

ALL ON EDGE

Development of Objective Test Methods for Furniture Edges and Rims



„Long-term Prognosis methods”

Methodological investigations on long-term prognosis

- Changing climate test methods for glued furniture materials

Workpackage C

Task C - 3



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FINAL UC Meeting

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The aims of WP-C

- Development and optimization of new test method(-s) for objective assessment of resistance furniture edges/rims to cyclic action of variable climate conditions.
- Development of test method ensuring suitable differentiation of furniture composite materials with edges glued by different technologies.
- Comparison of different developed climatic regimes on their repeatability and reproducibility level.
- Preparation of the final description of suitable long-term prognosis method.

Task C-3 Test materials

- Composite materials used for methodological investigations:
[MDF as substrate material]

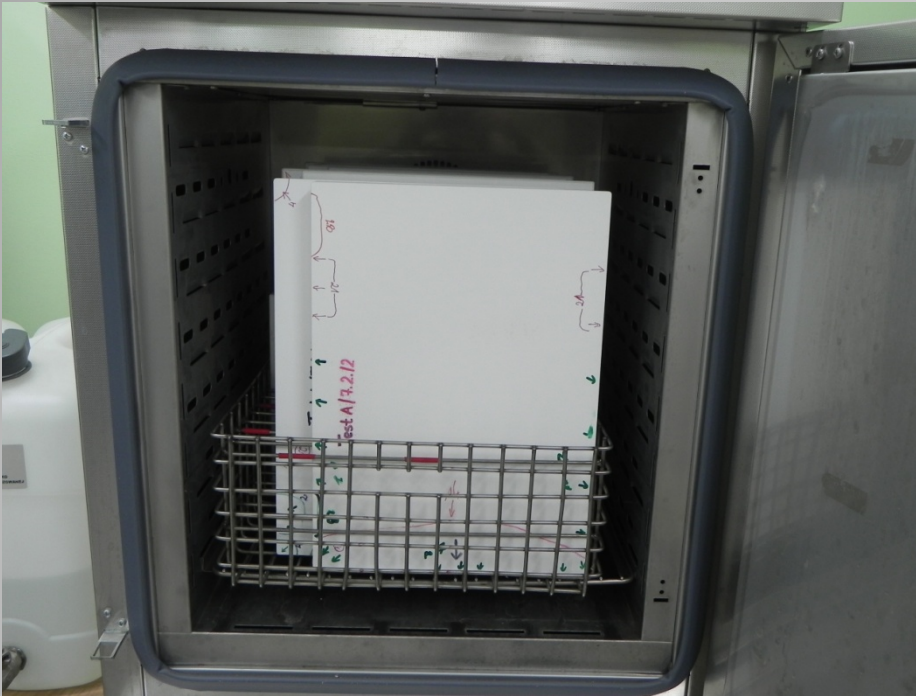
Material variant	Edge material	Glue type	Board surface finishing	Sample profile
3.1	ABS	PUR	Melamine Faced	flat
3.2	ABS	EVA	Melamine Faced	flat
3.3	ABS	PO	Melamine Faced	flat
6.1	ABS	Polymer – LASER	Melamine Faced	flat
6.2	PP	Polymer - LASER	Melamine Faced	flat
7.2	PET	2K-PUR	PET	3D

Task C-3 Equipment



- **Climatic chamber-KK 115 STD**
- Chamber capacity: 115 l
- Minimum working temperature: -10°C
- Maximum working temperature: 60°C
- Relative humidity range: 30 – 90 %
- Average heating rate: 1,21 K/min
- Average cooling rate: 0,63 K/min
- Air temperature and humidity – programmable
- Heating and cooling rate - not programmable
- Equipped with:
 - Testo 176-H1 recorder
 - Relative humidity / temperature probe (12 mm)

Task C-3 Equipment



Vertical position of test samples during climatic test – samples were placed in metal wire basket made of stainless steel

