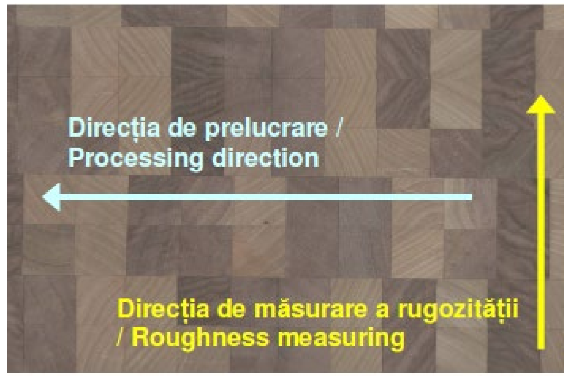
Ra, Rz, Rk, Rpk, Rvk

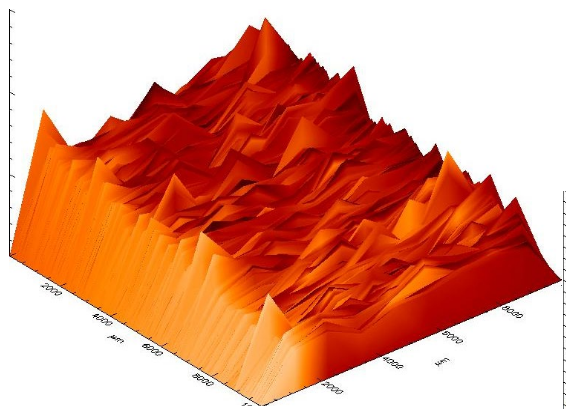
- The roughness measurements were made perpendicular to the sanding direction

- 8 samples of decorative panels were measured on 5 areas *in order to obtain an accurate assessment of the measurements*

- The parameters used to measure roughness were as follows: scanning speed: 750 μm/s; number of points scanned per line: 10000; Length investigated: 50 mm; Light spot diameter: 2 μm; Measurement resolution: 5 μm; Cut-off length: Lc = 2.5 mm.

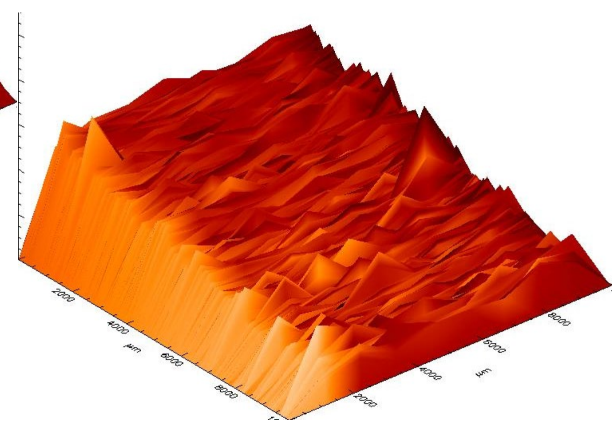
- The roughness profile was obtained after filtering the data with Gaussian filter





Spruce and poplar wood panel sanded with 80 grit size

Spruce and poplar wood panel sanded with 120 grit size



Chapter 3. Research on the quality of wood surfaces

3. Experimental research upon the quality of sanded surfaces of some decorative composite panels

Results and discussions

Surface roughness – Rk, Rpk, Rvk

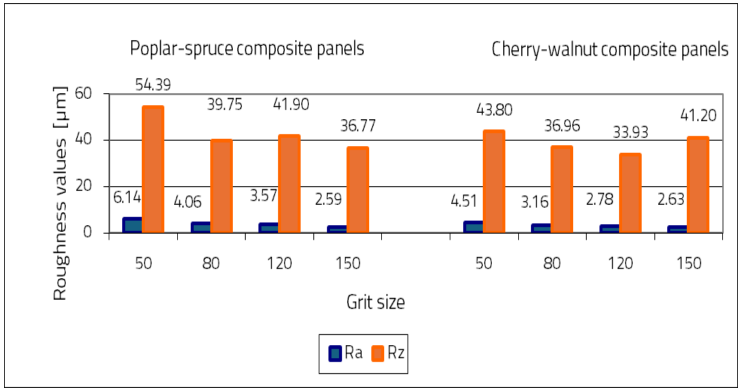
- In the case of Ra, Rk, Rpk (cherry-walnut) and Rvk roughness, the measured parameters highlighted a decrease in values with an increase in the grain size of the abrasive grit

