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Simultaneous Shaping and Fixation of Veneer by Specific Material Modification

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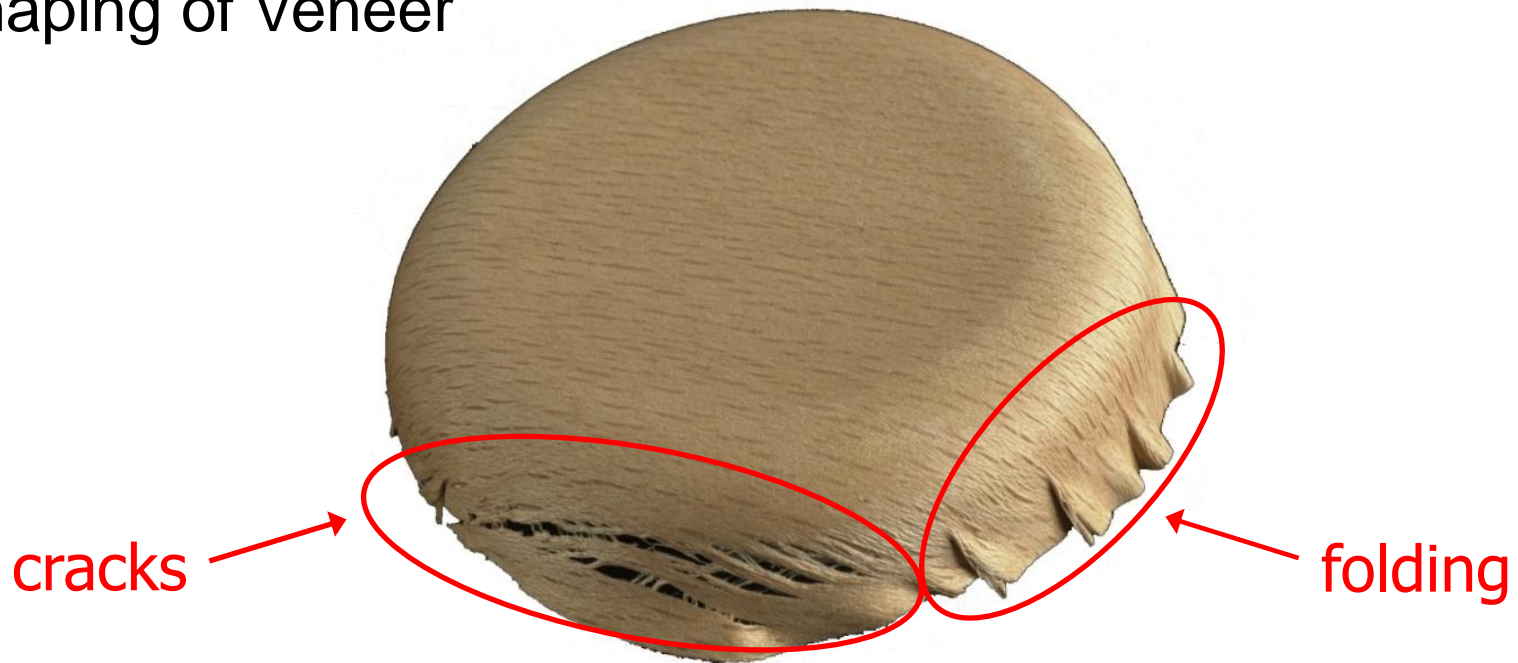
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Background

Failure at 3- Dimensional Shaping of Veneer



Cupping test, Beech, *Fagus sylvatica* L.
(source: Buchelt, TUD)

Approach of the Project

objective: development of a veneer modification process

- improved plasticization for 3-Dimensional shaping
- reduced spring-back effect

method: impregnation with an organic plasticizing solution:

- furfuryl alcohol (FA) **and**
- organic anhydride

step 1: impregnation

step 2: moulding, fixation/ curing at high temperatures

reference analyses

- FTIR
- Raman
- pyrolysis GC/MS
- DSC
- DMTA
- He pycnometry
- fluorescence microscopy

samples

- veneer (*Acer spec.*)
- thickness: 0.5 mm
- kiln dried

impregnation

defined load of the cell walls
with furfuryl component

- differently concentrated
two- component solution:
furf.comp: 90..99 %
org:anh.: 10..1 %
- vacuum impregnation
- soaking

analyses

- FTIR
- Raman
- DSC
- DMTA
- He pycnometry
- fluorescence microscopy

curing

- different temperatures

analyses

- FTIR
- pyrolysis GC/MS
- HS-GC/MS
- He pycnometry
- fluorescence
microscopy
- spring back

shaping

analyses

- cupping test
- fluorescence
microscopy

Aspects

- development of a process for shaping, form fixation and curing of veneers.
- What effects do the parameters have on the modification process?
- What are the mechanisms of the curing?
- Is it a wood modification process or rather an wood impregnation process?
- Is it possible to develop a model for the determination of mechanical properties according to loading and process parameters?

