Research Report

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TITAN WOOD

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Wood moisture content measurement Of Accoya™

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1. Background

In respect to quality control it is desirable to be able to measure the moisture content of Accoya™ non-destructively. Two measurement principles are commonly used: electric resistance and capacity wood moisture meters.

Electric moisture meters use the strong relation between the moisture content and electric resistance. The dryer the wood the higher the electric resistance. Electrodes are hammered into the wood, and measure the electric resistance. The meter can measure between approximately 8 and 30% moisture content. The relation is influenced by temperature and wood species. For a new wood species, like Accoya™, a calibration line is desired.

Capactive moisture meters are based upon measurement of the dielectric constant. The meters consists of a transmitter as well as a receiver and are hold against the wood surface. The relation between the dielectric constant and moisture content depends on the density of the wood.

In this initial investigation the suitability of the electric moisture meter and the capacitive moisture meter is studied. Since the equilibrium moisture content of Accoya™ is approximately 5% in a condition of 65% relative humidity and 20 °C, it is unlikely that the electric resistance meter can be used for moisture measurement. The capacitive meter is mostly influenced by the density and could be a solution, however only surface measurements can be performed in comparison to electric meters where the moisture gradient (in depth) can be studied.

2. Material and methods

In total 16 samples have been prepared originated from 4 boards (4 lengthwise paired samples per board). The paired samples have been conditioned at 4 different climates. The first three series of samples have been conditioned at approximately 65%, 33% and 91% relative humidity (RH) respectively. Temperature was at each climate 20 °C. The last series of samples has been impregnated with water. After conditioning the samples have been weighed and measured by one capacitive and two electric moisture meter (see table below). Finally all samples have been dried to determine the ovendry weight, and to be able to calculate the moisture content. The results of this first experiment suggested to perform a test at conditioned wood blocks at 81% relative humidity.

***Table 1**. Overview used wood moisture meters.*

Meter	Type
Brookhuis FMD 6	Electric resistance
Gann M4050	Electric resistance
Brookhuis FME	Capacitive

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3. Results and discussion

In table 1 the average results are shown. In figure 2 the individual measurements are shown in relation to relative humidity (RH). The Equilibrium Moisture Content of Accoya™ (determined by the ovendry-method) in respect to relative humidity is presented in figure 1.

There is little difference in the electric moisture meter readings of Accoya™ conditioned at 33% and 65% RH. Likely this is due to the lower limit of the electric moisture meters. The readings seem valid for samples conditioned at 81% and 91% RH conditioned samples and water saturated samples. This means that for these conditions the electric moisture meters could be employed.

The results of the capacitive meter show some differences for Accoya™ conditioned at 33%, 65% and 81% relative humidity. However this difference is minimal in respect to the standard deviation. The method seems to give less reproducible measurements. However the results shown are not corrected for density and the ovendry density is varying from 420 to 660 kg/m3.

***Table 2**. Average (standard deviation) of moisture measurements of Accoya™.*

Conditioned	Moisture content [%]			
	o.d. method	Brookhuis FME*	Brookhuis FMD	Gann M4050
33% RH	2.8 (0.2)	3.1 (0.8)	5.3 (0.2)	6.2 (0.1)
65% RH	4.5 (0.2)	4.2 (0.8)	5.2 (0.1)	6.2 (0.0)
81% RH	*6.1 (0.3)*	*3.7 (1.0)*	*6.6 (0.5)*	*9.0 (1.8)*
91% RH	8.6 (0.4)	8.1 (2.6)	11.7 (2.0)	11.0 (1.1)
Water saturated	112.9 (47.4)	61.7 (0.0)	35.8 (5.1)	39.2 (12.0)

** Uncorrected for density*

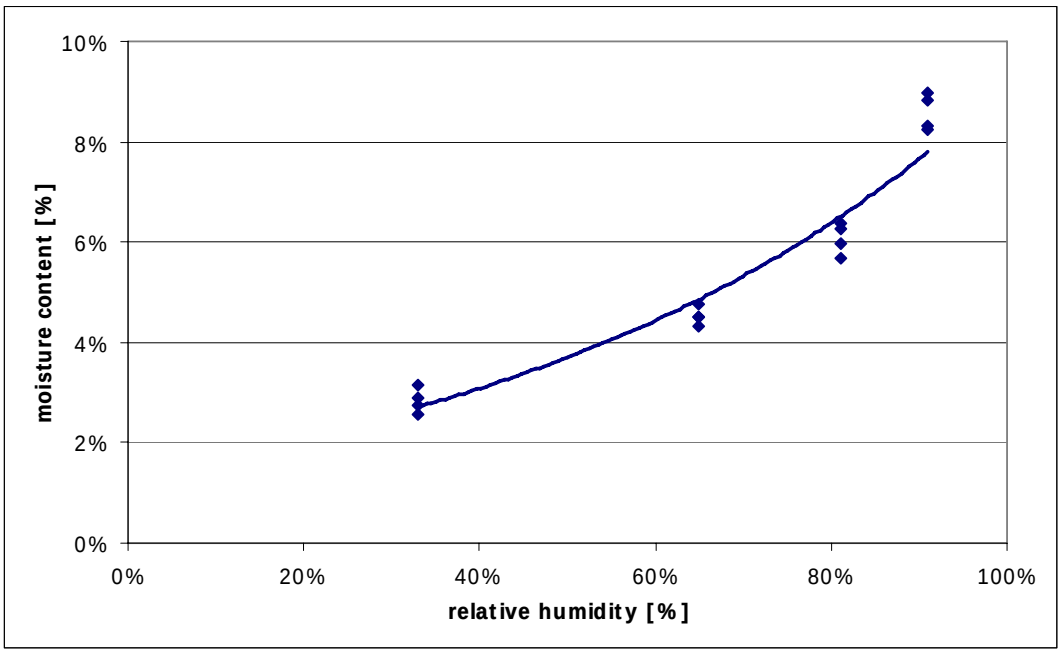

Figure 1. *Equilibrium moisture content of Accoya™ (determined by the ovendry-method) in respect to relative humidity.*