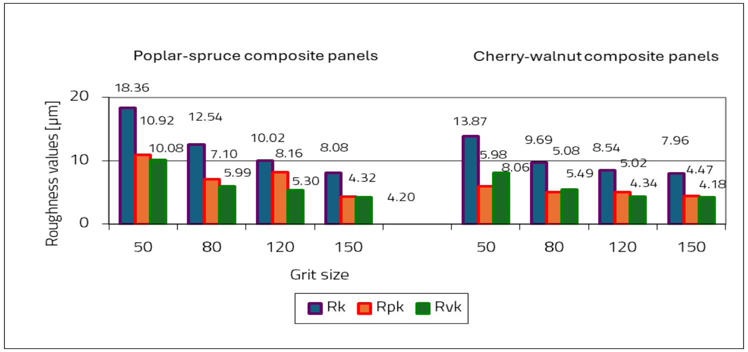
- Significant differences are observed for Rz, which increases when sanding spruce and poplar panels with 120 grit and cherry and walnut panels with 150 grit, due to the fiber orientation of the lamellas relative to the scanning direction.

- The scanning operation during the roughness measurement was not done on the same lamellas after sanding with different grit sizes.

- The Ra and Rz roughness are lower for the cherry-walnut panel compared to the poplar-spruce panel for all four abrasive paper grits.

- The roughness values Rk, Rpk and Rvk for the decorative cherry and walnut panel are lower compared to poplar-spruce panel, which means that they will perform better in finishing





Chapter 3. Research on the quality of wood surfaces

3. Experimental research upon the quality of sanded surfaces of some decorative composite panels

Conclusions

1. Increasing the abrasive grain size leads to a decrease in machining roughness (Rk), but differently for the two panels.
2. The results of measuring Rz roughness parameter after the final sanding lead to the conclusion that an extra-sanding operation is needed. The final sanding system used for the longitudinal structure of wood is not valid for the studied panels that have a transversal structure of wood on their faces
3. The measured roughness values exceed the recommended range for transparent finishing, limiting the decorative visibility of wood structure and color differences.
4. The roughness parameter Rpk highlighted the presence of fuzzy grain due to the anatomical structure of the panels made of poplar and spruce lamellas and less for panels made of cherry and walnut.

Results dissemination

The habilitation thesis is founded on:

- 8 publications, of which 5 scientific articles were published in Web of Science indexed journals and 3 articles were published in BDI indexed journals
- 1 scientific research project
- 2 patents
- 1 book
- 1 European Erasmus+ project

(B-ii) The evolution and development plans for career development

Academic and doctoral studies

Scientific title - Doctor

Thesis title: Contributions to the study of the construction and operation of profiled milling cutters for wood cutting.
Scientific supervisor Prof. Dr. Eng. Victor Dogaru

2005
Transilvania University of Brasov
(former University of Brasov)

Title obtained on 07.02.2005, in the field of Industrial Engineering

The bachelor degree diploma of Engineer

1984-1990
Transilvania University of Brasov
(former University of Brasov)

Faculty of Machine Construction Technology

(B-ii) The evolution and development plans for career development

Professional experience

- 2008 Associate Professor - "TRANSILVANIA" University of Brașov, Faculty of Furniture Design and Wood Engineering (former Faculty of Wood Industry)
- 2001 Lecturer – TRANSILVANIA University of Brașov, Faculty of Wood Industry
- 1997 Assistant - TRANSILVANIA University of Brașov, Faculty of Wood Industry
- 1995 Analyst-programmer - “TRANSILVANIA” University of Braşov, Faculty of Wood Industry
- 1991 Engineer - "TRANSILVANIA" University of Braşov, Faculty of Wood Industry