results

Improved Plasticization

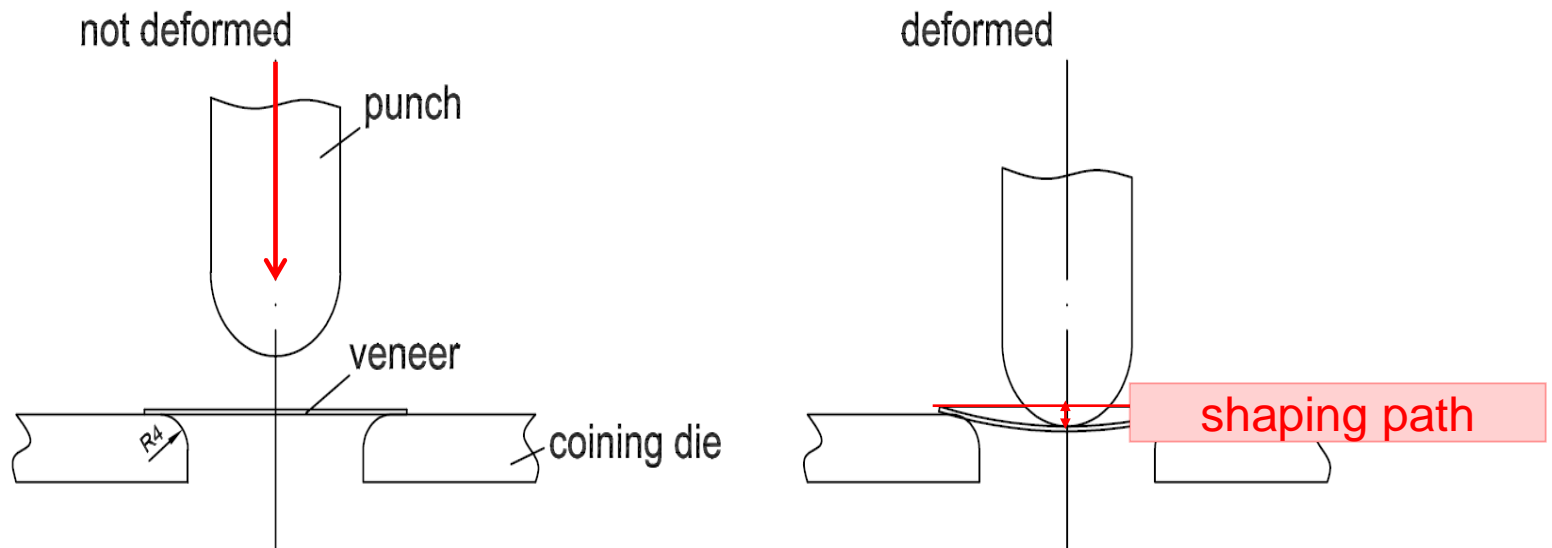
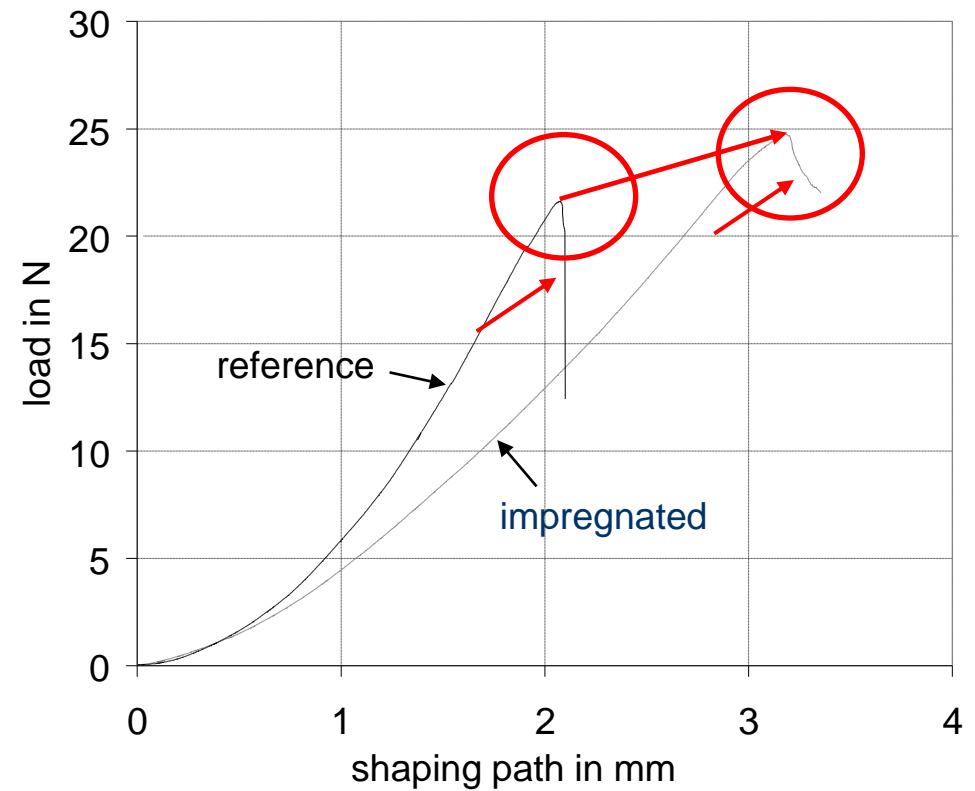
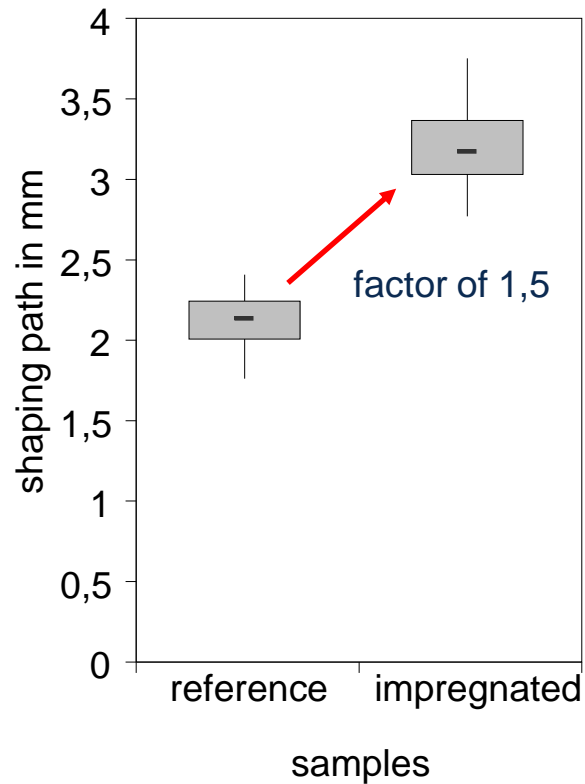


