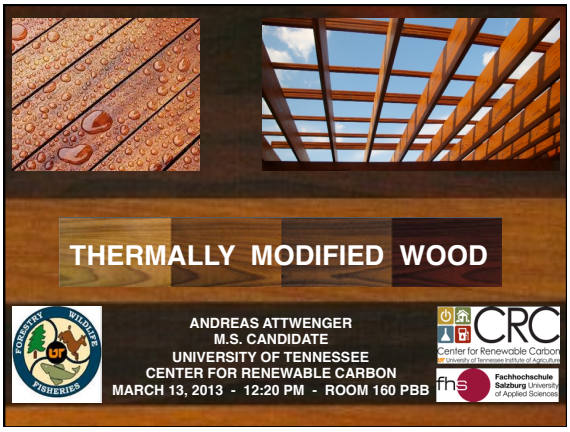
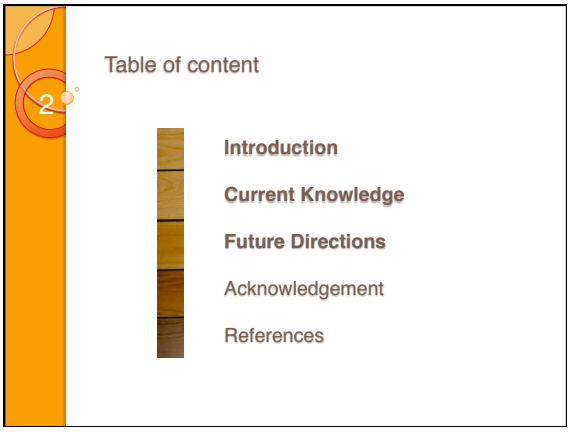

THERMALLY MODIFIED WOOD
ANDREAS ATTWENGER
M.S. CANDIDATE
UNIVERSITY OF TENNESSEE
CENTER FOR RENEWABLE CARBON
MARCH 13, 2013 - 12:20 PM - ROOM 160 PBB
CRC
Center for Renewable Carbon
Fachhochschule Salzburg University of Applied Sciences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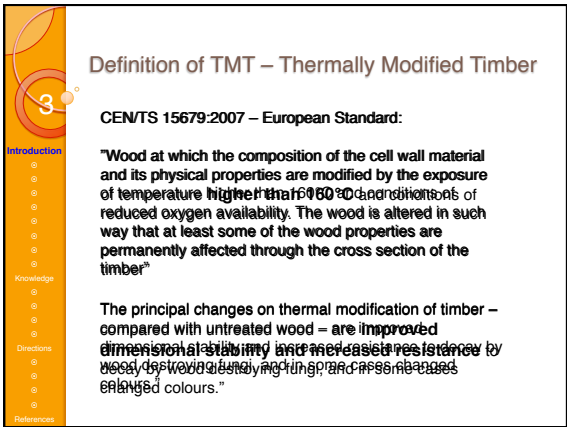
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Definition of TMT – Thermally Modified Timber
CEN/TS 15679:2007 – European Standard:
"Wood at which the composition of the cell wall material and its physical properties are modified by the exposure of temperature higher than 160 °C and conditions of reduced oxygen availability. The wood is altered in such way that at least some of the wood properties are permanently affected through the cross section of the timber"
The principal changes on thermal modification of timber – compared with untreated wood – are improved dimensional stability and increased resistance to decay by wood destroying fungi, and in some cases changed colours."
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Objectives of TMT

- Reduce the **hygroscopicity** of wood
- Improve the **dimensional stability** of wood
- Enhance the **resistance** against biological attacks
- **Color** improvement !?

Main advantage: Environmentally friendly!

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Manufactures

basic principle: by Burmester, 1973

different procedures & medium:

Plato BV (steam)	-> Netherlands
Rétification (N_2)	-> France
OHT (oil)	-> Germany
ThermoWood process	**-> Finland**
Stellac (steam)	-> Austria
Rétification (N_2)	-> Switz
Stellac (steam)	-> Estland
Celloc (steam)	-> Denmark

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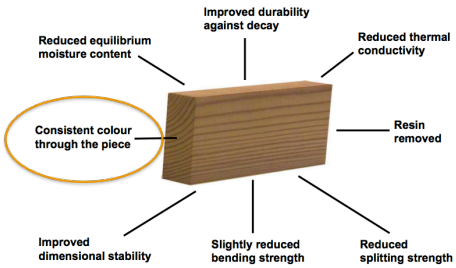
Properties of TMT



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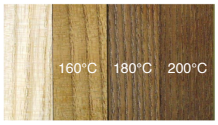
Objectives of TMT

Color improvement !?

Beech:

Ash:



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Without treatment the silvering process begins with 12-15 month…

… and the wood gains the often desired silver color.

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Applications

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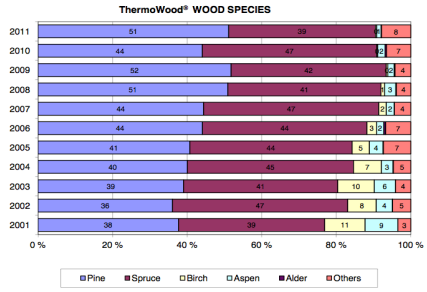
Facts about TMT



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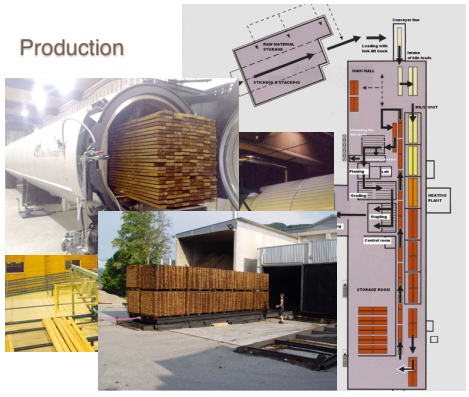
Production