(B-ii) The evolution and development plans for career development

Other specialisations and qualifications

16 specialisations and qualifications

15.04.1991 – 05.07.1991	Programmer analyst. Centre for Advanced Training in Management Informatics, Brașov
15.06.1994	Auto-CAD R11 Level 1. ATC "UTIL" Brașov Faculty of Wood Industry, "TRANSILVANIA" University of Brașov
21 October 1996 – 23 October 1996	AutoCAD R12, Level 1. ATC "UTIL" Brașov Faculty of Wood Industry, "TRANSILVANIA" University Brașov
25.11.1996	AutoLISP. ATC "UTIL" Braşov Faculty of Wood Industry, "TRANSILVANIA" University of Braşov
November 2000	English for Technical and Business in the Wood Industry. "TRANSILVANIA" University of Braşov, Faculty of Wood Industry.
March 2001	COSMOS/M – Finite Element. INICAD SOFT SRL
May 2002	Programming in Engineering. TRANSILVANIA University of Braşov, Faculty of Wood Industry.
February 2006	Computer-aided design programme – Solid Edge. Brașov. Ada Computer Bucharest
1 December 2025 – 30 January 2006	Web Designing and Use of Web Page Tools. Transilvania University of Brașov. Leonardo Da Vinci WBT WORLD Programme.
May 2006	Certificate of linguistic competence – English. Transilvania University of Brașov. Continuing Education Department, Faculty of Letters, Centre for Modern Language Learning.
27 October 2006 – 20 December 2006	Internal auditor certificate. S.C. Cometam S.R.L. Bucharest
2007	Training on modern manufacturing precision testing equipment (CADESQ measuring table, DESQ and OPTO DESQ laminates) - German company HECHT ELECTRONIC A.G
September 2011	Certificate of attendance for the training course – Assuring the quality of the Results. The practical implementation of section 5.9. of the EN ISO/IEC 17025 Standard. Iaşi, Romania, as part of the Third International Proficiency Testing Conference PTCONF.
2011	ARACIS evaluator
19-20 September	Certificate of participation in the training course for external evaluators in the field of higher education quality. Organiser: ARACIS
1 March 2012 – 30 November 2012	DidaTec training programme organised by Transilvania University of Brașov, partner in the project University school for initial and continuing training of teaching staff and trainers in technical and engineering specialisations – DidaTec. Project co-financed by the European Social Fund through the Sectoral Operational Programme Human Resources Development 2007-2013

(B-ii) The evolution and development plans for career development

Teaching activities

Began in 1997 and consisted of teaching courses and practical laboratory and project activities for the eight study programmes:

Wood Processing Engineering
Part-time bachelors degree

Forest Engineering and Management
Full-time bachelors degree

Advanced Wood Structures and Innovative Technologies
Full-time master degree

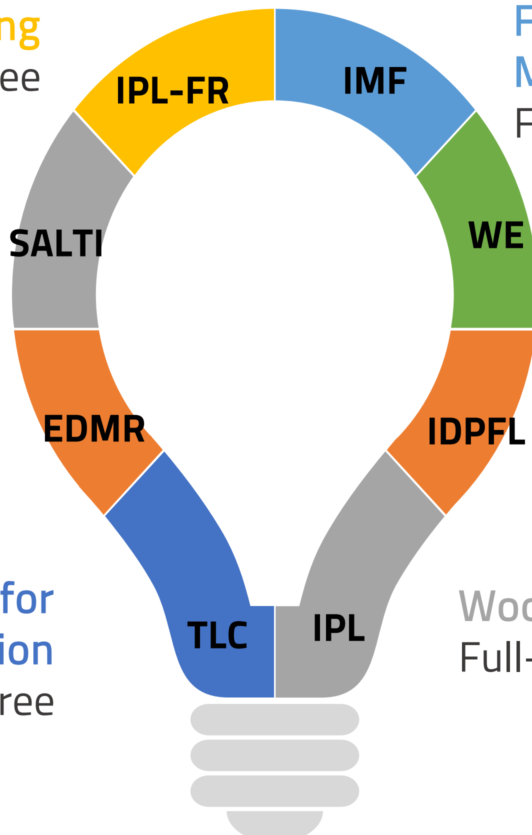
Wood Engineering
Full-time bachelors degree

Eco-design of Furniture and Restoration
Full-time master degree

Wood Products Engineering and Design
Full-time bachelors degree

Wood Technology for Construction
Full-time master degree

Wood Processing Engineering
Full-time bachelors degree



(B-ii) The evolution and development plans for career development

Awards and distinctions

- 2007 - Transylvania University Award for outstanding results in carrying out national research projects, as coordinator of the Research Department *Innovative Technologies and Advanced Products in the Wood Industry*.

Management experience

- **Manager of 2 international ERASMUS+ projects**
- **Vice-Dean** responsible for Student Activity and Relations with the Economic and Socio-Cultural Environment, Internationalization, and Teaching Activity: 2021–2024 and 2024 to present
- Coordinator of the Scientific Research Department C14 – *Innovative Technologies and Advanced Products in the Wood Industry:* 2008–2011 and 2013 – present
- **Member of the Council** of the Department of Wood Processing and Wood Product Design, Faculty of Furniture Design and Wood Engineering: 2011-2013 and 2015–2025
- **Member of the Senate** of Transilvania University of Brașov: 2016–2019 and 2024 – present

(B-ii) The evolution and development plans for career development

Research career development

- 2 international projects as Manager (UNITBV – partner in projects)

