

Modified wood: processes, products and markets

Holger Militz

Wood Biology and Wood Technology
Georg-August-University Göttingen
GERMANY

content



- Why modification?
- How (principles)
 - Processes
 - Products
 - Markets



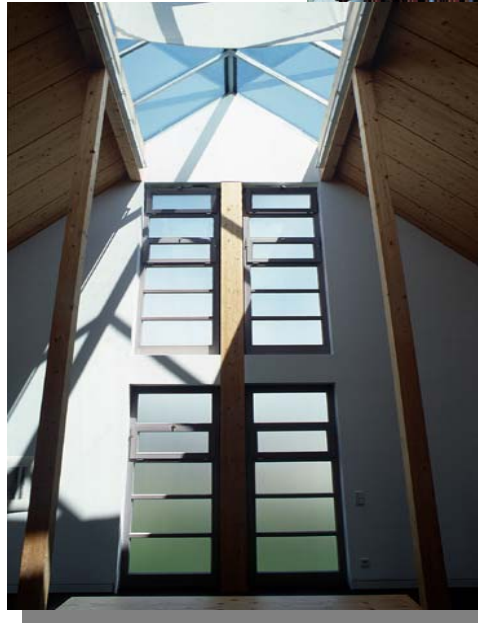
Wood: material of the future

- Ecological
- Sustainable
- Renewable
- Esthetical
- Technologically diverse
- Modern



Wood: material of the future

- Energy efficient
- End-of-life: energy

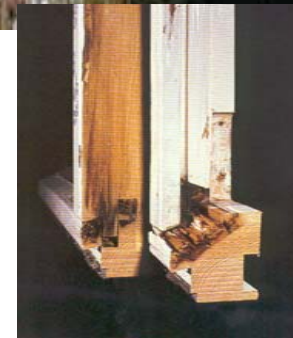


Wood: material of the future?

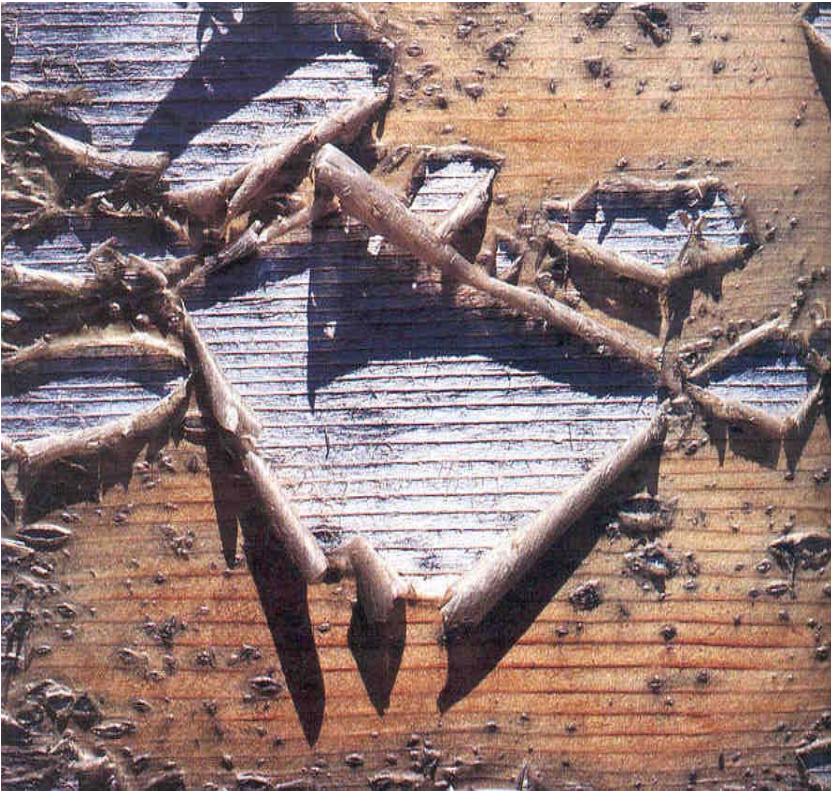


Weak points:

- Moisture sensitive
- UV-stability
- Dimensional unstable
- Resistance against fungi
- Soft surface



Wood: material of the future?

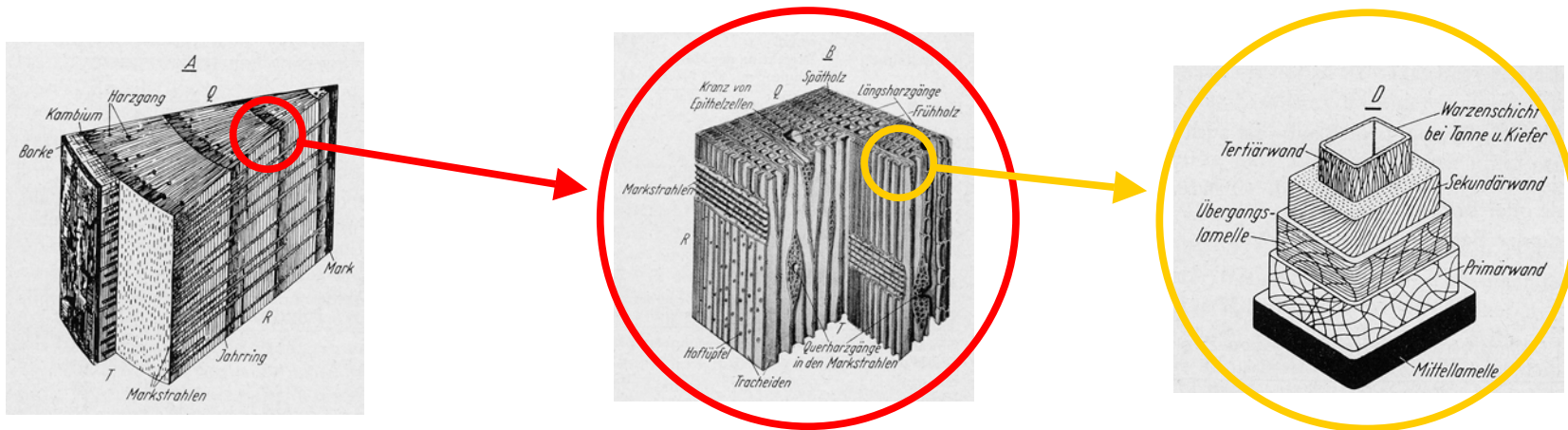


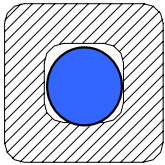
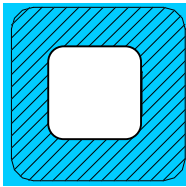
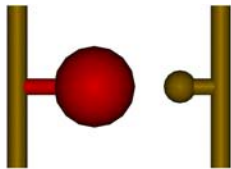
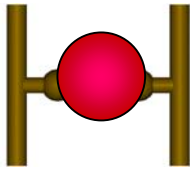

How to solve these problems?

