

Water-induced cell wall porosity in wood – investigations with differential scanning calorimetry

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The porosity of wood cell walls is of great interest for different basic and applied applications. When water is absorbed into wood a dimensional change can be observed. The question how this water is stored within the cell wall has been discussed over decades. One hypothesis is the creation of water induced mesopores within the cell wall. Several experiments with heat flux differential scanning calorimetry were done to proof this assumption. Thermoporosimetry is often used for porosity determinations of inorganic materials as well as for pulp. The technique shows that there are no pores in the range between 2 to 10 nm which are built by the swelling process in Wood. This is supported by measurements of heat capacity with standardized sapphire method according to DIN 51007. Additionally with DSC only non-freezing-bound water can be found within wood. Therefore we conclude that detected pores must have previously existed because of biological structures or cavities. Our measurements reject the hypothesis that water sorption into wood leads to pore structures within the cell wall. We propose that the term cell wall porosity can only be used for pores which are gained from the biological structure. The finding offers the possibility to renew wood-water-sorption theories generally. Based on the research results wood modification as well as wood degradation and the water transport processes within the wood cell wall can be seen from a different perspective.