ALL ON EDGE

Development of Objective Test Methods for Furniture Edges and Rims

Work Package C

„Long-term Prognosis methods“

Overview of working steps

START

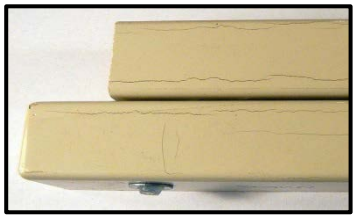
- Background: Existing methods not satisfying

MATERIAL

- Chosen: 11 glues & lacquers, 24 finished samples
- Delivered: 10 glues & lacquers, 6 finished samples

AGING LACQUERS & GLUES

- Knowledge about the aging behaviour of typical lacquers and glues for edges



AGING SAMPLES

- Different climatic regimes tested

GOAL

- New testing method

Tasks

- Tasks:
  - Task-C1: Definition, preparation and providing of different coating/glue materials and furniture edges (IHD/ITD)
  - Task-C2: Investigations on aging behavior of coatings and glues under the influence of temperature and humidity (IHD)
  - Task-C3: Methodological investigations on long-term prognosis (IHD/ITD)
  - Task-C4: Comparative tests of the developed long-term methods (IHD/ITD)
  - Task-C5: Round Robin Tests of optimized long-term methods (IHD/ITD)
  - Task-C6: Final description of suitable long-term methods (IHD/ITD)

Previous steps

- Investigations on glues and coatings:
  - Differential scanning calorimetry (DSC) and microhardness to detect the influences on brittleness by aging of coatings and glues,
  - FTIR for the determination of changes in the chemical structure of glues and coatings,
  - Determination of surface energy of coatings, glues as well as edge materials in unused and aged state to predict the general adhesion behavior and to determine changes in the expectable adhesion induced by aging.
- Amongst others, it was found out that the temperature should not be higher than 55 °C to prevent a structural weakening of glued parts.
  - Considered for choice of aging procedures.

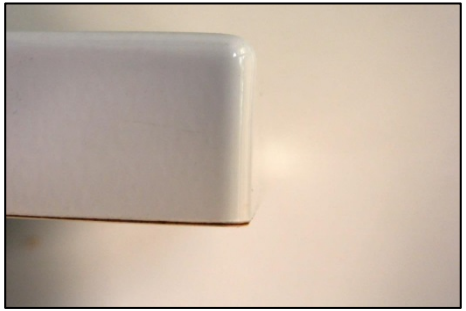
Material

- Material used for climate 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

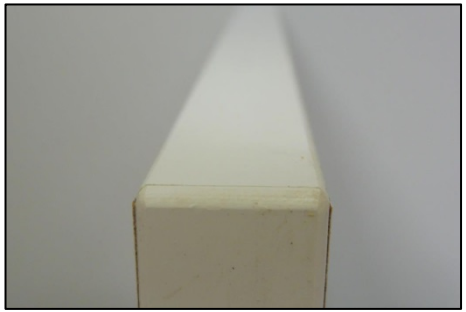
First Climate Test

- "Climate Test 1":
  - 55 °C / 90 % RH / 8 h
  - 55 °C / 30 % RH / 8 h
  - -20 °C / 8 h
  - duration: ~~28~~ 21 days
- After 21 days, all samples were destroyed
- Regime too hard



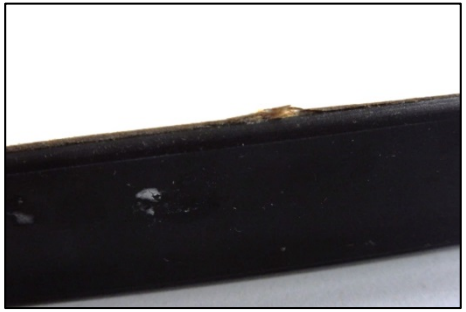
7.2 PET/2K-PUR

3.1 ABS/PUR/flat



3.2 ABS/EVA/flat

6.1 ABS/laser



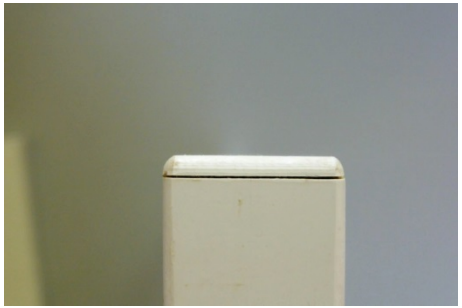
6.2 PP/laser

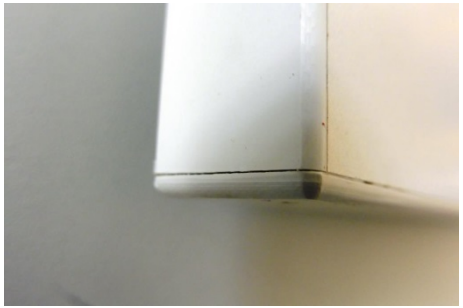
New Climatic Tests

- "Climate Test 2": pre-treatment 14 days at 23 °C/50 % RH + 20 cycles á 9 h of changing climate test acc. to AMK-MB 005 Test Module 3:
  - 0.5 h Cool down to -20 °C at cooling rate of 1.33 ± 0.1 K/min
  - 1 h Constant temperature of (-20 ± 2) °C
  - 0.5 h Heat up to 20 °C at a heating rate of 1.33 ± 0.1 K/min
  - 3 h Storage at (20 ± 2) °C and (85 ± 5) % RH
  - 0.5 h Heat up to 60 °C at a heating rate of 1.33 ± 0.1 K/min
  - 3 h Storage at (60 ± 2) °C and (55 ± 5) % RH
  - 0.5 h Cool down to 20 °C at a cooling rate of 1.33 ± 0.1 K/min
- "Climate Test 3": pre-treatment 14 days at 50 °C as pre-aging + 10 cycles á 9 h of changing climate test acc. to AMK-MB 005 Module 3
- "Climate Test 4", 30 days:
  - 6 h 50 °C / 90 %
  - 10 h 50 °C / 30 %
  - 6 h -20 °C *(at ITD with -10 °C instead of -20 °C)*
  - 2 h 23 °C / 50 %
- Visual assessment of the samples (changes/no changes, description of changes).