- Use wood with high natural quality (as many tropical hardwoods)
 - Availability (mid term, long term)
 - Sustainability
- Use of wood preservatives
 - Toxicity issues
 - New biocides with low impact
 - Only durability item solved
- Use of new technologies for wood treatment!!

What is „wood modification“?







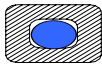

Principles of wood modification



Lumen filling	Cell wall filling	Reaction with wood polymers	Cross linking	Degradation of cell wall
				

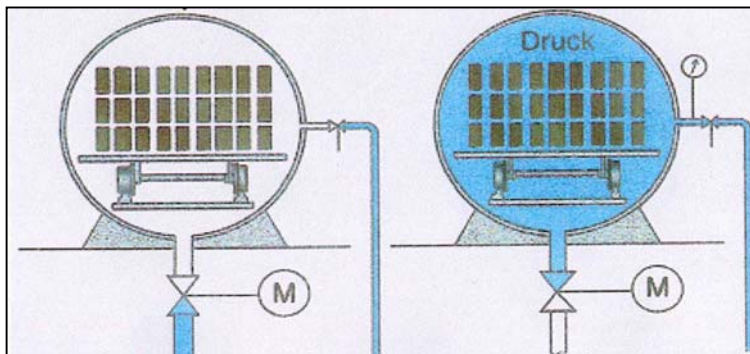
Bilder: Sandermann (1963)

Modification methods

Modification method	Commercial	Principle
Heat treatment	X	
Acetylation (Accoya)	X	
Melamine resin	(X)	
DMDHEU (Belmadur)	X	
Furfurylation(Kebony)	X	
Silicone/Silane	(x)	
oil / wax/ parafins	X	
Chitosan		

Treatment steps

- ➔ liquid, catalyst
- ➔ vacuum-pressure impregnation
- ➔ drying and reaction
- ➔ drying temp: above 100 C



Thermo treatment (TMT, Thermowood)

Process:

- no chemicals
- temperature 180°C to 220°C
- many wood species used
- difference between producers: technology used



Producers (Europe)

- Finland
- The Netherlands
- France
- Austria
- Germany
- Russia
- ...



STELLAC OY



Barkett



Plato

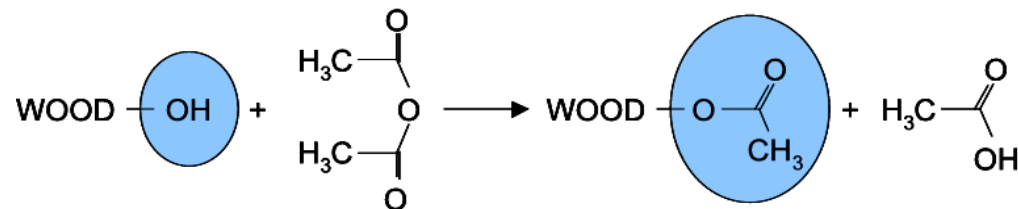


Production (2007): approx. 100.000 m³ ?

Acetylation

Process:

- impregnation with acetic anhydride
- reaction at elevated temperatures
- post treatment (acetic acid)