Changing climate test A

Characteristics of the test procedure

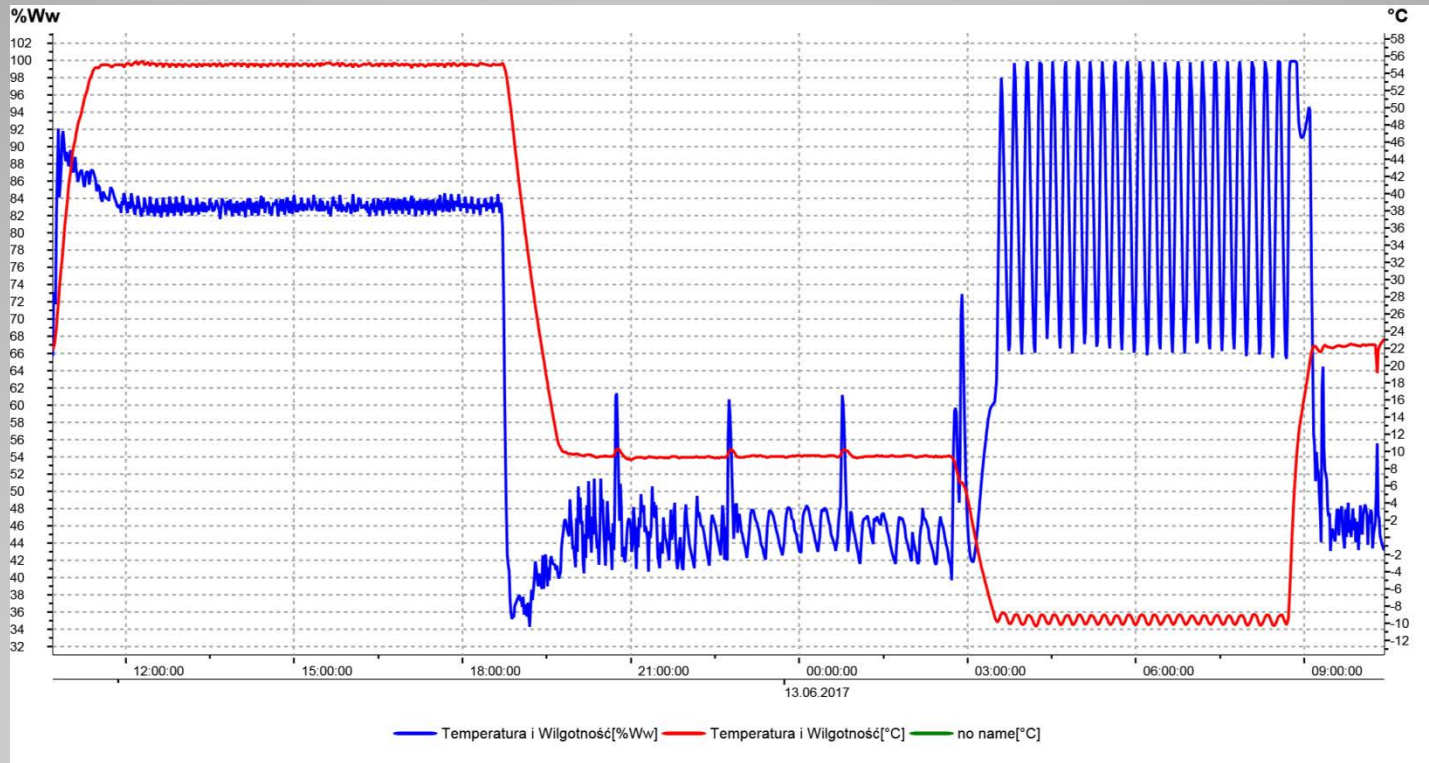
- Preliminary conditioning of test samples
23 °C / 50 % / 3 days
- Test cycle scheme (covering 24 h)
 - 50 °C / 90 % / 6 h
 - 50 °C / 30 % / 10 h
 - -10 °C / 6 h
 - 23 °C / 50 % / 2 h
- Test duration: 28 days
- Assessment: after 1,2,3,4,7,14,21 and 28 test cycles
- Number of unit samples used: each material variant represented by 2 samples
- Assessment of test samples: visual acc. to working scale

Changing climate test B

Characteristics of the test procedure

- Preliminary conditioning of test samples
23 °C / 50 % / 3 days
- Test cycle scheme (covering 24 h)
 - 55 °C / 85 % / 8 h
 - 10 °C / 45 % / 8 h
 - -10 °C / 6 h
 - 23 °C / 50 % / 2 h
- Test duration: 28 days
- Assessment: after 1,2,3,4,7,14,21 and 28 test cycles
- Number of unit samples used: 2 samples
- Assessment of test samples: visual acc. to working scale

Monitoring of climatic parameters within TEST „B”



— Temperature

— Relative humidity

Variation of air temperature and relative humidity inside climatic chamber loaded with test samples within 1 test cycle – TEST „B”

Working assessment scale

Working scale of damage gradation – ITD proposal

- Based on observed and predicted (possible) types of damages on furniture edges and rims the following damage gradation scale is proposed for purposes of results discussion

Grade of damage	Description of edge damage / rim damage
5	No damages
4	Single swelling along the edge / rim, single swelling at the corner
3	Several or many swellings along the edges / rims <u>or/and</u> swellings at all corners, <u>or/and</u> increasing of the single swellings <u>or/and</u> slight weakening of glue joint between edge material and board (resulting in a narrow gap)
2	Deformation of the edge band (eg. shrinkage or folding), rupture of the edge band, <u>or/and</u> strong weakening of glue joint between edge material and board (resulting in a greater gap), <u>or/and</u> breaking of edge material away the board at a distance of no more than half the length of the edge.
1	Rupture of the board; <u>or/and</u> breaking of edge material away the board at least at a distance of 2/3 of the length of the edge.

Results – Detailed results – TEST „A”

DETAILED RESULTS OF ASSESSMENT OF RIMS AND EDGES' DAMAGES FOR TEST SAMPLES
SUBJECTED TO CYCLIC ACTION OF VARIABLE CLIMATE CONDITIONS

Test sample code	Evaluation of edge damage <u>or/and</u> rim damage ¹⁾ after test cycle no.							
	1	2	3	4	7	14	21	28
Test A/3.1/1	5	5	5	5	5	5	4	3
Test A/3.1/2	5	5	5	5	5	4	4	3
Test A/3.2/1	5	4	3	3	3	3	3	3
Test A/3.2/2	5	4	3	3	3	3	3	3
Test A/3.3/1	5	5	4	3	3	3	3	3
Test A/3.3/2	5	5	4	3	3	3	3	3
Test A/6.1/1	4	4	3	3	3	3	3	3
Test A/6.1/2	4	4	3	3	3	3	3	3
Test A/6.2/1	5	5	5	5	4	3	3	3
Test A/6.2/2	5	4	3	3	3	3	3	3
Test A/7.2/1	5	4	3	3	3	3	3	3
Test A/7.2/2	4	4	4	3	3	3	3	3

¹⁾ Evaluation was performed acc. to working scale of damage gradation (ITD proposal)

Results – Detailed results – TEST „B”

DETAILED RESULTS OF ASSESSMENT OF RIMS AND EDGES' DAMAGES FOR TEST SAMPLES
SUBJECTED TO CYCLIC ACTION OF VARIABLE CLIMATE CONDITIONS