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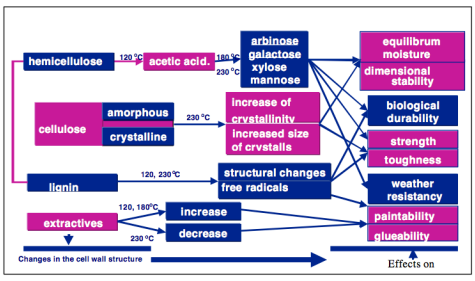

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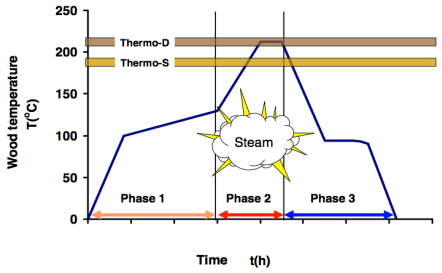
Heat treatment



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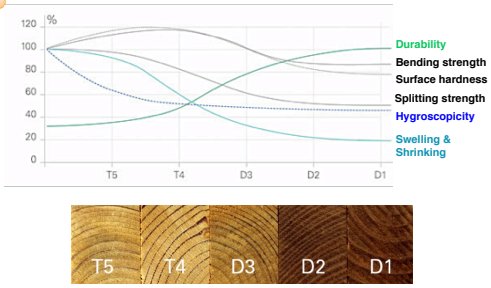
Conclusion Properties



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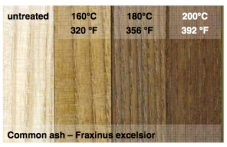

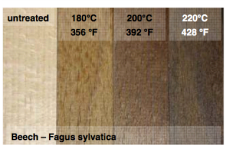

Modification of wood properties by thermally treatment without any active agents.

- ☺ natural durability
- ☺ dimensional stability
- ☺ EMC – equilibrium moisture content
- 😐 color
- 😐 maschining
- ☹ strength properties

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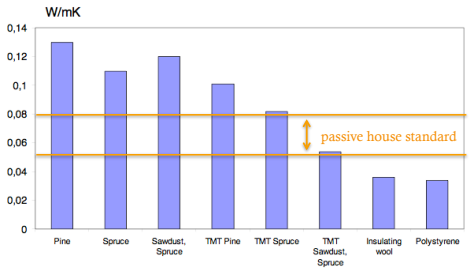
Thermal Conductivity



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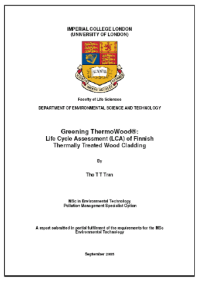
Future Directions – LCA Life Cycle Assessment

LCA study of ThermoWood® was carried out by Imperial college London

Conclusion:
" ThermoWood® has a potential of being a ´green´ building material if consideration is made to the production as well as the use and disposal at the end of its life cycle using best available technologies"


IMPERIAL COLLEGE LONDON
Greening ThermoWood®:
Life Cycle Assessment (LCA) of Finnish Thermally Treated Wood Cladding

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Example

McDonalds' headquarters in Helsinki

- Built 1997
- Photos 2007
- ThermoWood Pine 220 °C

Conclusions
- Excellent Stability
- No Decay
- Good condition

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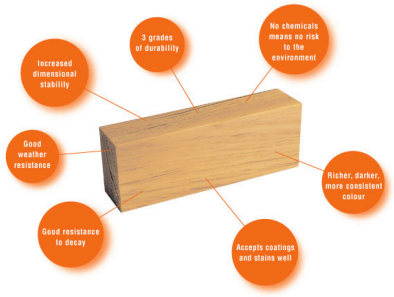
Conclusion

Thermally Modified Wood

Wood Made Better!



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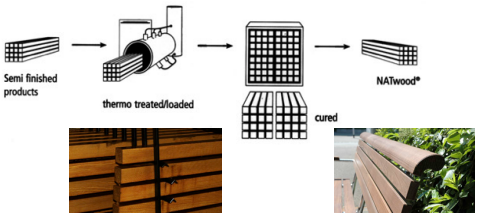
Similar product

NATWOOD outdoor innovation

Wood as material is gaining more in importance for construction and decorative applications. Still this unlimited renewable raw material has disadvantages and for this reason other materials often are preferred.

"These disadvantages are removed by the NATwood procedure."



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Similar product - **BalanceBoard**

PFLEIDERER

"The raw materials found in BalanceBoard grow back in one season "

" … fulfills the technical demands of comparable standard chipboard."

Pfleiderer Industrie in Frankfurt has **received the 2011 Design Plus Award from Material Vision**, which is awarded by the Frankfurt Exhibition Centre and the Design Council, for its product innovation of **BalanceBoard.**

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Acknowledgements

THE UNIVERSITY of TENNESSEE KNOXVILLE

fhs Fachhochschule Salzburg University of Applied Sciences

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Dr. Young

Dr. Petutschnigg

CRC-Team

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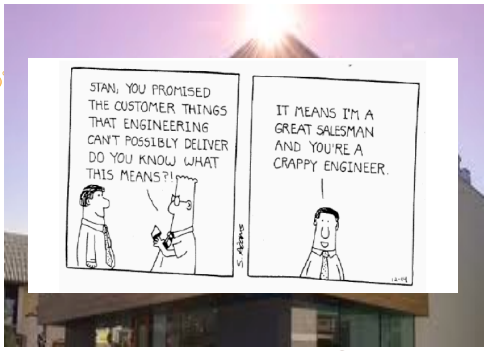

… any Questions ?
aattweng@utk.edu