ALL ON EDGE

Development of Objective Test Methods for Furniture Edges and Rims

Work Package B

„Short-term methods“

– Part „Water and damp resistance“

Overview of working steps

START

- Background: Existing methods not satisfying

MATERIAL

- Chosen: 24 finished samples
- Delivered: 6 finished samples

TESTS ON RESISTANCE AGAINST

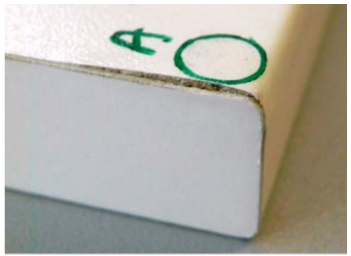
- DAMP
- WATER
- TEMPERATURE
- CONTACT HEAT

COMPARATIVE TESTS AND RRT

- Assuring repeatability and reproducibility of the methods

GOAL

- New testing methods



Tasks

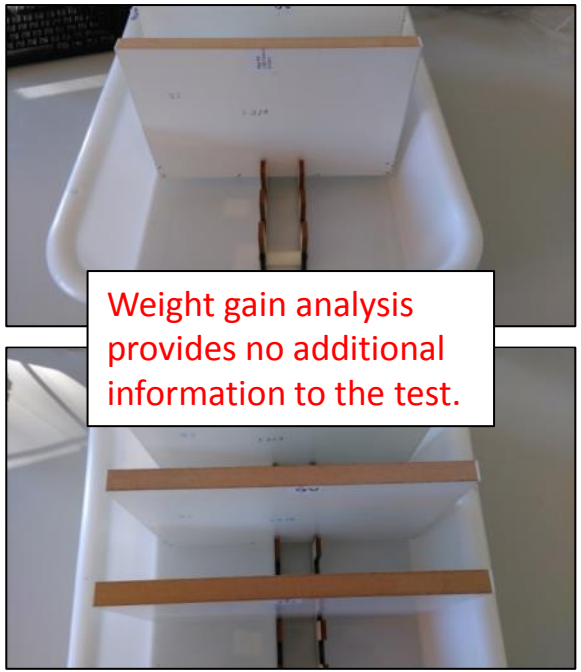
- Tasks:
  - Task-B1: **Definition, preparation and providing of different furniture edges**
  - Task-B2: **Methodological investigations on new test methods for damp and water resistance**
  - Task-B3: Methodological investigations on new test methods for contact heat and temperature resistance
  - Task-B4: **Comparative tests of the developed short-term methods**
  - Task-B5: **Round Robin Tests of optimized short-term methods**
  - Task-B6: **Final description of suitable short-term methods**

Previous steps

- Methodological investigations on damp resistance
  - Five different procedures tested.
  - No satisfying results, discrepancies in quality assessments between different procedures.
  - Problems with assuring stable conditions within the equipment – no comparability possible.
  - Together with the Members of User Committee it has been decided to abandon further development of this method and to concentrate on water resistance instead.

Previous steps

- Methodological investigations on water resistance
  - An easy method basing on immersion in water was developed
  - Parameters:
    - immersion of the tested edge in distilled water, 10 mm
    - assessment: thickness swelling on 6 points along the edge of the tested specimen, visual assessment
    - additionally for scientific purposes: measurement of weight gain
    - testing procedure:
      - 6 x [30 min water immersion and 30 min of drying]
      - 1 x 24 h of drying
      - drying occurs at 23 °C / 50 % RH



Material

- Material used for the investigations (substrate: MDF):

Var.	Edge	Glue	Board surface	Profile
3.1	ABS	PUR	Melamine Faced	flat
3.2	ABS	EVA	Melamine Faced	flat
3.3	ABS	PO	Melamine Faced	flat
6.1	ABS	LASER	Melamine Faced	flat
6.2	PP	LASER	Melamine Faced	flat
7.2	PET	2K-PUR	PET	3D