No.	Project name	Period	Amount UNITBV (Euro)
1	TAckling Environmental sustainability through Blended Learning opportunities for ivEt in the furniture and wood sector (TABLE). Proiect ERASMUS+ KA202, Cooperation for Innovation and the Exchange of Good Practices, Strategic Partnerships for vocational education and training. Total project 251818 EURO	2019 - 2021	29024
2	"Circular Economy Transition Manager: guiding companies of the furniture value chain to deploy their transition strategy for a more circular economy (CirCLER)," within the ERASMUS+, A.2 – Skills and Innovation, Topic: ERASMUS-EDU-2023-PI-ALL-INNO-EDU-ENT (Partnerships for Innovation - Alliances). Project no. 101140033. Total project 1168043 Euro	2024 - 2027	62493

- 3 international projects as team member (UNITBV – partner in projects)

No.	Project name	Period
1	Novel learning approach for ERGOnomic principles for deSIGNers working in the upholstery and sleep sectors by using Virtual Reality (ERGOSIGN), Funded by: ERASMUS+, Contract no. 2015-1-RO01-KA202-015091	2015-1017
2	Erasmus+ PN: 601011-EPP-1-2018-1-ES-EPPKA2-SSA - Programul: KA2: Cooperation for innovation and the exchange of good practices - Sector Skills Alliances. DITRAMA - Digital transformation manager: leading companies in Furniture value chain to implement their digital transformation strategy. Value 994094 Euro. No: Grant Agreement N° 2018 – 2992 / 001 – 001, Project Number 601011-EPP-1-2018-1-E	01.01.2019-31.12.2021
3	Erasmus+ PN:2018-1-IT01-KA202-006734 FACET- Furniture sector Avant-garde Creativity and Entrepreneurship Training finantator: Uniunea Europeana, Programme: KA2 - Cooperation for Innovation and the Exchange of Good Practices Strategic Partnerships for vocational education and training. Grant Agreement no. 2018-1-IT01-KA202-006734 Grant amount: 25342 Euro UNITBV. Project amount 324163 Euro	01.11.2018-30.04.2021

(B-ii) The evolution and development plans for career development

Research career development

- 8 national projects as team member

No.	Project name	Period
1	Network of scientific excellence for the Romanian wood industry, in the context of our country's integration into the European Union in 2007. CNCSIS development project No. 1339/2004. Duration: 3 years Project manager Prof. Dr. Eng. Loredana Anne-Marie Bădescu	2004-2007
2	Laboratory for testing manufacturing precision in the wood industry. Value 793,095 lei. CEEX Structural Development Project No. 168/2006, P-CONFORM type project, MODULE-4. Project manager Prof. Dr. Eng. Ivan Cismaru. Duration 2 years	2006-2008
3	Research and testing laboratory for quality and conformity certification of wood products, aligned with European standards. Value: 795,000 lei. CEEX Structural Development Project No. 195/2006, P-CONFORM type project, MODULE-4. Project manager: Prof. Dr. Eng. Virgil Grecu. Duration: 2 years.	2006-2007
4	Platform for the sustainable use of natural resources through biotechnology and ecological processes in agrotourism, forestry and wood processing. Value: 371,000 lei. RENATSIL interdisciplinary training and research platform, project no. 18/2006. Duration: 2 years.	2006-2008
5	Biodegradable composites with textile inserts for environmentally friendly products BICOMPTEX. Value 400,000 RON. Grand PNCD12 - PC-type partnerships. Contract 72-200. Project manager Prof. Dr. Eng. Camelia Coșereanu. Duration 2 years	2008-2011
6	Research on improving technology and developing products with improved functional performance for S.C. Holzindustrie Schweighofer BACO SRL, Contract no. 8743/2015, 2015-2016, member of the team project. Project manager Prof. Dr. Eng. Mihai Ispas. Duration 1 year.	2015-2016
7	Design of innovative solid wood furniture with bio/technological finishes and design of production infrastructure. Value 15,750 lei. Contract no. 4917/28.04.2015. S.C. Biomobila S.R.L. Project manager Prof. Dr. Eng. Camelia Coșereanu. Duration: 1 year.	2015
8	Qualitative, dynamic and acoustic analysis of anisotropic systems with modified ACADIA interference. Project manager Prof. Dr. Eng. Mariana Domnica Stanciu. Duration 2 years	2023-2025

(B-ii) The evolution and development plans for career development

Research career development

- 2 project proposals in the UEFISCDI competition as manager

No.	Project name	Year of submission	Project registration number	Number of points obtained
1	ECO-Lignocellulose Panels for Interior Design and Furniture	2016	PN-III-P2-2.1-PED-2016-0561	83
2	Boards with reduced harmful emissions into the air	2019	PN-III-P2-2.1-PED-2019-0964	88.2