Holz und Essigsäure-Anhydrid \longrightarrow acetyliertes Holz und Essigsäure

Production site „Accoya“

Quelle: www.titanwood.com

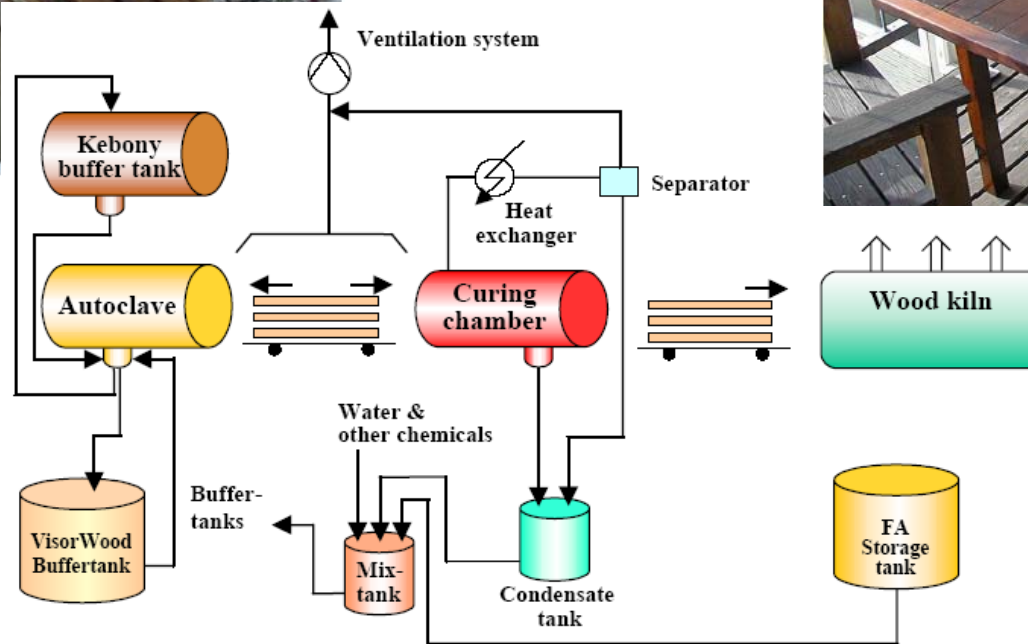
TITAN
WOOD

Accsys Chemicals PLC (UK)
Production since 2007

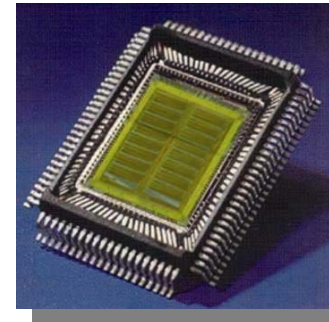
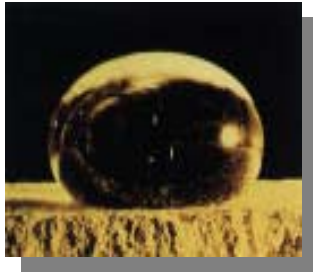
