



THERMALLY MODIFIED TIMBER AS DURABLE WOOD FOR EXTERIOR APPLICATIONS

Background and Properties

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CONTENTS

- Background
- Process
- Properties
- Classification
- Applications
- Conclusions



Picture: Finnish Thermowood Association

THERMAL MODIFICATION OF WOOD

- Methods developed in Finland, France, the Netherlands and Germany
- Common objectives: increased dimensional stability and biological durability
- Differences between thermal modification methods: raw material (green / dried), shielding gas, equipment, pressure, duration, production capacity

FINNISH PROCESS (ThermoWood) DEVELOPMENT

- VTT started first research projects in 1992 (physical and biological properties of thermally modified wood)
- Few years later first pilot-scale equipment
- Latest research projects concentrated on examining the reasons for changed physical properties and determining the product properties

PRODUCTION DEVELOPMENT OF THERMALLY MODIFIED WOOD

- First producers started production at the end of 1990's
- First stages of production: totally new product, varying raw material, differences between modification processes, insufficient quality control system and directions
- Enhancement of situation in few years (establishment of Finnish Thermowood Association in 2000)

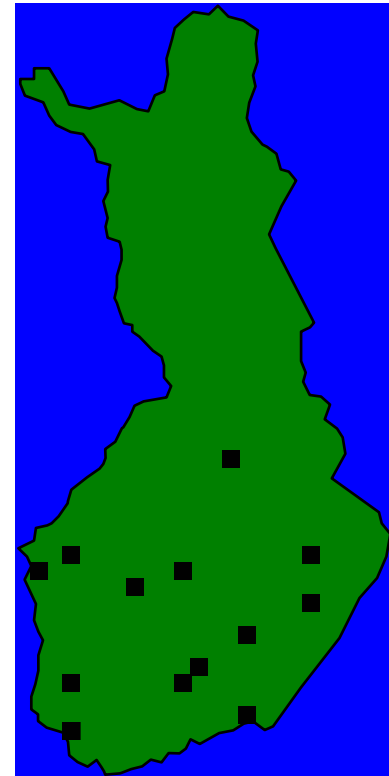
FINNISH THERMOWOOD ASSOCIATION

MEMBERS

- 10 producers
- 3 kiln manufacturers

THERMOWOOD TECHNOLOGY

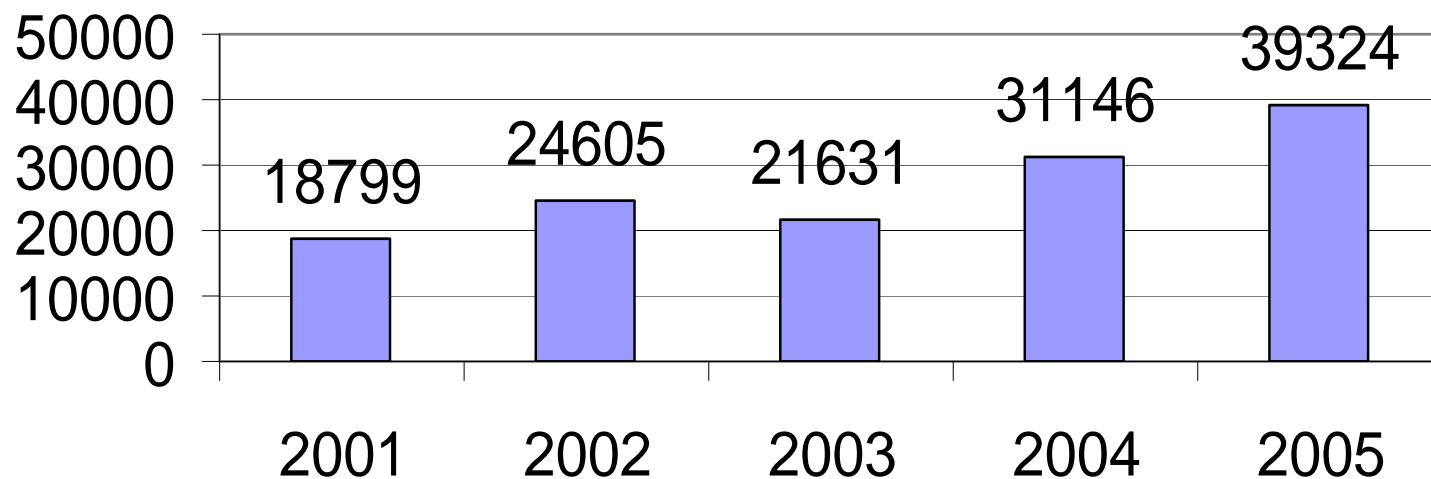
- developed and patented at VTT together with Finnish industry
- licensed to members of Finnish Thermowood Association