Test sample code	Evaluation of edge damage <u>or/and</u> rim damage ¹⁾ after test cycle no.							
	1	2	3	4	7	14	21	28
Test B/3.1/1	5	5	5	5	5	5	5	5
Test B/3.1/2	5	5	5	5	5	4	3	3
Test B/3.2/1	5	5	4	3	3	3	3	3
Test B/3.2/2	4	4	4	3	3	3	3	3
Test B/3.3/1	5	5	5	5	4	3	3	3
Test B/3.3/2	5	5	5	5	4	3	3	3
Test B/6.1/1	4	3	3	3	3	3	3	3
Test B/6.1/2	4	3	3	3	3	3	3	3
Test B/6.2/1	4	3	3	3	3	3	3	3
Test B/6.2/2	5	4	3	3	3	3	3	3
Test B/7.2/1	5	5	5	5	5	4	3	3
Test B/7.2/2	5	5	5	5	5	5	5	4

¹⁾ Evaluation was performed acc. to working scale of damage gradation (ITD proposal)

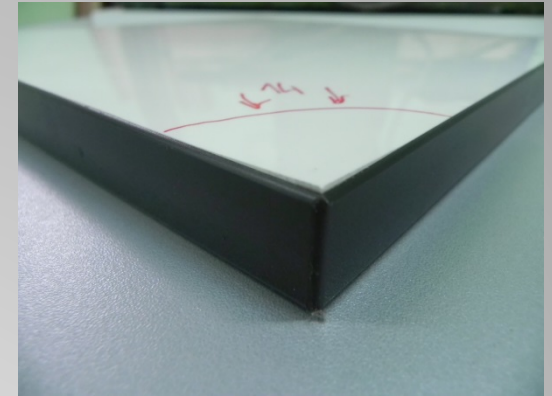
Results – Types of damages



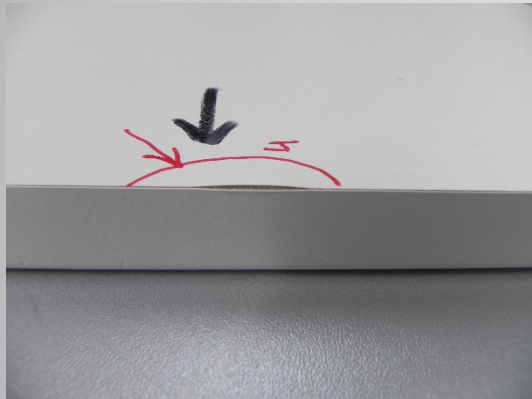
TEST A/3.2/EVA/ABS
After 2 cycles



