

STSM REPORT :

Evaluation of mechanical and barrier properties of wood coating for outdoor uses

PURPOSE OF THE ACTION

This STSM is divided on two parts because two types of tests were performed. First, I performed indentation test to assess film extensibility. This STSM was the opportunity to learn about the experience at Holzforschung Austria. They proposed a new CEN/TS 16360 for this test. Indentation test is interesting for me because it deals with mechanical properties of wood coating and during my PhD I work on Persoz pendulum to assess surface hardness. So, the idea was to link the Persoz hardness results with the indentation results. Secondly, I did vapor water permeability test. Indeed, this test is performed both at FCBA and Holzforschung Austria but with two different methods because at FCBA, it is a machine which performs the weighing and controls atmosphere and at Holzforschung Austria, the test is all performed manually. Therefore, the results of vapor water permeability will be compared between both labs. In consequence, this STSM is a great opportunity to complete the work I have done for my PhD on the assessment of mechanical properties of wood coating.

DESCRIPTION OF THE WORK CARRIED OUT

Before the STSM, applications of coatings were made. I applied 4 different commercial acrylic coatings in 3 layers by brush on spruce and prepared samples for permeability and indentation tests.

During the STSM, my work was divided in two parts.

First, for the vapor water permeability test, I started preparing the samples by sanding them. This part of the work was the opportunity to discuss about the interest of having the same thickness of the sample for all of the coatings. Then samples were prepared for the test by putting them in a cup filled with KNO_3 solution. This solution provides a 94 % relative humidity inside the cup whereas the outside of the cup is left in a climate room at 50 ± 5 % of relative humidity (and 23 ± 2 °C). The difference of the partial pressure of the water vapour inside and outside the cup will lead to a diffusion of the water vapour through the coating under test. By weighing the samples at different times, the water-vapour transmission rate and the water-vapour diffusion-equivalent air layer thickness were calculated. This part of the work was also an opportunity to discuss the interest of placing the coated face of the sample towards climate room. Indeed, in this way, it allows the wood (which is towards the solution at 93% of relative humidity) to swell and the water vapour can diffuse through the wood before going through the coating.

Secondly, I performed indentation tests. A metal plate with 12 cones with different heights is pressed into a coated wood surface and after removing the plate coating cracks in the areas indented by the cones are assessed by observation with a microscope. According to which cone lead to cracking, an information is given on the film extensibility.

DESCRIPTION OF THE MAIN RESULTS OBTAINED

For water-vapour permeability tests, one of the four coatings appeared to be more permeable than the others (the mean S_d was 0.6 m whereas it was 0.3 m for the others). The aim is to compare these results with those which will be obtained at FCBA in Bordeaux (when the machine is available). One of the discussions was about the requirements in terms of water-vapour permeability for exterior coatings (window, cladding...). Indeed, it does not exist requirements which could be useful. ISO 7783 was used for this test and some questions arise from this work about this standard. Indeed, it seems that P_0 which is the standard atmospheric pressure is expressed in Pascals and should be in hPa. Moreover, ΔP_v the difference between the partial water-vapour pressure in the test cup and that in the test enclosure is a constant value whereas it depends on temperature and relative humidity present in the climate room. So, to be precise, the real ΔP_v was calculated registering temperature and relative humidity in the climate room between two weighings.

For indentation tests, the aim was to compare the results obtained with those I obtained with Persoz pendulum to see if a link can be made between indentation test results and Persoz hardness. For three of the coating, a link has been established between high Persoz hardness and low film extensibility.

With this test, it was observed that there is an influence of the thickness of the coating on indentation test results. Indeed, the more layer there is (so the thicker the coating is), the fewer damages are observed. It is logical with the fact that the thicker is the coating, the better is the protection.

FORESEEN PUBLICATIONS/ ARTICLES RESULTING FROM THE STSM

I would like to present the results I obtained during this STSM with the results I obtained on Persoz pendulum during the next IRG conference (International Research Group on Wood Protection): IRG46 in May 2015. Moreover, the results may be an input for CEN/TC139/WG2.

OTHER COMMENTS

I really would like to thank all the people in Holzforschung Austria because I learnt more than the methodology of two tests. Indeed, this STSM was an opportunity for me to learn other techniques to determine dry film thickness. Moreover, I had the opportunity to see the making of free films in order to perform traction tests and to subject them to weathering. Finally, this STSM was an opportunity to discuss about Holzforschung Austria methodologies and their expertise in both tests: water-vapour permeability test and indentation test.