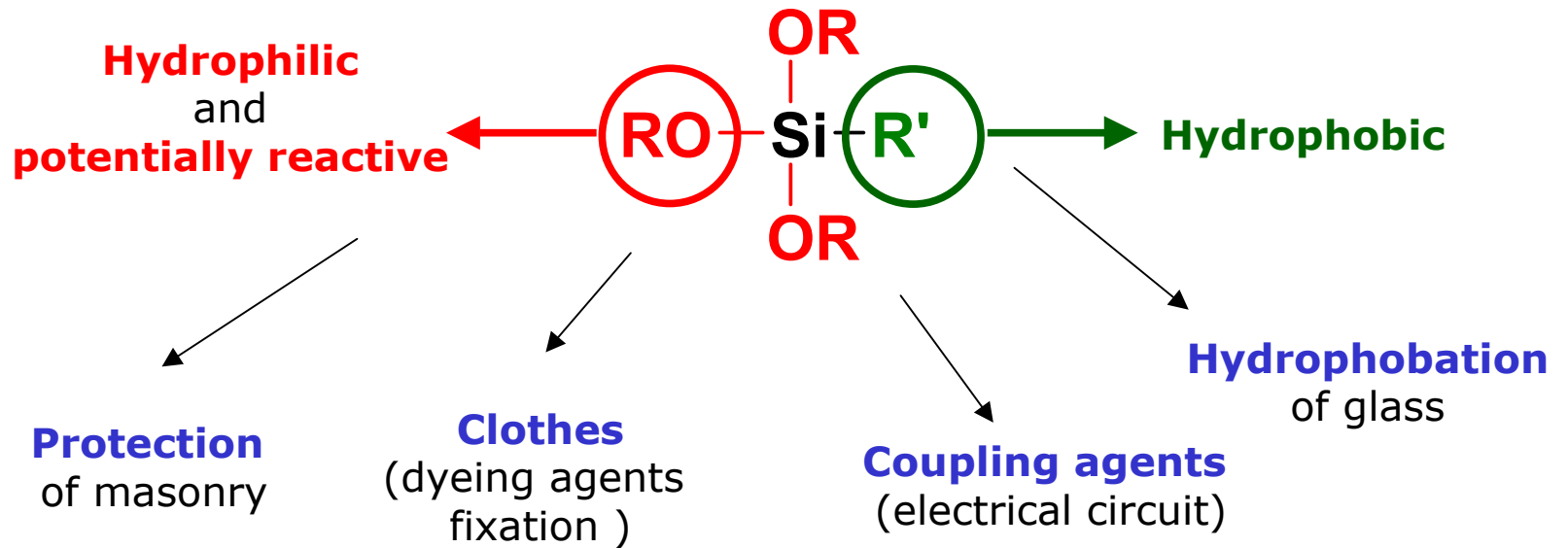


Furfurylation

Wood Polymer
Technologies
www.wpt.no



silicon based compounds



Silanes, silicones

degussa.

“water shade effects”

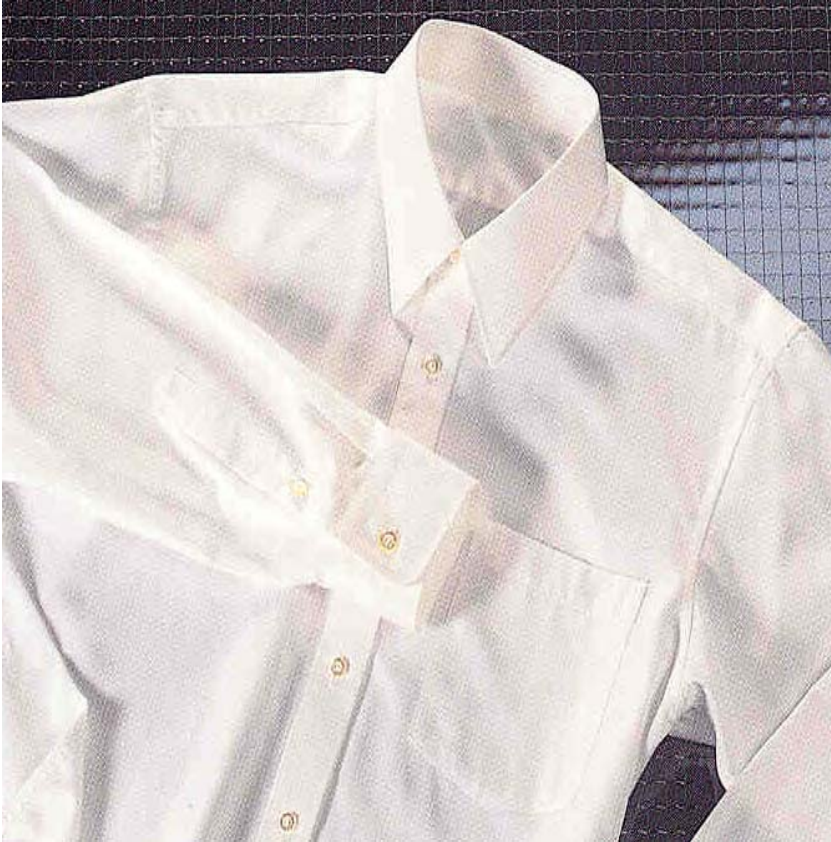
creating essentials



www.holz.uni-goettingen.de

cmai@gwdg.de

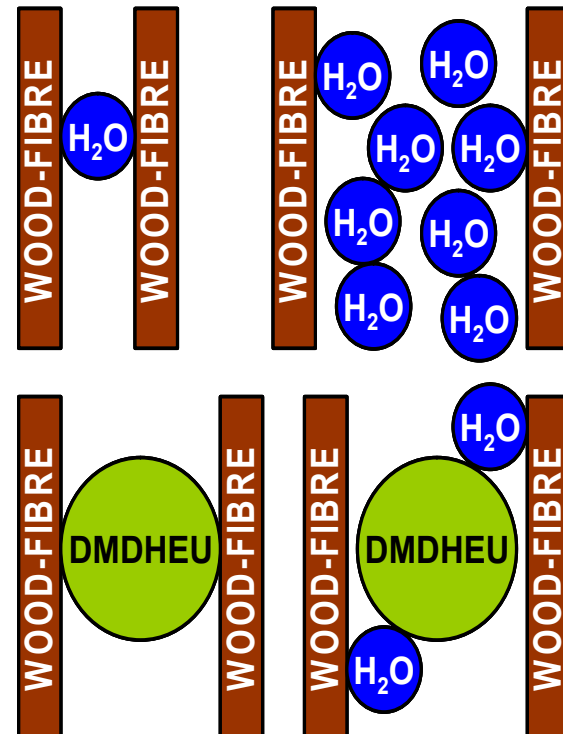
Wrinkle free wood?