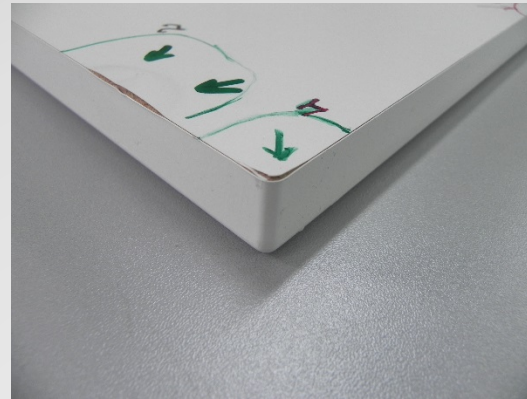
TEST A/3.2/EVA/ABS
After 14 cycles



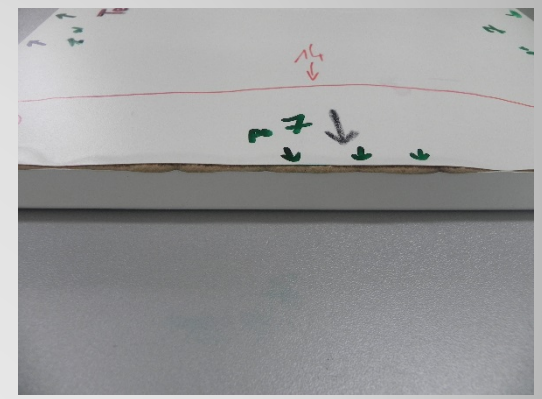
TEST A/6.2/Polymer/PP
After 14 cycles



TEST A/7.2/WB-PUR/PET
After 4 cycles

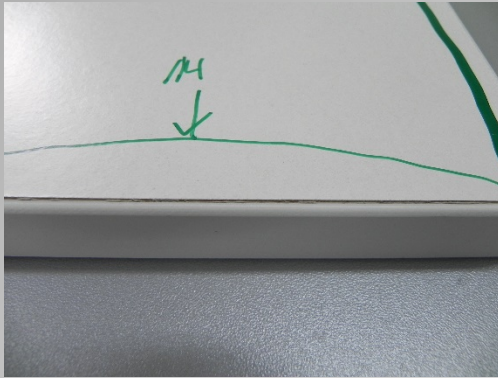


TEST A/7.2/WB-PUR/PET
After 4 cycles

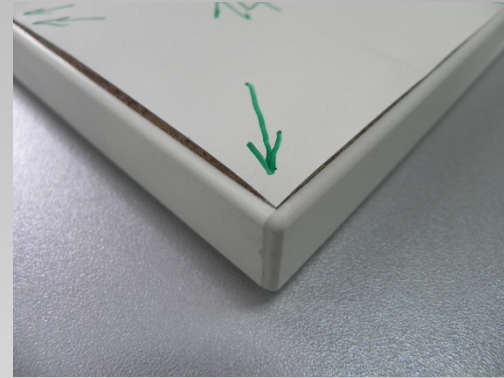


TEST A/7.2/WB-PUR/PET
After 14 cycles

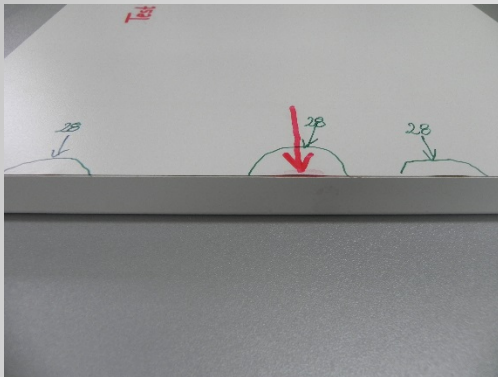
Results – Types of damages



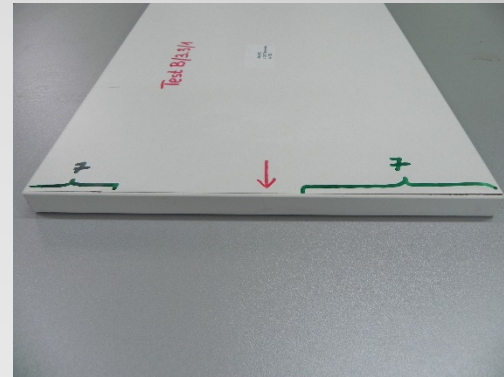
TEST B/3.2/EVA/ABS
After 14 cycles



TEST B/6.1/Polymer/ABS
After 14 cycles



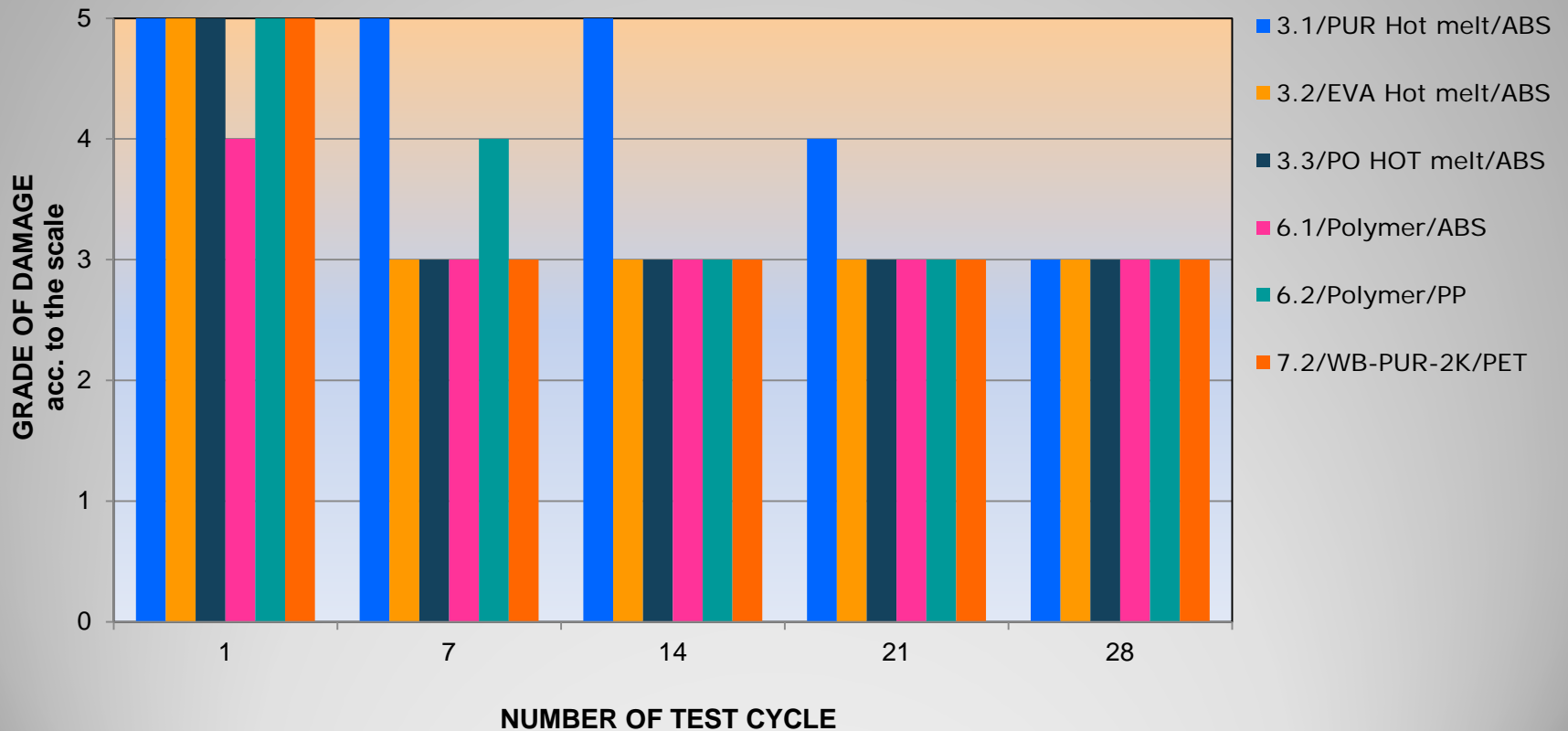
TEST B/7.2/WB-PUR/PET
After 28 cycles



TEST B/3.3/PO/ABS
After 7 cycles

Results – Differentiation – TEST „A”