Findings

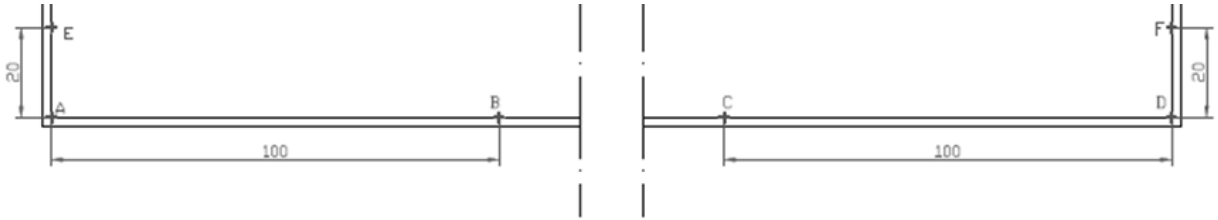
- Clear distinction between ABS and PP in laser technique was possible.
- For PP, the problems begin always at the rim (connection PP-melamine).
- In case of PP, the final drying added even more stress, for ABS and hotmelts, the swelling went back. This could be due to the MDF quality rather than due to edge banding material.
- The current testing procedure does not allow any differentiation between the different hotmelts qualities.
- The value of 0.2 mm is said to be the borderline value – up from 0.2 mm the human eye can see the damage. If the value of 0.2 mm shall be the limiting value, a differentiation can be done after 3 cycles.

Findings

- The preliminary results do not allow a predicament of suitability of the procedure for further testing for all types of gluing, as a good differentiation does not seem to be possible at the moment.
- Weight gain analysis confirms the information from the test but gives no additional knowledge.
- It is crucial to pursue the tests with more samples of different qualities to develop a reliable and differentiating test method – unfortunately, no further samples were delivered.
- Decision: comparative tests for testing the method itself.
- In addition, it shall be stated if a visual assessment could replace the measurement.

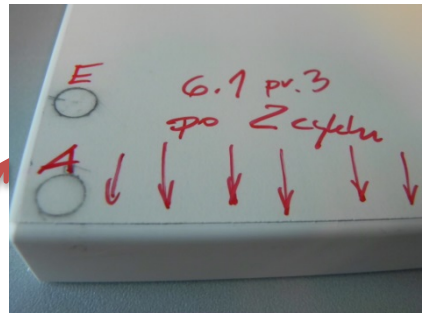
Comparative test

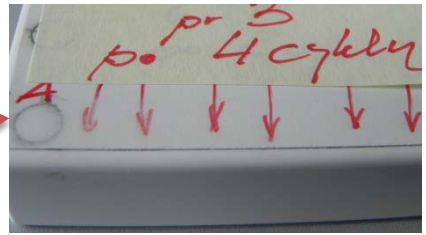
- For the comparative tests, measurements at the 6 points remained, but were additionally accompanied by visual assessment.
- The results of previous findings were confirmed.
- For the laser technique samples, the test could have been shortened to 2 cycles, as damages were detectable very quickly.
- No damages at the other samples.



- Results of measurements: 6.1 as an example

	No of test samples/edge	Thickness in mm Measuring points A	B	C	D	E	F	Visual assessment [0-1]
Before test	1	19,107	19,119	19,129	19,100	19,140	19,126	
	2	19,139	19,158	19,165	19,125	19,165	19,157	
	3	19,150	19,169	19,175	19,147	19,172	19,165	
1. Cycle	1	19,117	19,120	19,134	19,118	19,146	19,130	1: visible loosing of glue joint
	2	19,156	19,160	19,165	19,145	19,172	19,158	1: visible loosing of glue joint
	3	19,156	19,161	19,175	19,145	19,172	19,164	0
2. Cycle	1	19,161	19,128	19,150	19,151	19,159	19,135	1:visible elevation of the laminate (along the edge and corner)
	2	19,194	19,163	19,165	19,188	19,185	19,157	1:visible elevation of the laminate (along the edge and corner): photo
	3	19,188	19,172	19,174	19,203	19,172	19,174	1: visible loosing of glue joint in a few points; photo
3. Cycle	1	19,209	19,145	19,179	19,194	19,184	19,133	1:deepening the change
	2	19,235	19,162	19,167	19,235	19,200	19,163	1:deepening the change
	3	19,214	19,176	19,178	19,206	19,177	19,172	1:deepening the change
4. Cycle	1	19,251	19,170	19,216	19,249	19,215	19,140	1:deepening the change and visible loosing of the glue joint on the other side
	2	19,291	19,161	19,171	19,281	19,225	19,165	1:deepening the change; photo
	3	19,241	19,178	19,180	19,229	19,179	19,208	1:deepening the change; photo
5. Cycle	1	19,309	19,190	19,255	19,326	19,247	19,161	1:deepening the change
	2	19,354	19,164	19,197	19,373	19,255	19,185	1:deepening the change
	3	19,287	19,175	19,178	19,294	19,179	19,220	1:deepening the change
6. Cycle	1	19,405	19,237	19,310	19,417	19,310	19,189	1:deepening the change
	2	19,446	19,164	19,228	19,419	19,306	19,217	1:deepening the change; photo
	3	19,335	19,199	19,175	19,344	19,188	19,258	1:deepening the change
After 24 h at 23 °C/50 RH	1	19,574	19,295	19,427	19,603	19,429	19,265	1
	2	19,584	19,166	19,303	19,625	19,422	19,254	1
	3	19,445	19,233	19,205	19,481	19,263	19,307	1