- ➔ Dimensionally stable
- ➔ Crease resistant
- ➔ “Easy care”
“Non-iron”

 **BASF**
The Chemical Company

Polymerisable chemicals



Belmadur® Technology

BASF
The Chemical Company

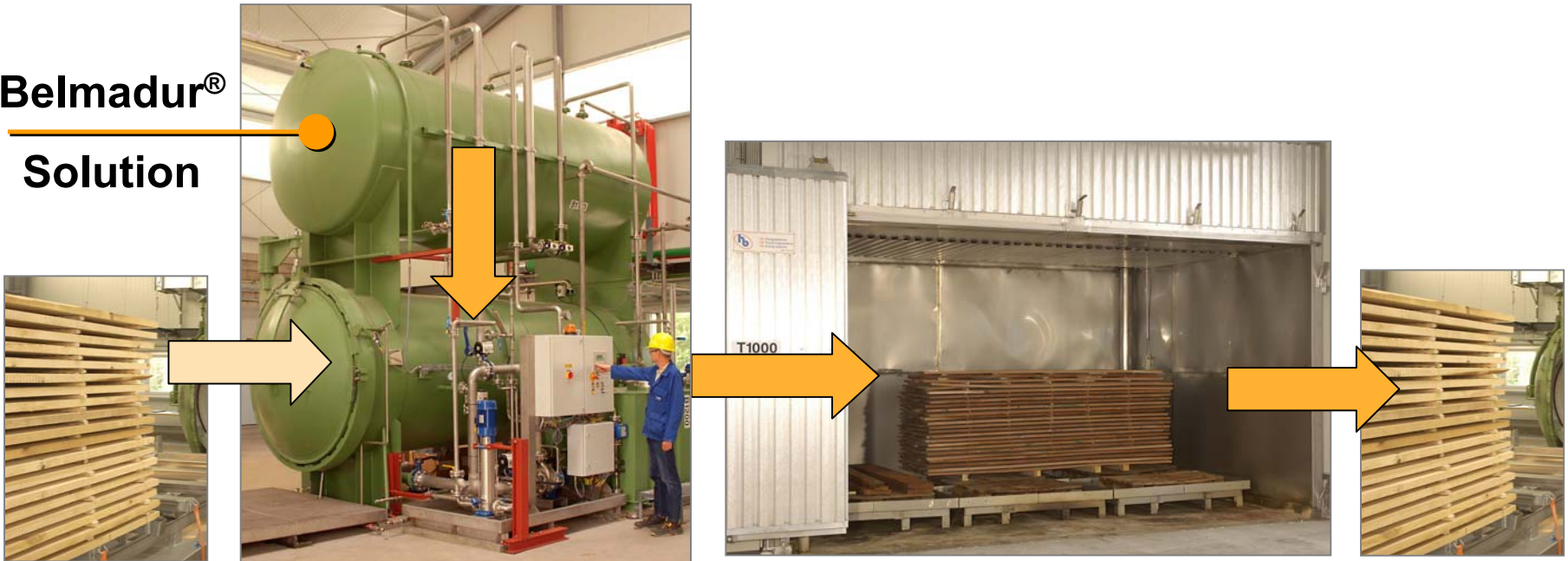
Wood

Treatment

Curing

**Belmadur®
Wood**

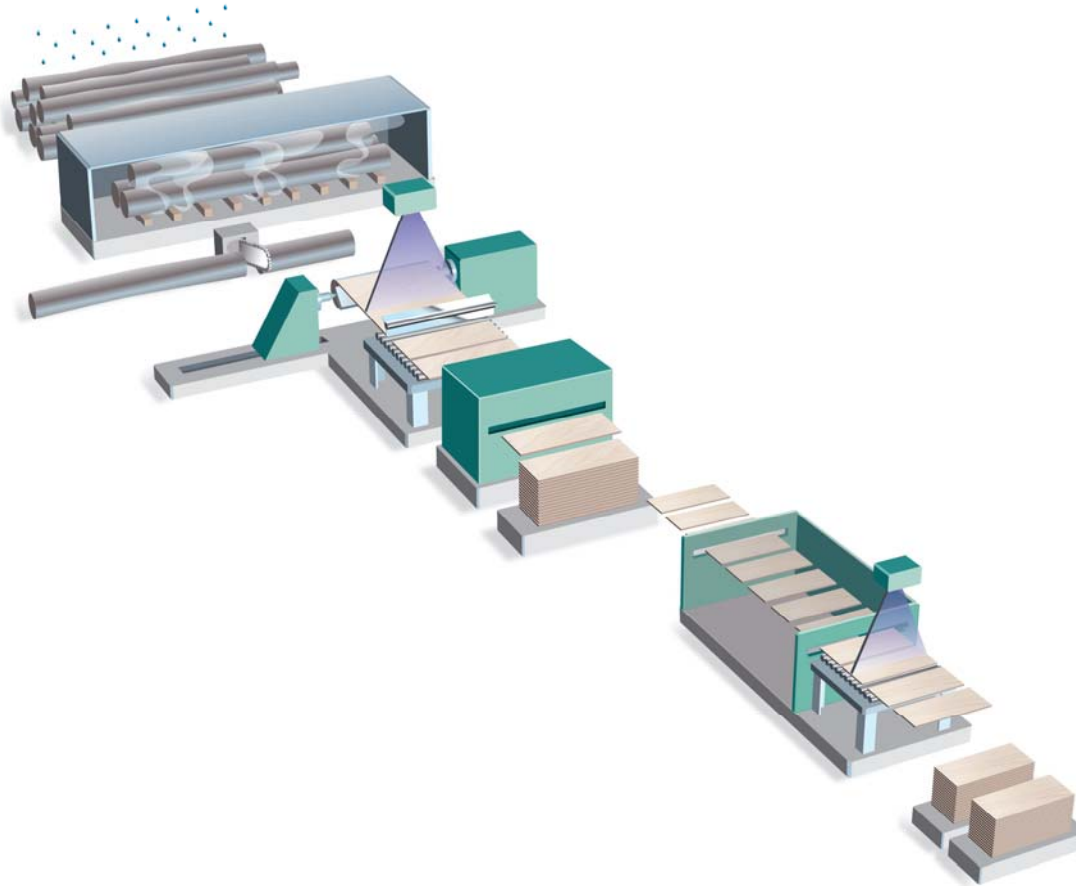
**Belmadur®
Solution**



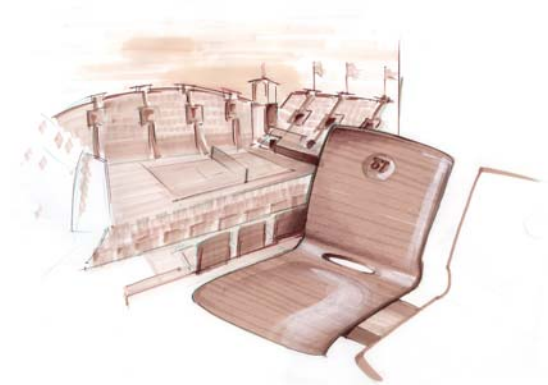
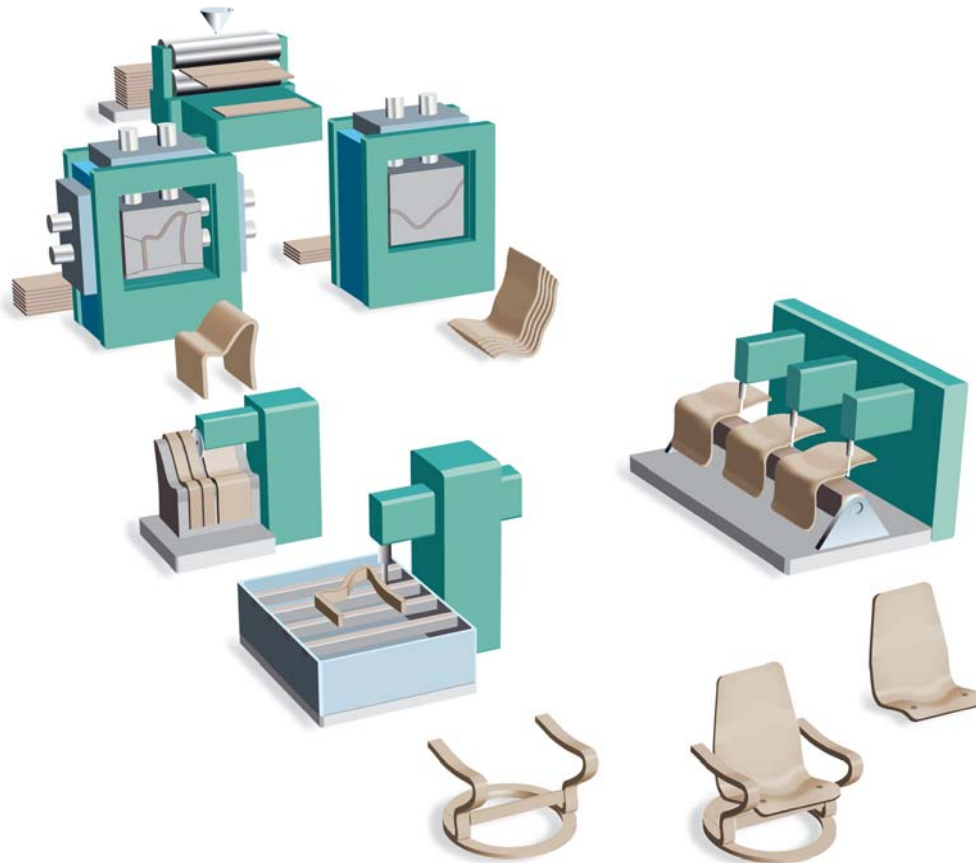
Room temperature