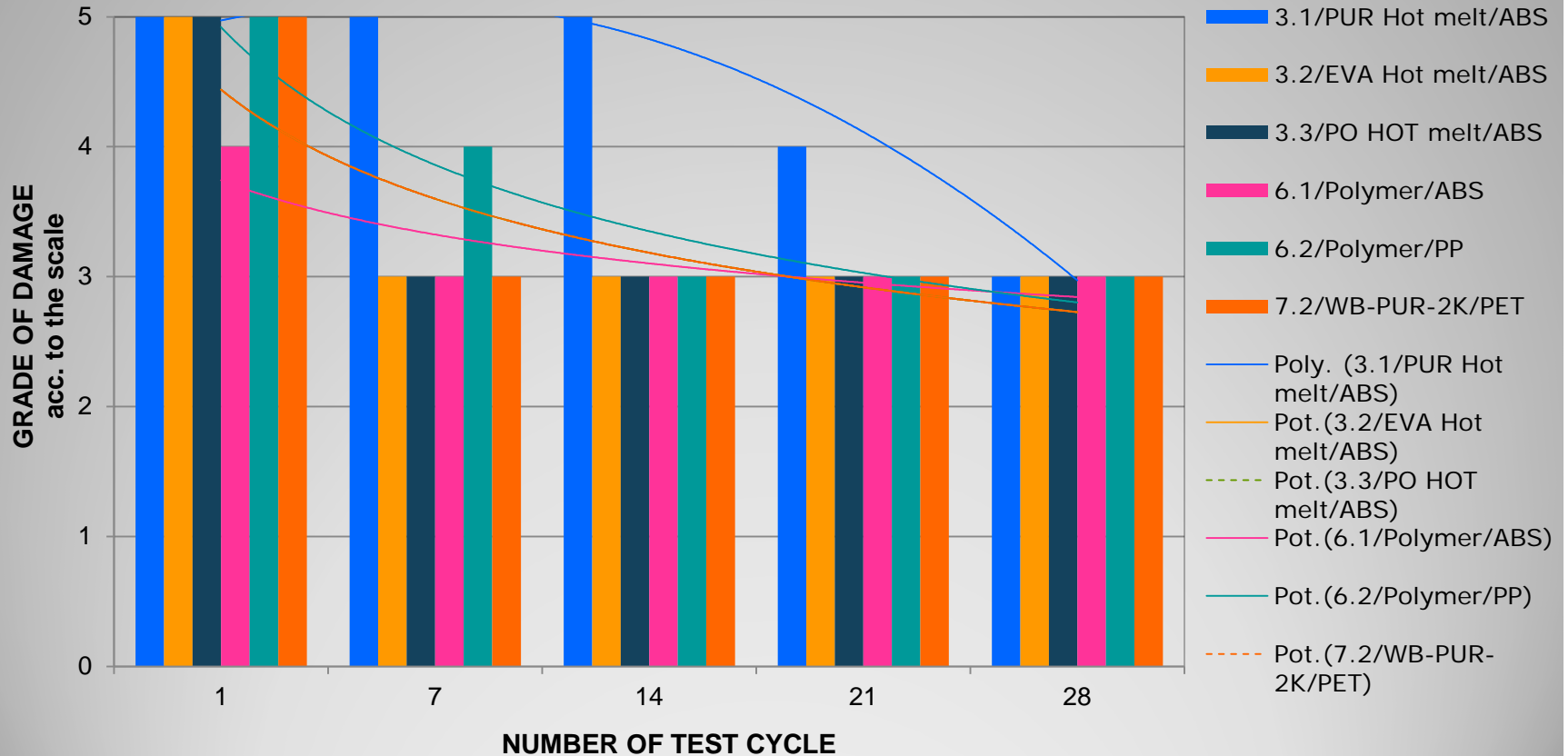
Differentiation of damage grade for edges and rims of composite materials by using of changing climate test A



Results – Differentiation – TEST „A”

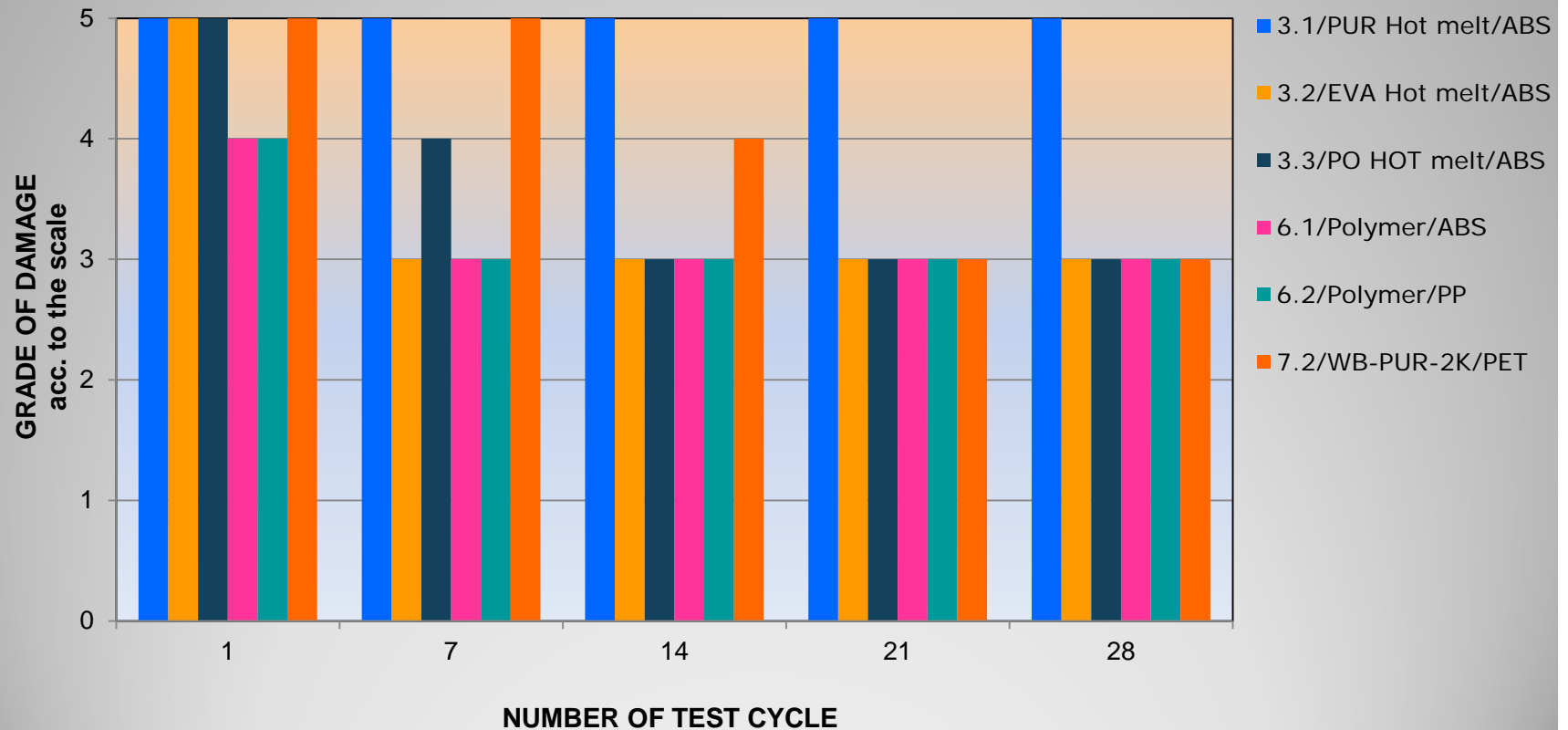
(alternative slide with trend lines)