0.2 or 0.15 mm?

- Assessment of 0.2 mm in Lab 1 in comparison to visual assessment of Lab 2
- In Lab 2, already after the 1st cycle changes at Var. 6.1 and 6.2 were stated as "**visible** loose of glue joint"
- In Lab 1, those changes are not visible in the scaling when assuming 0.2 mm as the visibility border.

Lab 1

	variant 3.1	variant 3.2	variant 3.3	variant 6.1	variant 6.2	variant 7.2
Cycle 1	0	0	0	0	0	0
Cycle 2	0	0	0	1	1	0
Cycle 3	0	0	0	1	1	0
Cycle 4	0	0	0	1	1	0
Cycle 5	0	0	0	1	1	0
Cycle 6	0	0	0	1	1	0
24 h 23 °C/ 50%	0	0	0	1	1	0

Lab 2

	variant 3.1	variant 3.2	variant 3.3	variant 6.1	variant 6.2	variant 7.2
Cycle 1	0	0	0	1	1	0
Cycle 2	0	0	0	1	1	0
Cycle 3	0	0	0	1	1	0
Cycle 4	0	0	0	1	1	0
Cycle 5	0	0	0	1	1	0
Cycle 6	0	0	0	1	1	0
24 h 23 °C/ 50%	0	0	0	1	1	0

0.2 or 0.15 mm?

- A change to 0.15 mm results in a different picture.
- Possibly, 0.2 mm is not enough as a border.
- Comparison of measurement and visual assessment at Lab 2 showed that the human eye is able to see differences of 0.1 mm or even smaller (0.08)!

Lab 1

	variant 3.1	variant 3.2	variant 3.3	variant 6.1	variant 6.2	variant 7.2
Cycle 1	0	0	0	1	1	0
Cycle 2	0	0	0	1	1	0
Cycle 3	0	0	0	1	1	0
Cycle 4	0	0	0	1	1	0
Cycle 5	0	0	0	1	1	0
Cycle 6	0	0	0	1	1	0
24 h 23 °C/ 50%	0	0	0	1	1	0

Lab 2

	variant 3.1	variant 3.2	variant 3.3	variant 6.1	variant 6.2	variant 7.2
Cycle 1	0	0	0	1	1	0
Cycle 2	0	0	0	1	1	0
Cycle 3	0	0	0	1	1	0
Cycle 4	0	0	0	1	1	0
Cycle 5	0	0	0	1	1	0
Cycle 6	0	0	0	1	1	0
24 h 23 °C/ 50%	0	0	0	1	1	0

Visual/measured?

Visual assessment (worst case decides)

	variant 3.1	variant 3.2	variant 3.3	variant 6.1	variant 6.2	variant 7.2
Cycle 1	0	0	0	1	1	0
Cycle 2	0	0	0	1	1	0
Cycle 3	0	0	0	1	1	0
Cycle 4	0	0	0	1	1	0
Cycle 5	0	0	0	1	1	1
Cycle 6	0	0	0	1	1	0
h 23 °C/ 50%	0	0	0	1	1	0

Measurement: border value 0.2

	variant 3.1	variant 3.2	variant 3.3	variant 6.1	variant 6.2	variant 7.2
Cycle 1	0	0	0	0	0	0
Cycle 2	0	0	0	0	1	0
Cycle 3	0	0	0	0	1	0
Cycle 4	0	0	0	0	1	0
Cycle 5	0	0	0	1	1	0
Cycle 6	0	0	0	1	1	0
24 h 23 °C/ 50%	0	0	0	1	1	0