Temperature > 100°C

First application in Germany: Fa. Becker/ Brakel



Fa. Becker: Furnierformholz

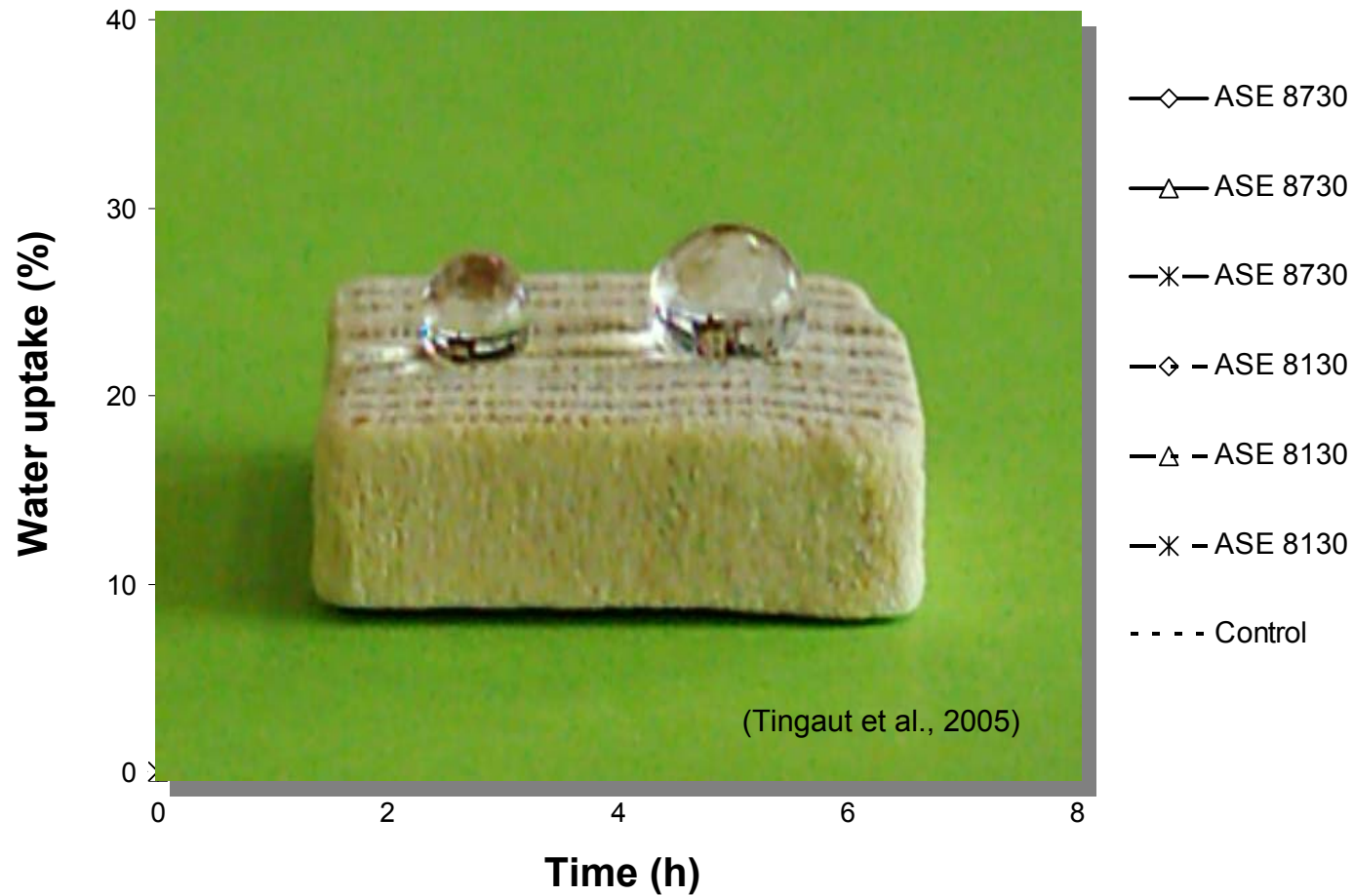



Solid wood-veneers-fibres



Material properties

Water uptake