Differentiation of damage grade for edges and rims of composite materials by using of changing climate test A



Results – Differentiation – TEST „B”

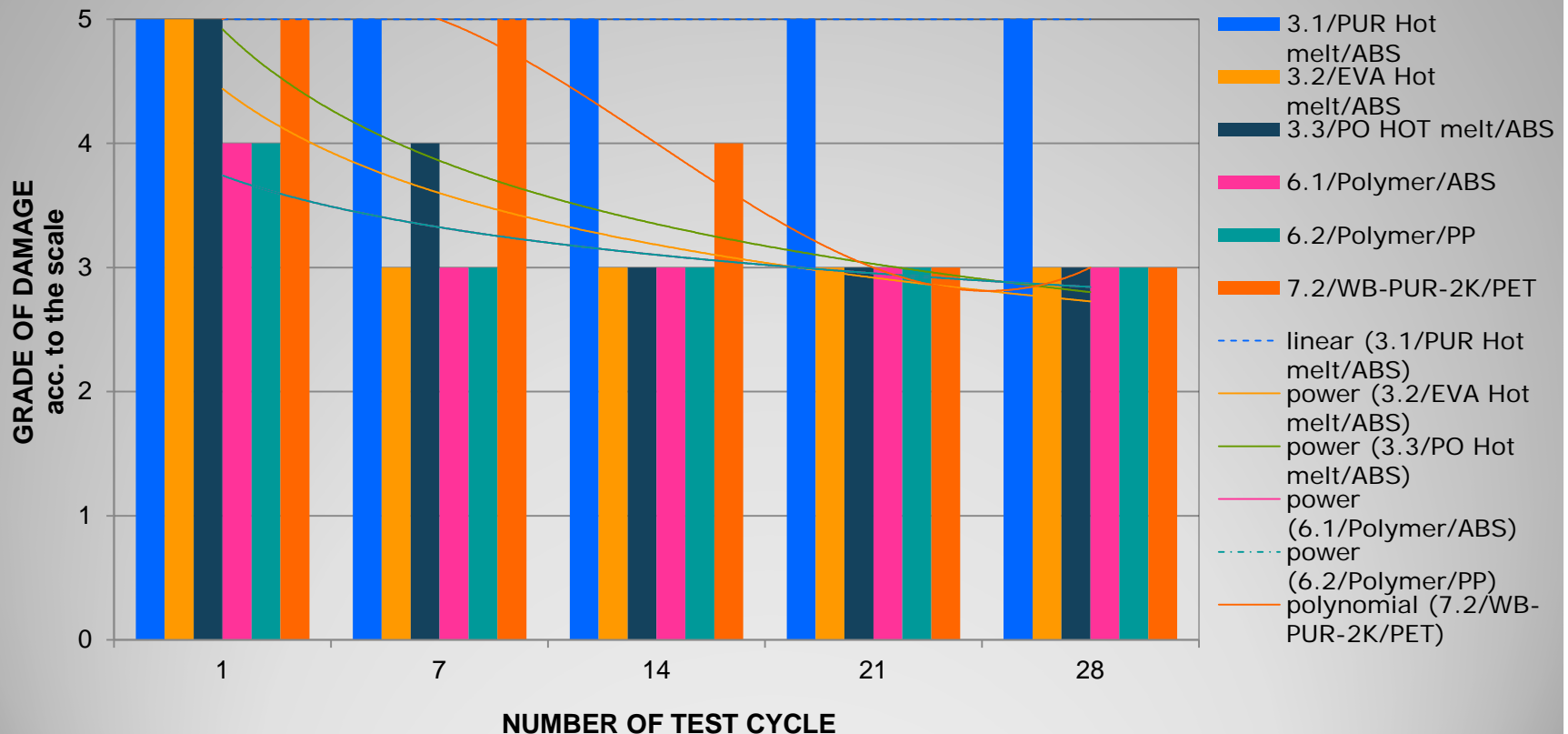
Differentiation of damage grade for edges and rims of composite materials by using of changing climate test B



Results – Differentiation – TEST „B”