PRODUCTION

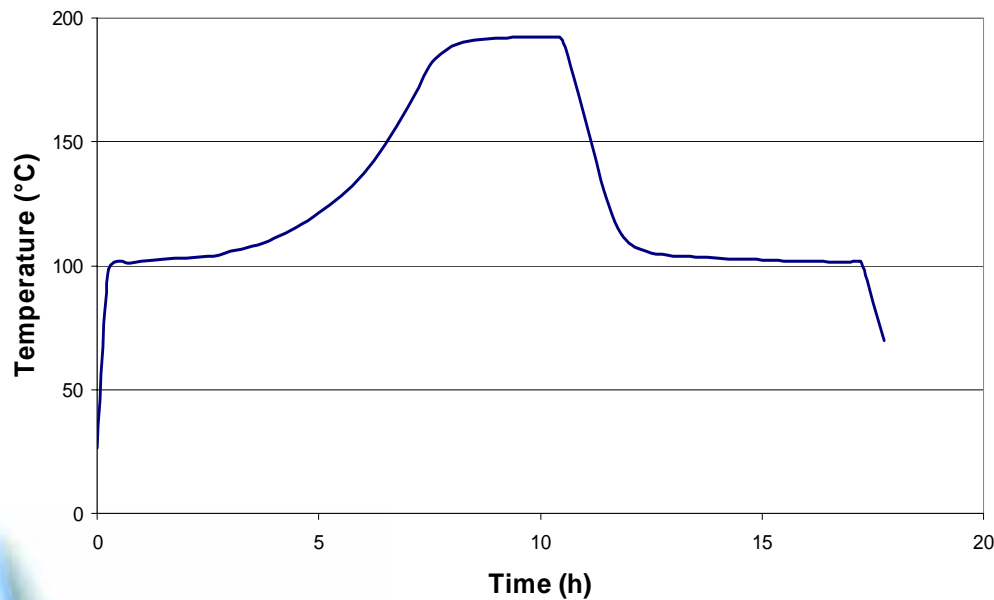
- Main wood species: Scots pine and Norway spruce
- Main market area: EU

SALES PRODUCTION (m³)



Source: Finnish Thermowood Association

THERMAL MODIFICATION PROCESS



- Modification temperature 180-230°C
- Modification time 2-3 h
- Normal air pressure, steam
- Stainless or acid-proof steel kiln
- Green or dried raw material

EFFECTS OF THERMAL MODIFICATION ON WOOD

- Changed chemical structure of wood
 - degradation of hemicelluloses and amorphous cellulose
 - modification of lignin structure
 - evaporation of extractives
- Changed physical and biological properties of wood
- Level of the changes depends on modification temperature and time