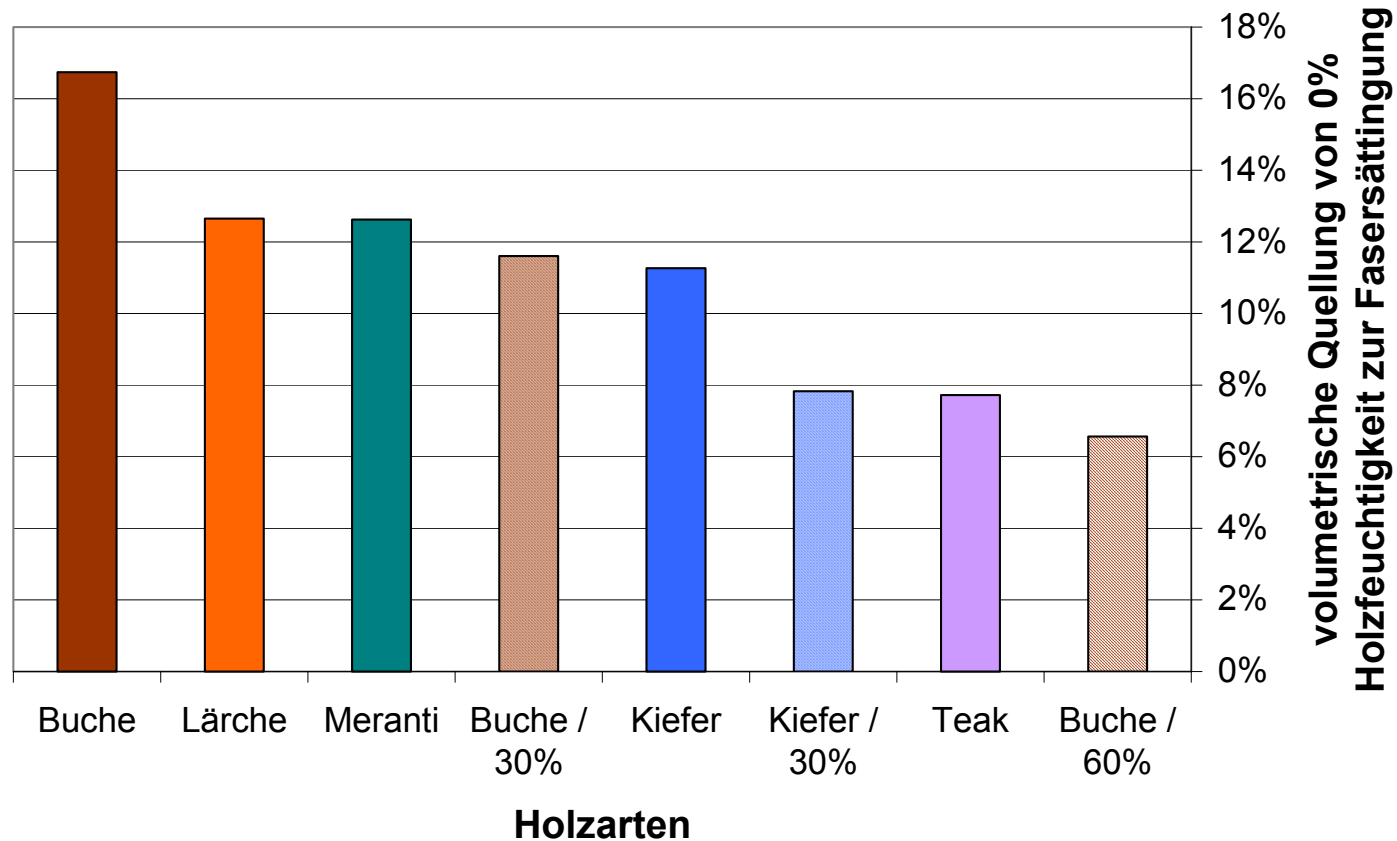




DV15-1

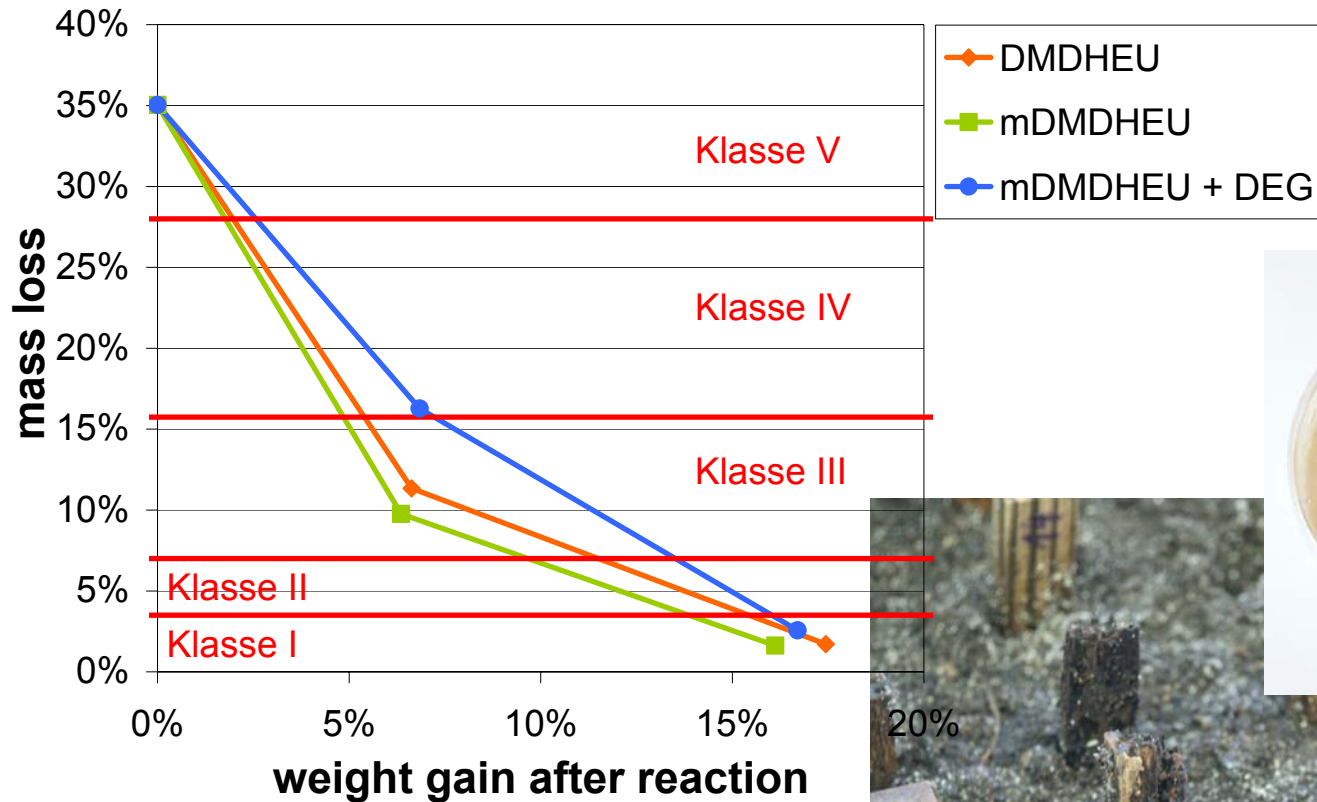
DV03-4

Shrinkage and swelling

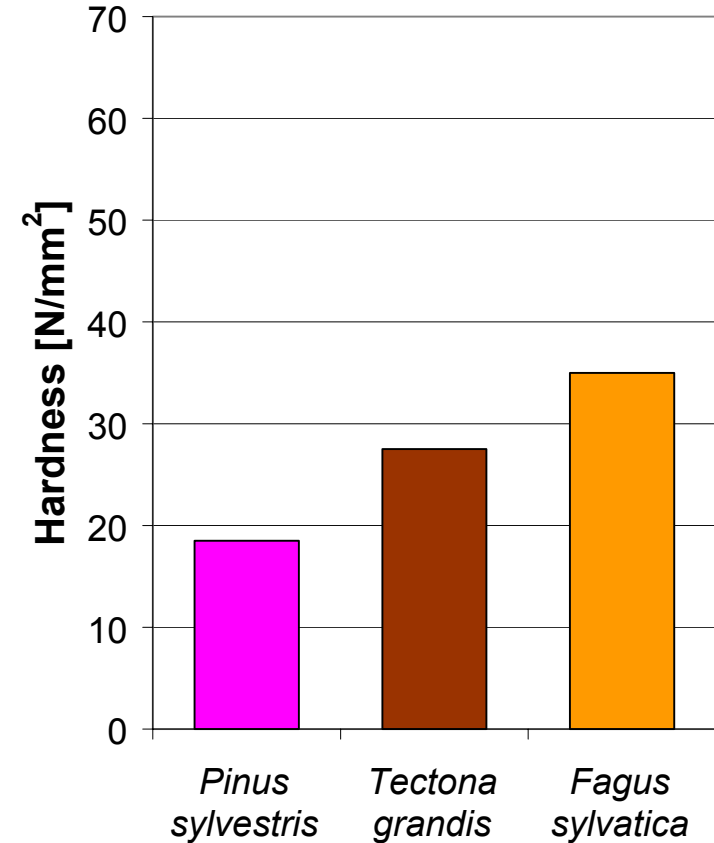
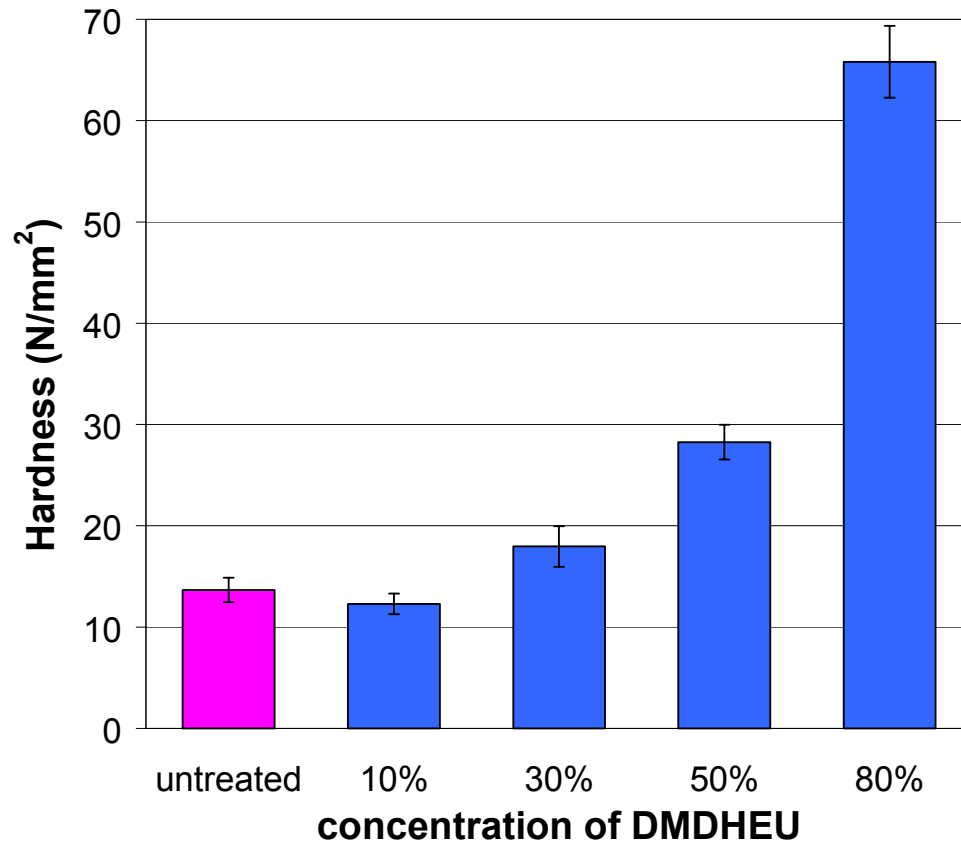