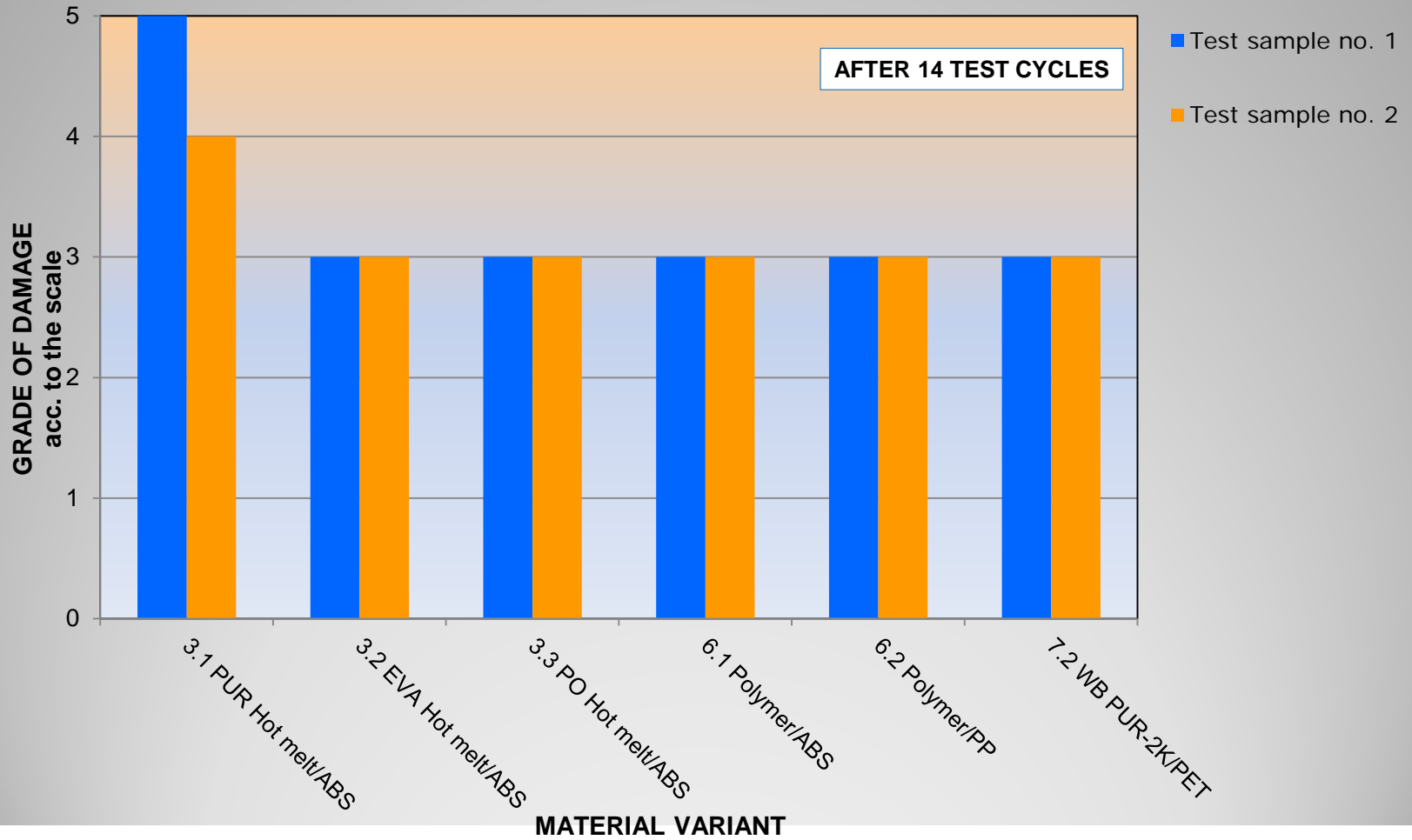
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Differentiation of damage grade for edges and rims of composite materials by using of changing climate test B



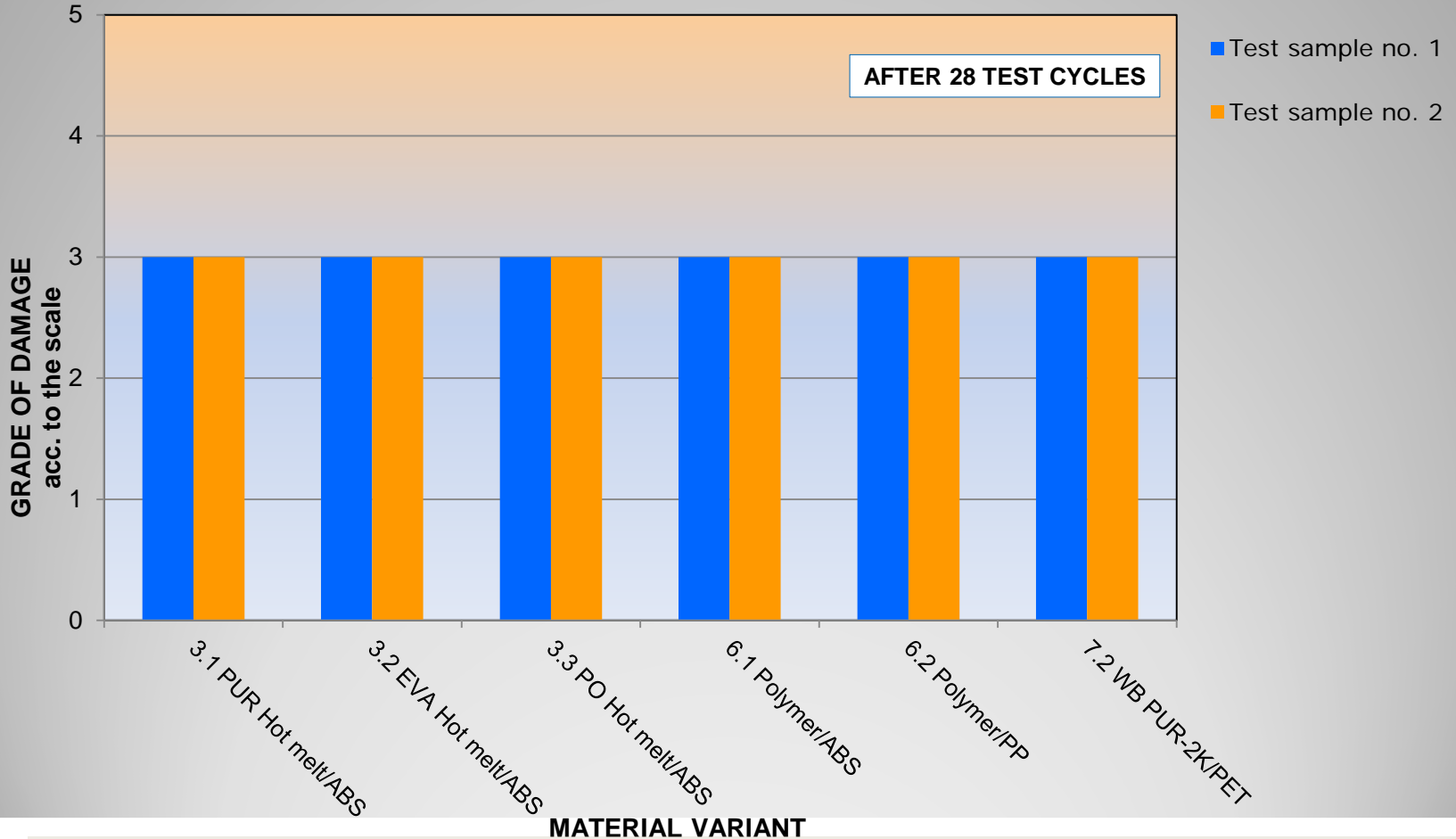
Results – Repeatability – TEST „A”