COLOUR



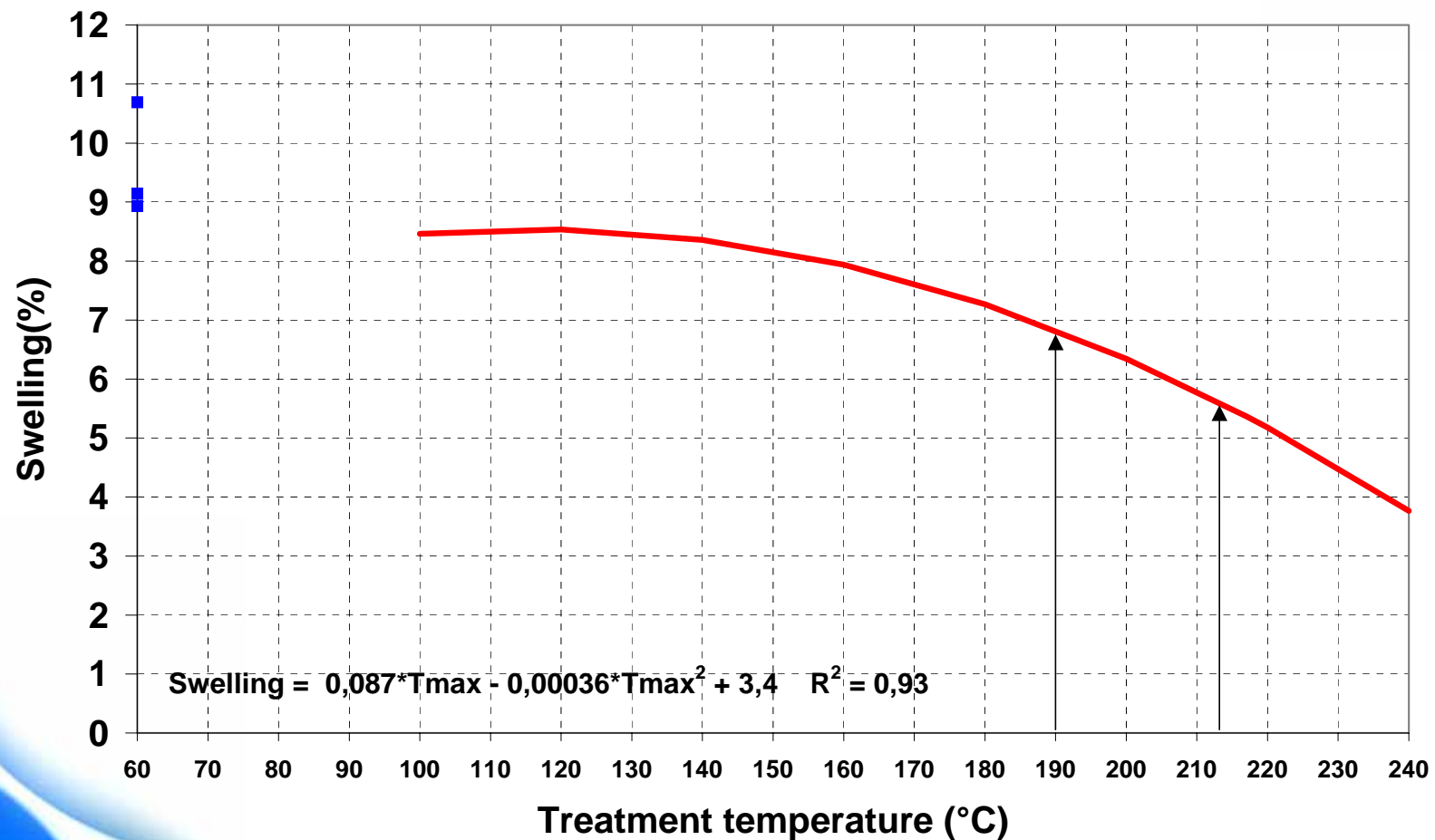
Colour after thermal modification



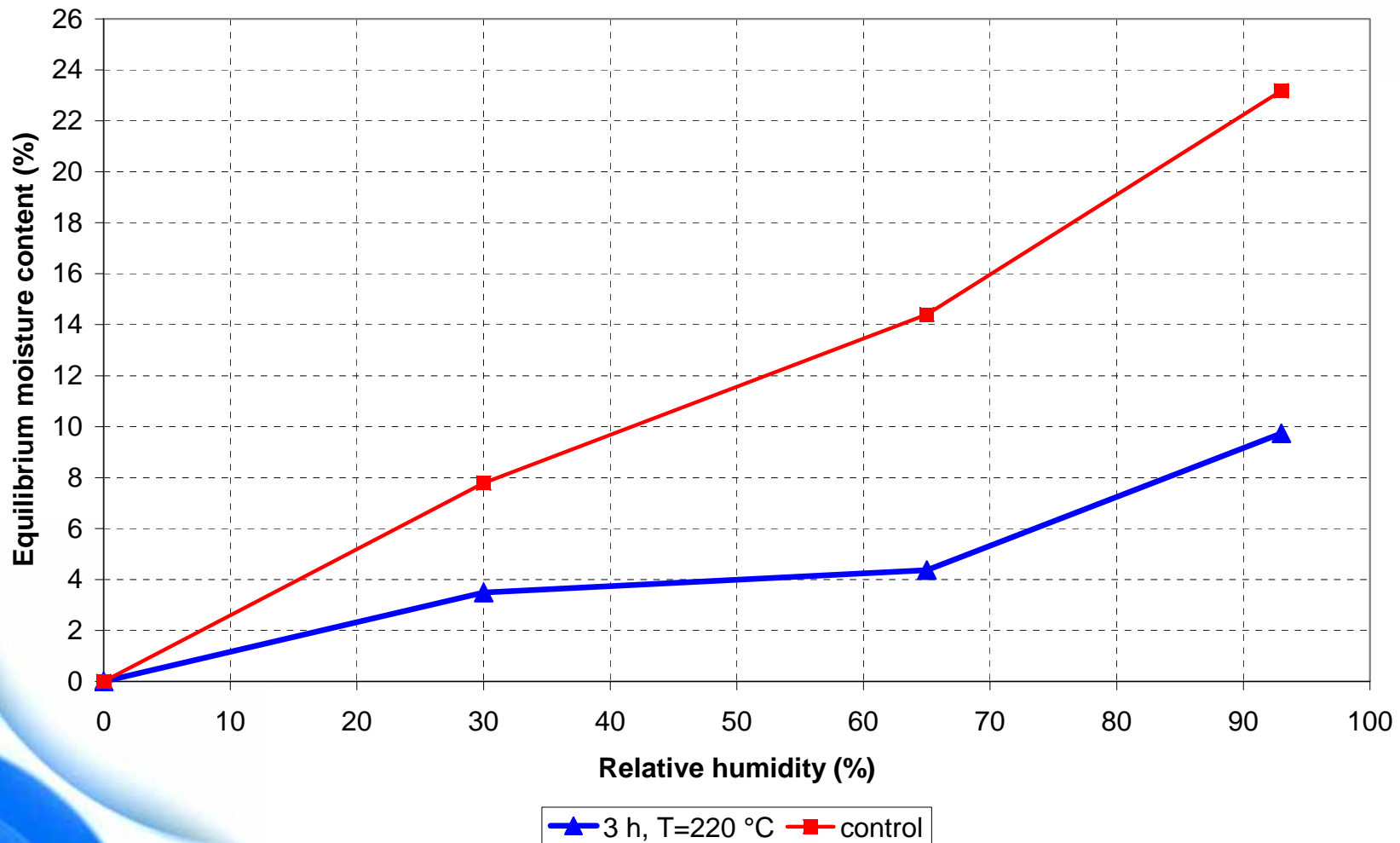
Colour after 6 months weathering

DIMENSIONAL STABILITY

Tangential swelling of pine

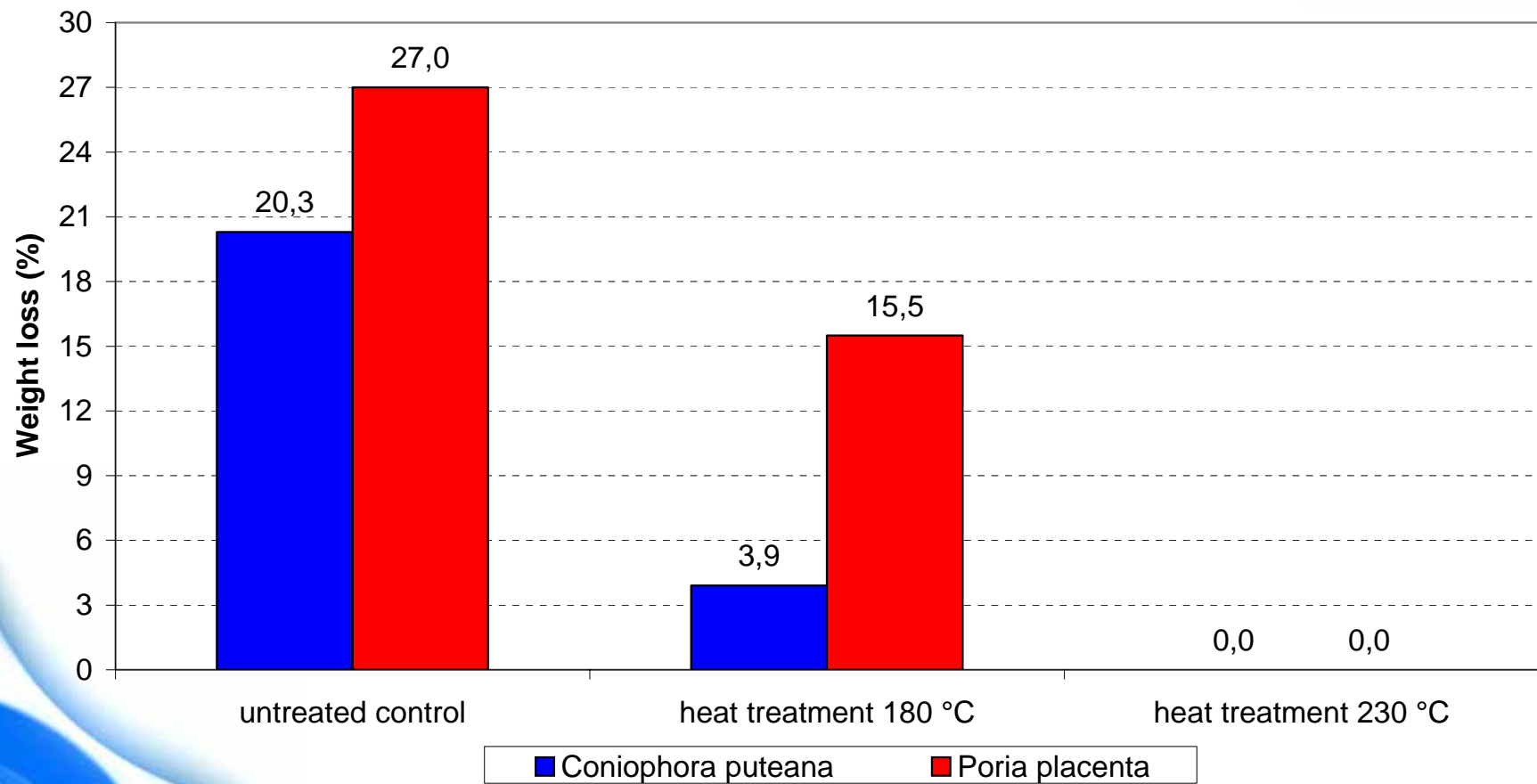


EQUILIBRIUM MOISTURE CONTENT Spruce



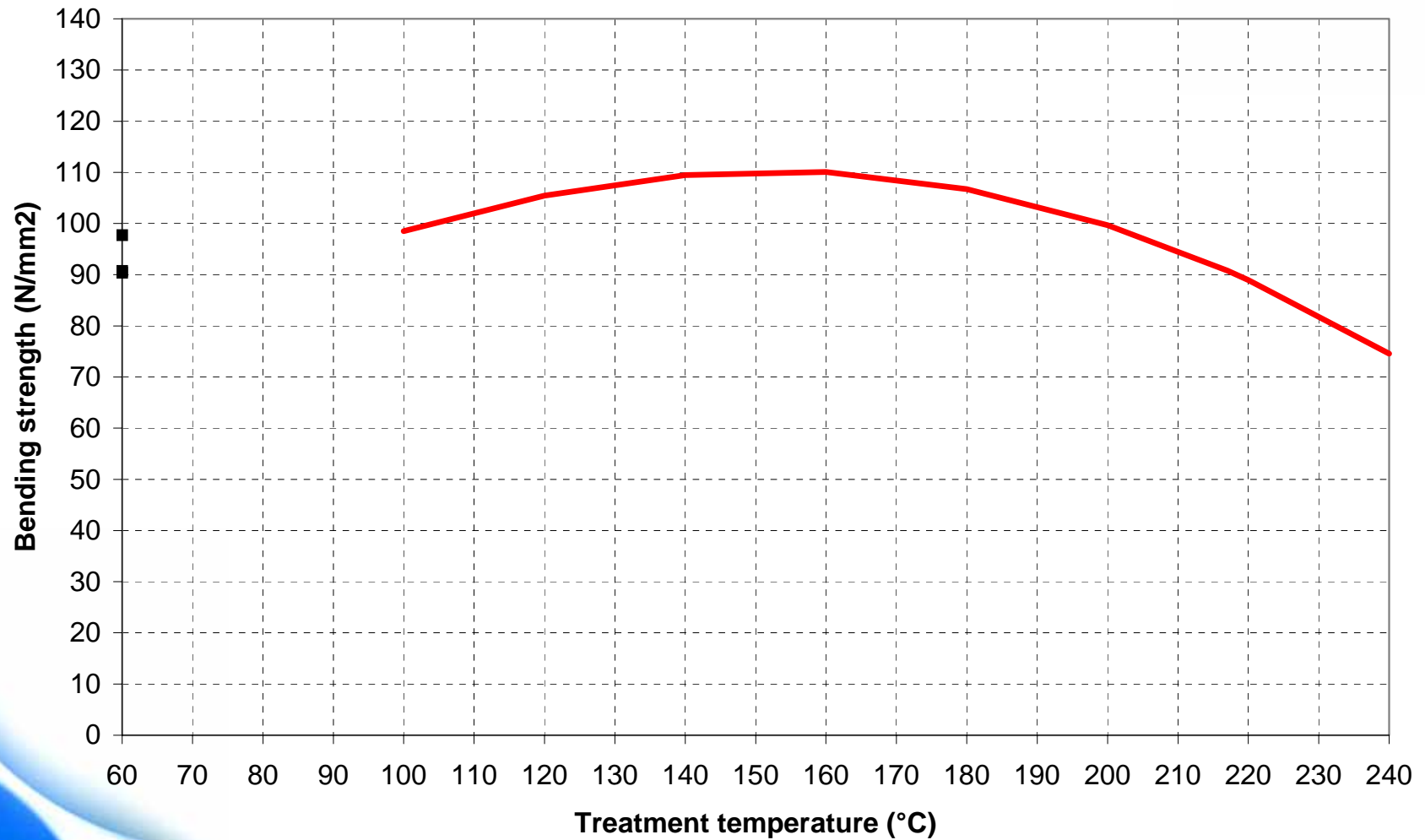
BIOLOGICAL DURABILITY

Modified EN113 decay test, 6 weeks, pine



MECHANICAL PROPERTIES

Bending strength



ThermoWood STANDARD CLASSES

Thermo-S and Thermo-D

Properties of softwood (sapwood)

Class	Treatment temperature (°C)	Tangential swelling (%)	Natural durability class
Thermo-S	190	6 - 8	3
Thermo-D	212	5 - 6	2
Untreated	60 - 80	8 - 10	3 - 4

Source: Finnish Thermowood Association

THERMALLY MODIFIED WOOD

- Modified properties
- Like a new wood species
- Carefulness needed in whole production process
- Not problems in painting, gluing and jointing
- For applications, where enhanced dimensional stability and biological durability are required
- Not recommended for use in load-bearing constructions and in deep ground contact applications

EXTERIOR APPLICATIONS

- cladding
- decking
- shutters, window and door components
- environmental constructions
- garden constructions and furniture



Pictures: Finnish Thermowood Association

INTERIOR APPLICATIONS



- cladding
- interiors of bathrooms and saunas
- flooring
- furnishings
- furniture

Picture: Finnish Thermowood Association

CONCLUSIONS

- Thermally modified wood is a result of long-term research and development work
- Benefits: friendliness to the environment, affordable production costs, enhanced dimensional stability and biological durability
- Not optimal building material for all applications (will not replace the pressure treated wood)
- Essential to find right applications for thermally modified wood



THANK YOU!



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