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ABSTRACTS

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***In-situ* MOISTURE CONTENT AND DENSITY MEASUREMENTS IN SURFACE DENSIFIED WOOD USING DUAL X-RAY ABSORPTIOMETRY IN MEDICAL CT-SCANNING**

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There is a considerable interest in developing treatments for densifying wood species which have a low density in order to improve mechanical properties like impact resistance, longitudinal Young's modulus, strength and hardness. The abrasion resistance and hardness of a wood surface can be improved by densifying only a thin surface layer of the wood [1].

A challenge when studying surface densified wood is to be able to study the degree of densification when the moisture content (MC) varies in the wood. Small changes in MC can initiate release of interlocked stresses and cause unwanted set-recovery of the densified wood structure. This process is rapid and difficult to study in-situ, but this is necessary for a better understanding of the phenomenon.

The aim of this study was to investigate, using a dual X-ray absorptiometry (DXA) technique, whether it is possible to detect MC gradients and density-profile variations in surface-densified specimens of Scots pine (*Pinus sylvestris* L.). This technique could contribute to the development of better methods to reduce set-recovery and ensure a higher quality of the surface-densified end products.

The DXA technique for MC estimation involves two consecutive scans at two different X-ray energies. Methods that apply this technique are currently being tested to develop prediction models for MC using either DXA machines or CT-scanners [2]. In the present study, MC was estimated by applying DXA with a medical computed tomography (CT) scanner Siemens Somatom Emotion Duo.

Several MC measurements were made by performing two scans at 80 and 130 kV in a group of surface-densified Scots pine specimens. MC was estimated at different stages, after the specimens had been subjected to conditions that would lead to a change in MC and the formation of a moisture gradient. The division between the CT numbers in the two images was used to create a regression model against the reference measured MC and the R^2 value was greater than 0.95. Predictions for MC were made on a different group of specimens, resulting in a root mean square error of about 2 MC percentage points. The 130 kV level was used to measure the density profile throughout the specimens.

The estimation of MC using DXA in CT-scanners is a technique still under development. Furthermore, medical CT-scanners have a relatively low range of scanning energies for this goal. Nevertheless, these results show that DXA is applicable using such a range of medical CT scanning energies for in situ MC measurements, as well as for the determination of density profiles of surface-densified wood. The relatively low scatter suggests that, with further refinement, the method could achieve a high level of precision.

References

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