figure: cupping test according to **Buchelt**, et al.

results

Improved Plasticization



figures: results from cupping test according to Erichson (DIN EN ISO 20482)

results

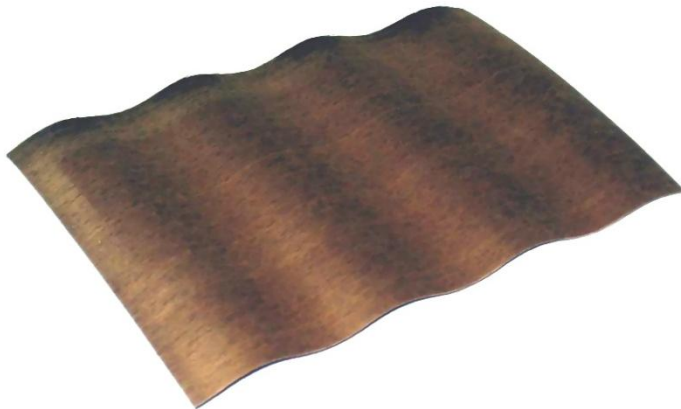
Moulding Tests



Tray. (source: Fa.Denkinger)



Part of a steering wheel.
(source: Fa.Furwa Furnierkanten GmbH)



General conclusions of the project

- There are reactions between lignin and furfuryl alcohol.
- The curing time depends strongly on the curing temperature.
- The degree of the polymerization depends strongly on the amount of maleic anhydride.
- For lower concentrations of furfuryl alcohol higher amounts of catalysts are required.
- There are either exothermic reactions of the furfuryl alcohol or the maleic anhydride with the wood or the wood serves as a template for the reaction.

Thank you for your attention!

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