Climate Test 2

- “Climate Test 2”: 14 days at 23 °C/50 % RH + 20 cycles á 9 h of changing climate test acc. to AMK-MB 005 Test Module 3
  - No changes after pre-treatment 23/50
  - After 10 cycles of AMK changes at 3.2 (edge/rim), 3.3 (MDF swelling at the edge) and 7.2 (only foil, not the edge)
  - After 20 cycles of AMK also sample 3.1 showed failures (MDF swelling at the edge), 7.2 showed foil shrinkage
  - No changes at the laser edges
- Differentiation of different qualities possible
- Multiplication of AMK cycles yields good results

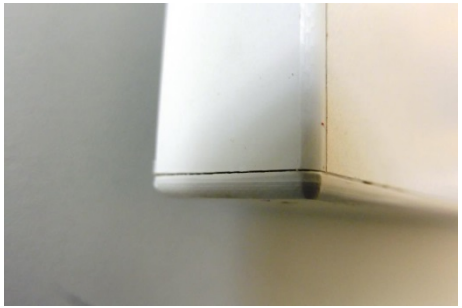




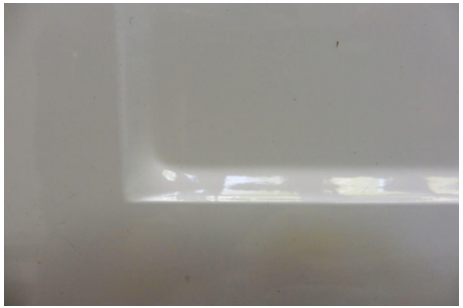
3.2 ABS/EVA/flat

Climate Test 3

- "Climate Test 3": 14 days at 50 °C as pre-aging 10 cycles á 9 h of changing climate test acc. to AMK-MB 005 Module 3
  - no changes after pre-aging
- after 10 AMK-cycles, changes at 3.2 (edge/rim) and 7.2 (only foil, not the edge)
  - other qualities not detected
  - poor differentiation
  - no benefit against standard AMK test



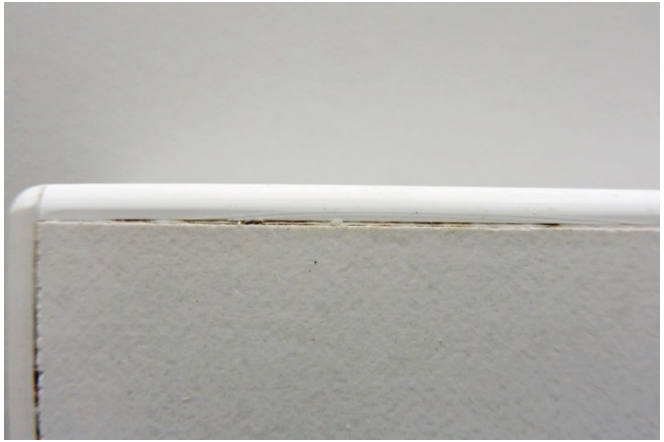
3.2 ABS/EVA/flat



7.2 PET/2K-PUR

Climate Test 4

- “Climate Test 4”, 30 days:
  - 6 h 50 °C / 90 %
  - 10 h 50 °C / 30 %
  - 6 h -20 °C
  - 2 h 23 °C / 50 %
- No changes after 10 and 20 days
- After 30 days, only the weakest variant 3.2 was detected
- The test does not differentiate between different product qualities
- Possible causes:
  - too slow heating/cooling rates?
  - too mild conditions?



3.2 ABS/EVA/flat

Summary

- From four tested climatic regimes, one leads to a complete destruction of the samples and two lead to nearly no changes of the samples.
- „Climate Test 2“ is the most promising approach, which could lead to good results with slight changes.
- However, the temperature in this test rises over the 55 °C shown as maximum upper value at DSC measurements – it is possible that the shown effects are due to structural weakening rather than due to aging.
- Until now, no solid statement on the differentiation of the method can be made.

Further steps

- It seems a good idea to pursue a RRT with following parameters:
  - pre-treatment ~~14~~ **7 days at 23 °C/50 % RH**
  - ~~20~~ **30 cycles á 9 h of changing climate test acc. to AMK-MB 005 Test Module 3**
  - with **assessment of results after every 10 cycles**
- Participants:
  - IHD
  - ITD
  - FCBA
  - CATAS
  - ...?
- Determination of the real changes of the glues after aging using FTIR.
- Comparison of the changes (if found) with previous investigations on aging.
- After RRT, detailed method description and proposal of a new method to the Standardization Committees.

THANK YOU FOR YOUR ATTENTION!

QUESTIONS? REMARKS?