SCIENTIFIC CONTRIBUTIONS

- **2 projects with third parties as manager** (1 project of 4166 lei and 1 project of 8566.8 lei);
- **1 book chapter as co-author** published by Springer Nature Switzerland;
- **7 books published** by Transilvania University Press Brașov, of which: 5 as single author, 1 as first author and 1 as co-author ;
- **4 patents**;
- **7 laboratory guidelines**, of which 1 as single author and 6 as co-author;
- **17 ISI articles**, of which 10 were published in ISI journals and 7 were published at international conferences with ISI proceedings;
- **26 articles published in BDI-indexed** journals;
- **4 articles published in B+** journals;
- **25 articles published in the proceedings of international conferences**;
- **16 international and national conferences** as a member of the scientific committee and the organising team, of which 13 were international conferences and 3 were national conferences.

(B-ii) The evolution and development plans for career development

Research career development

CONTRIBUTIONS IN DEVELOPING THE INFRASTRUCTURE FOR RESEARCH WITHIN THE RESEARCH CENTER C14

As Coordinator of the Research Center (C14) during the implementation of the project *"Research, Development, and Innovation Institute: High Tech Products for Sustainable Development," funded by the Sectoral Operational Program – Economic Competitiveness Growth, Axis 2,* ***from ERDF funds (76.7%) and the national budget*** *(23.3%)*, **I had developed 4 technical documents and 1 technical document in cooperation** with colleagues from the C11 Research Centre, which led to purchasing the following advanced research equipment:

No.	Equipment type	Euro
1	Static load testing equipment (Zwick Roel Z010)	190000
2	Fixed installation for acoustic testing of wood materials (Kund Tub)	67000
3	Equipment for determining the heat transfer coefficient (HFM Lambda 436)	87000
4	Laser system for cutting veneer Coherent, Light CELL	300000
5	Nikon SMZ14 stereomicroscope (in collaboration with colleagues from the C11 centre)	17127

Also within the *Digital Transformation for Innovation and Competitiveness* project, funding contract 14039/16.09.2022 (**PNRR**), **I have drawn up 1 Technical document for the purchase of a:**

No.	Equipment type	Euro
1	Digital hydraulic (hot) press	435364

The equipment purchased are used by the faculty's doctoral students and teaching staff in research activities, and the results of these investigations have been published in doctoral theses or valuable scientific articles in prestigious international journals indexed by WOS.

(B-ii) The evolution and development plans for career development

The results obtained in teaching and professional activity, in research activity, as well as in recognition and impact of activity, have led to the fulfilment of the criteria corresponding to the minimum standards of CNATCDU, for the specialised **Commission for Plant and Animal Resource Engineering**, with a total of **1501.364 points**, compared to the minimum total of 420 points.

No.	Category		
	Field of activity	Teacher/habilitation conditions	Score achieved by the candidate
1	Teaching/professional activity (A1)	Minimum 100 points	374.63
2	Research activity (A2)	Minimum 260 points	687.794
3	Recognition and impact of activity (A3)	Minimum 60 points	438.94
	TOTAL	Minimum 420 points	1501.364

(B-ii) The evolution and development plans for career development

PROFESSIONAL CAREER DEVELOPMENT PLANS

Future professional teaching development

- using research results in teaching materials for courses;
- teaching courses in English for subjects taught in bachelor's degree programs, in order to support incoming ERASMUS students;
- developing the course for the master's degree program in Furniture Ecodesign and Restoration (in English);
- facilitating the teaching of modules within the disciplines of the master's degree program in Furniture Ecodesign and Restoration (in English) by professors from relevant universities in Europe through the UNITA Alliance, as well as based on the relationships developed as manager of ERASMUS+ projects;
- publishing technical books and laboratory guides;
- developing teaching materials focusing on the circular economy in the woodworking sector;
- adapting the content of the subjects taught to the requirements of the labour market, in order to ensure the successful integration of graduates in companies in the field.

(B-ii) The evolution and development plans for career development

PROFESSIONAL CAREER DEVELOPMENT PLANS

Plan for the development of future scientific activity

- development of new research topics that include sustainable materials in composites with significantly improved performance;
- continuing to publish scientific research results in ISI articles with high impact factors, in order to increase international visibility;
- collaboration with interdisciplinary groups to address the issues raised by the research topics;
- continuing collaborations with the economic community, as well as with relevant clusters in the country;
- participation at international conferences in the field, with the aim of disseminating research results;
- developing new project proposals that will lead to obtaining funding in the thematic areas specific of the field.

Thank you for your attention!