Aalto University

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Bringing new functions to wood through surface modification

The Effect of Coating on the Moisture Buffering Properties of Pine

Introduction

In Finland, designers and architects are aware that wood material can buffer moisture in interiors. However, there are only a few examples of purposeful design to create a wooden surface with moisture buffering capacity. Especially the effect of coatings seems to raise questions among the users.

In the case of wood, the effect of grain direction, density and surface treatment are significant factors contributing to the performance of a wooden surface. Coatings are usually applied to both unmodified and modified wooden surfaces before the end-use and therefore this poster aims to provide a brief insight on the effect of two coatings on the pine's moisture buffering properties.

Material and Methods

Two different surface treatments were applied to the planed and sanded pine surfaces [Figure 1] according to the instructions provided by the manufacturers: water-borne lacquer Kiva (manufacturer Tikkurila) with low water vapour permeability and water vapour-permeable soap finish (manufacturer Wennex). Specimens inclued both sapwood and heartwood.

Dimensions of the test boards were 123/150mm*80mm*13mm. Only one side of the board (radial or tangential cut) was exposed to water vapor; other five sides were sealed with aluminum tape. The moisture buffering test was followed for the most part the protocol of Nordtest Method [1]. The set values for the humidity loads were RH75 and RH33, but according to the monitored values using Scanntronik Hygrofox Mini data logger, the actual levels of relative humidity were 80% and 33%. Test boards were pre-conditioned in RH50, T=23ºC for several weeks before testing.

Figure 1 *Tangential (left) and radial surfaces with untreated (top), varnished (middle) and soap treated (bottom) pine boards were exposed to cycling humidity conditions. Five sides of the boards were sealed with aluminum tape. Species from left: ash, birch, black alder, elm, maple and oak.*

Results

Lacquer treatment clearly decreased the moisture uptake and release when compared to the reference with no treatment, but soap treatment had no effect on the adsorption [Figure 2]. Moisture buffering values (MBV) also showed the same effect : MBV of lacguered surfaces was only 50% of reference boards' and soap treated boards' MBVs. Hameury observed similar effect in his work with various water-permeable coatings [2] : acrylic latex paint decreased the moisture buffering value (MBV) most, more than 50%. His test did not include soap or water-borne lacquer. Hameury's MBV for the pine reference was 1.36 g/(m2·%RH), which is twice the value obtained in this study.

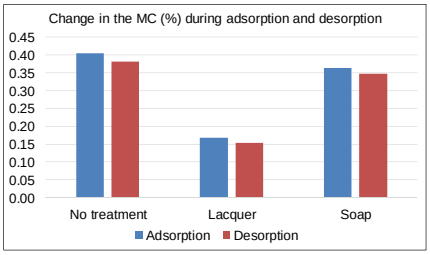

Figure 2 *The Moisture Buffer Values below are only indicative, because they are based on one cycle, in which the mass change had not yet reached the criteria of Nordtest Method.*

Hameury used small defect-free samples (diameter of 12mm) whereas our samples were 80mm wide and 123mm or 157mm long. The amount of heartwood and sapwood was varied in the samples as well as grain pattern and therefore these results are only indicative and form a basis for the more profound measurements in the future.

Conclusions

The knowledge regarding the effect of coatings on the moisture buffering properties of various wood-based materials should be easily available both for professionals (designers and architects) and consumers. This study showed the difference in the behavior of pine due to a few different coatings within the RH range from 33% to 75%. More coatings and various RH ranges need to be studied to enable the design of functional wooden surfaces with an acceptable level of usability.

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References

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