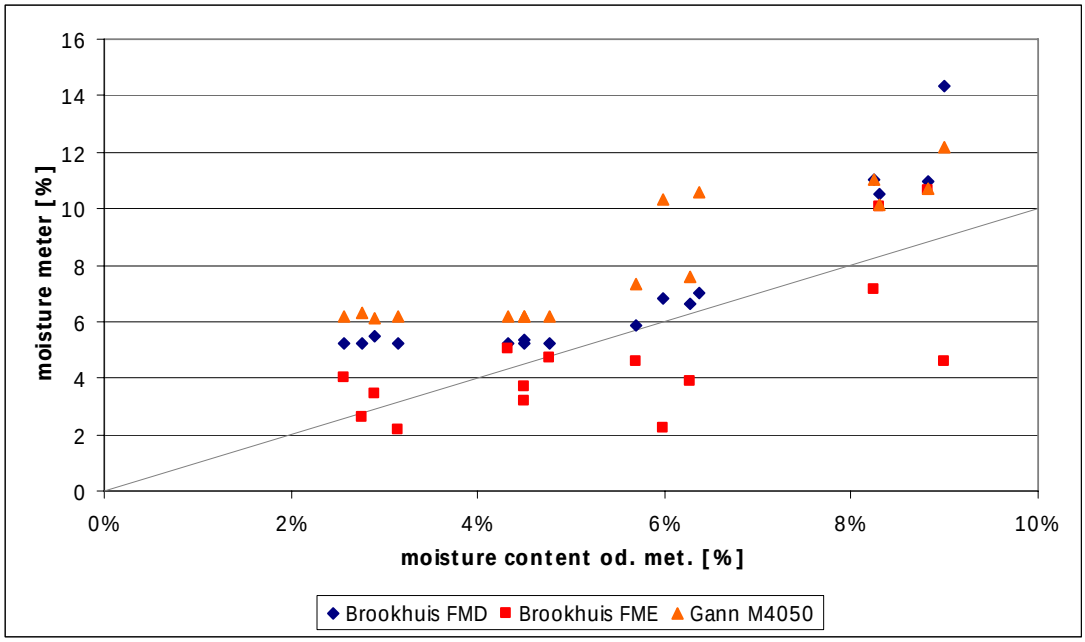

***Figure 2**. Different moisture meters in relation to moisture content determined by ovendry method.*

4. Conclusion

The investigated type of wood moisture meters (electric resistance and capactive) do not seem to be suitable to measure the (equilibrium) moisture content of Accoya™. This can be explained by the detection limit of the investigated meters.

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Appendix 1. Individual measurements

Sample	Condition	Density ovendry [kg/m³]	Moisture content [%]							
			o.d. method	Brookhuis FME*			Brookhuis FMD			Gann M4050	
				meas. 1	meas. 2	meas. 3	meas. 1	meas. 2	meas. 3	meas. 1	meas. 2
1A	65% RH	648	4,3	5,1	5,0	5,1	5,2	5,2	5,2	6,2	6,2
2A	65% RH	587	4,8	4,7	4,7	4,7	5,2	5,2	5,3	6,2	6,2
3A	65% RH	468	4,5	3,6	3,7	3,7	5,2	5,2	5,6	6,2	6,2
4A	65% RH	421	4,5	3,1	3,2	3,3	5,2	5,2	5,2	6,2	6,2
1B	33% RH	655	2,6	4,0	4,1	4,0	5,2	5,2	5,2	6,2	6,2
2B	33% RH	578	2,9	3,5	3,5	3,4	6,0	5,2	5,2	6,2	6,1
3B	33% RH	455	2,8	2,6	2,6	2,7	5,2	5,2	5,2	6,2	6,4
4B	33% RH	421	3,1	2,3	2,0	2,2	5,2	5,2	5,2	6,2	6,2
1C	91% RH	665	8,2	6,6	7,2	7,7	11,2	10,9	10,9	11,6	10,4
2C	91% RH	587	8,8	9,8	11,2	10,9	10,6	10,9	11,3	10,3	11,1
3C	91% RH	457	8,3	9,7	10,4	10,1	9,8	11,0	10,7	10,3	10,0
4C	91% RH	424	9,0	3,5	4,7	5,6	15,3	16,2	11,5	13,4	11,0
1D	Water sat.	676	50,7	61,7	61,7	61,8	28,2	28,6	27,3	24,2	23,0
2D	Water sat.	589	104,5	61,7	61,7	61,8	37,4	37,5	37,4	38,9	41,9
3D	Water sat.	455	136,2	61,7	61,7	61,7	41,5	41,7	41,1	56,6	53,3
4D	Water sat.	427	160,4	61,8	61,7	61,7	36,5	36,6	36,0	36,1	39,4
1D	*81% RH*	*676*	*5,7*	*4,6*	*4,6*	*4,5*	*5,9*	*5,6*	*6,0*	*7,4*	*7,3*
2D	*81% RH*	*589*	*6,3*	*3,9*	*4,0*	*3,8*	*6,5*	*6,8*	*6,6*	*7,7*	*7,5*
3D	*81% RH*	*455*	*6,0*	*2,1*	*2,4*	-	*6,6*	*6,9*	*6,9*	*9,1*	*11,6*
4D	*81% RH*	*427*	*6,4*	-	-	-	*7,3*	*7,0*	*6,8*	*11,3*	*9,8*

** uncorrected for density*

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