Measurement: border value 0.15

	variant 3.1	variant 3.2	variant 3.3	variant 6.1	variant 6.2	variant 7.2
Cycle 1	0	0	0	0	0	0
Cycle 2	0	0	0	0	1	0
Cycle 3	0	0	0	0	1	0
Cycle 4	0	0	0	1	1	0
Cycle 5	0	0	0	1	1	0
Cycle 6	0	0	0	1	1	0
24 h 23 °C/ 50%	0	0	0	1	1	0

Measurement: border value 0.1

	variant 3.1	variant 3.2	variant 3.3	variant 6.1	variant 6.2	variant 7.2
Cycle 1	0	0	0	0	0	1
Cycle 2	0	0	0	1	1	1
Cycle 3	0	0	0	1	1	1
Cycle 4	0	0	0	1	1	1
Cycle 5	0	0	0	1	1	1
Cycle 6	0	0	0	1	1	1
24 h 23 °C/ 50%	0	0	0	1	1	0

- Except of variant 7.2, the human eye catches more damages than the calliper.

Repeatability

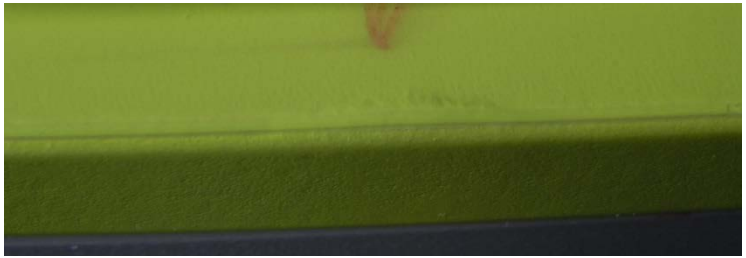
- The test shows a very good repeatability.

		variant 3.1 PUR hotmelt/ABS	variant 3.2 EVA hotmelt/ABS	variant 3.3 PO hotmelt/ABS	variant 6.1 laser/ABS	variant 6.2 laser/PP	variant 7.2 WB 2-K-PUR/PET
1. Cycle	**1**	0	0	0	1	1	0
	2	0	0	0	1	1	0
	3	0	0	0	0	0	0
2. Cycle	**1**	0	0	0	1	1	0
	2	0	0	0	1	1	0
	3	0	0	0	1	1	0
3. Cycle	**1**	0	0	0	1	1	0
	2	0	0	0	1	1	0
	3	0	0	0	1	1	0
4. Cycle	**1**	0	0	0	1	1	0
	2	0	0	0	1	1	0
	3	0	0	0	1	1	0
5. Cycle	**1**	0	0	0	1	1	0
	2	0	0	0	1	1	0
	3	0	0	0	1	1	1
6. Cycle	1	0	0	0	1	1	0
	2	0	0	0	1	1	0
	3	0	0	0	1	1	0
After 24 h at 23 °C/50 RH	**1**	0	0	0	1	1	0
	2	0	0	0	1	1	0
	3	0	0	0	1	1	0

Additional test

- Additionally, two samples from WP-A underwent the same testing procedure showing response to the treatment:

Var.	Substrate	Edge-Material Type	Profile
A-I-14	UV-lacquered MDF1	WB Acrylic 1	flat
A-I-15	UV-lacquered MDF2	WB Acrylic 2	flat



A-I-14 after 6 cycles, swelling of the coating along the edge at one point

A-I-15 after 5 cycles, swelling of the coating along the whole edge

Summary

- On the available samples, a well comparable method with very good repeatability was developed which can be used at the moment at least for the laser edgings.
- More samples are necessary to assess if the method is able to differentiate also between other techniques and qualities. The additional test on the lacquered samples with simulated low quality confirm this assumption.
- At the moment, the method is not ripe for standardisation, but has potential for the future and can very well be used for factory production control.
- It is to be decided if the measurements are necessary or if visual assessment would be enough with trained personal as the experience shows that human eye can actually see more than assumed.

Outlook

- RRT of the method with different samples
  - Who could provide „bad“ and „good“ variants for the RRT?
  - Per variant, 15 samples are needed (min. 300 x 400 mm²)
  - Who would join the RRT?
    - ITD
    - IHD
    - …
    - …
    - …
- Optionally, final optimisation of the method.
- Final description of the method.

THANK YOU FOR YOUR ATTENTION!

QUESTIONS? REMARKS?