Resistance against fungi

ENv 807



Brinell hardness (parket flooring)



Production and markets

Market survey „modified wood“

Status quo: production

- * Production heat treated wood in Europe:
approx. 100.000 m³
- * Production other wood modification
treatments: approx. 50.000 m³

- Biocide treated wood
 - Costs!!
 - Special products
- Markets of tropical hardwoods
 - Hazard classes 1-5
 - „high quality“
- Special products



esthetics



Foto Parkett: Hamberger, Ro

Products/ markets: use class 1

(Photos by Mitteramskogler/ Austria)



Products/ markets: use class 2

(Photos by Mitteramskogler/ Austria)



Products/ markets: use class 3

(Photos by Mitteramskogler/ Austria)



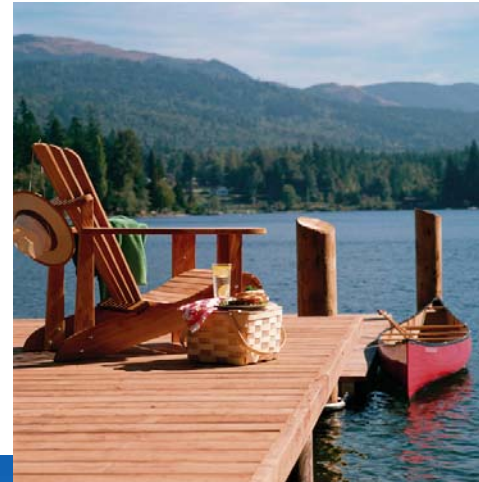
Products/ markets: use class 3

(Photos by Thermowood Association, Finland)



products: hazard classes 1-5



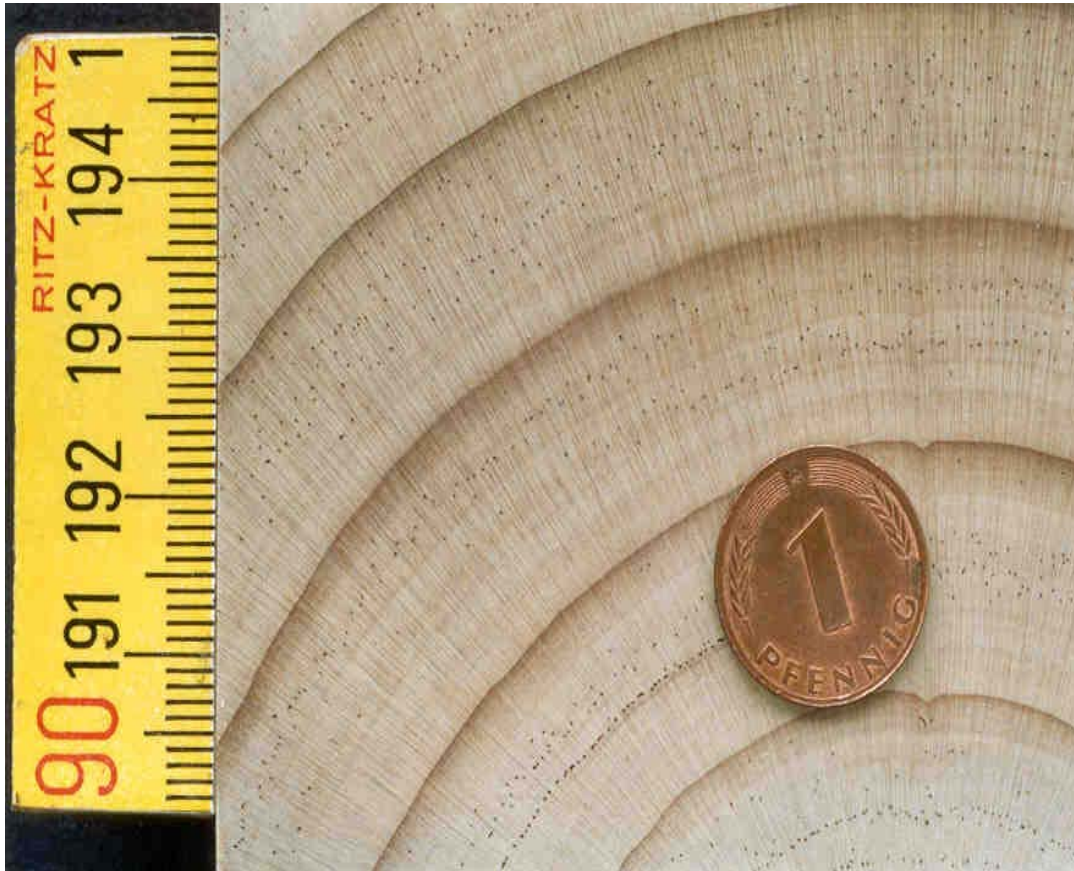


Basis materials for wood modification

- Fast growing
- Easy „treatable“
- Large quantities



Basis materials for wood modification



- Pines
- Poplars
- Beech?
- Eucalypts
- Other fast growing wood species!

Outlook „modified wood“

1. New methods will get to market
2. Will get larger market share
3. Will be introduced in high quality/ special products
4. Must be marketed as „new material“
5. New type of industry will develop („wood modifiers“)
between chemical industry and wood industry

☐ get involved in this new business!

Thank you for your attention!

