

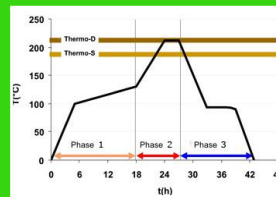
Thermal modification of wood

Purpose of the research:

Various thermal modification processes are industrially applied in Europe, which differ considerably regarding the process conditions that are used. Therefore, the scientific research at University of Göttingen focuses on the impact of different process conditions (e.g. temperature, duration, pressure and rel. humidity) on the final product. Since industrial scale processes suffer from large variations within the treatment kiln, the thermal modification process will be performed at laboratory-scale.



Thermal modification using pressurized steam in an industrial-scale autoclave at Firmolin BV (NL)



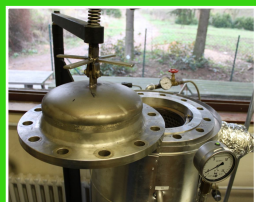
Principle process schedule for the ThermoWood® process that uses atmospheric steam conditions

Thermal modification at laboratory-scale:

Construction of the high-pressure autoclave for the imitation of various industrially applied processes

Vessel

Main part is the vertically oriented vessel with a volume of 65l that is designed for pressures between -1 and 9 bar and temperatures up to 260°C.



Steam generator

The vessel is connected to an external steam generator that heats up water with a maximum of 600 Watt.



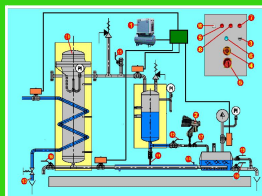
Gas washer and vacuum pump

The autoclave is additionally equipped with a gas washer traps by-products of the process and a vacuum pump e.g. to minimize the oxygen content before the process.



Control unit

The whole autoclave, including all sensors and valves, are wired to an electric cabinet that enables the computer-based control of the equipment.



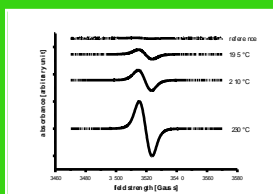
Computer software

A custom-designed software is used to monitor and to steer different thermal modification processes, e.g.:

- Using pressurized steam (e.g. WTT)
- Using atmospheric steam (e.g. ThermoWood)
- Processes under vacuum (e.g. Timura)

Evaluation of the final product:

Chemical changes:

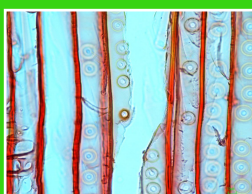


Measurement of stable free radical formation with ESR-spectroscopy



FT-IR spectrometer equipped with an ATR-unit

Anatomical changes:



Analysis of longitudinal cracks in tracheid walls by means of light microscopy (left) and scanning electron microscopy (right)