Repeatability of damage grade for edges and rims of particular materials subjected to climate test regime A



Results – Repeatability – TEST „A”

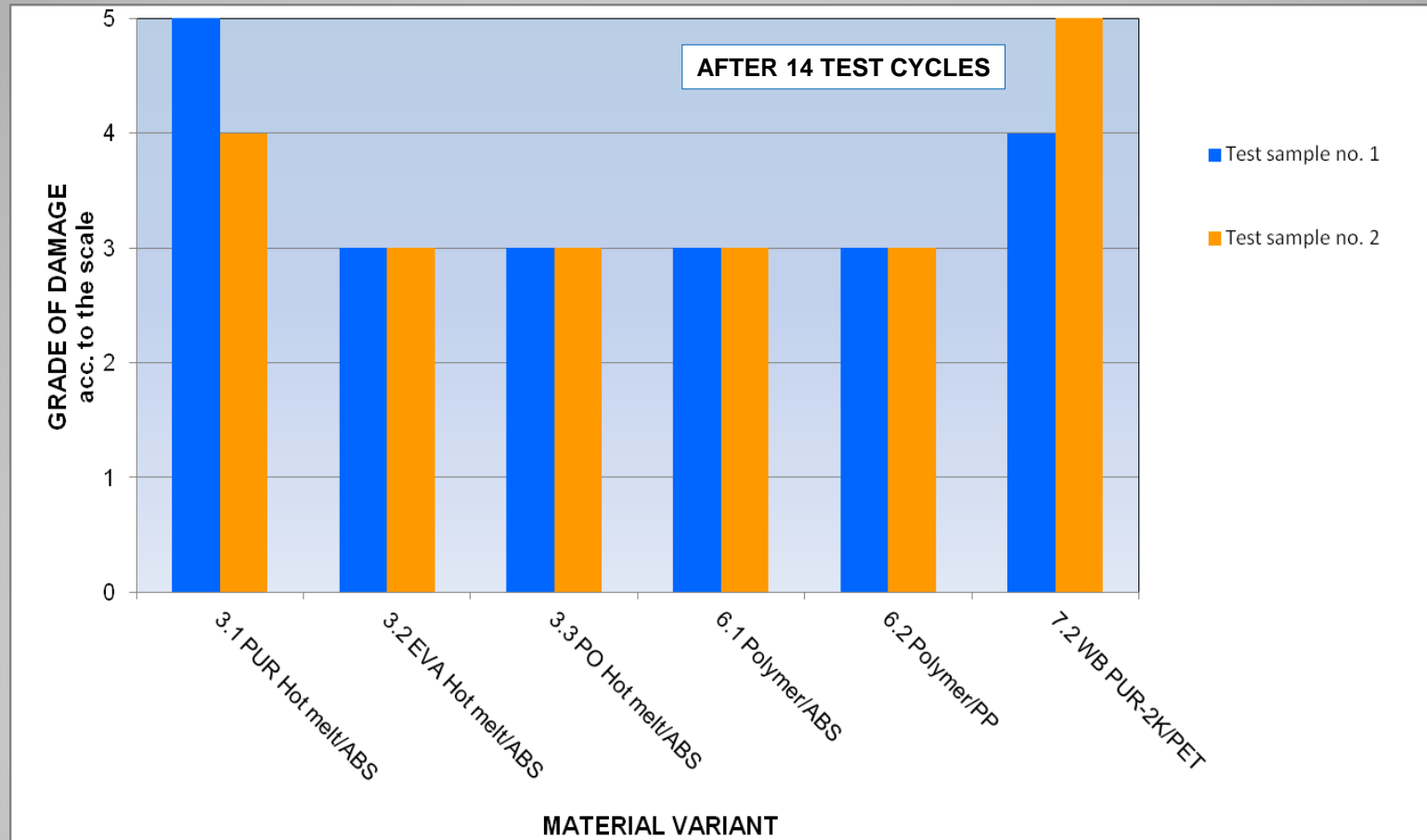
Repeatability of damage grade for edges and rims of particular materials subjected to climate test regime A



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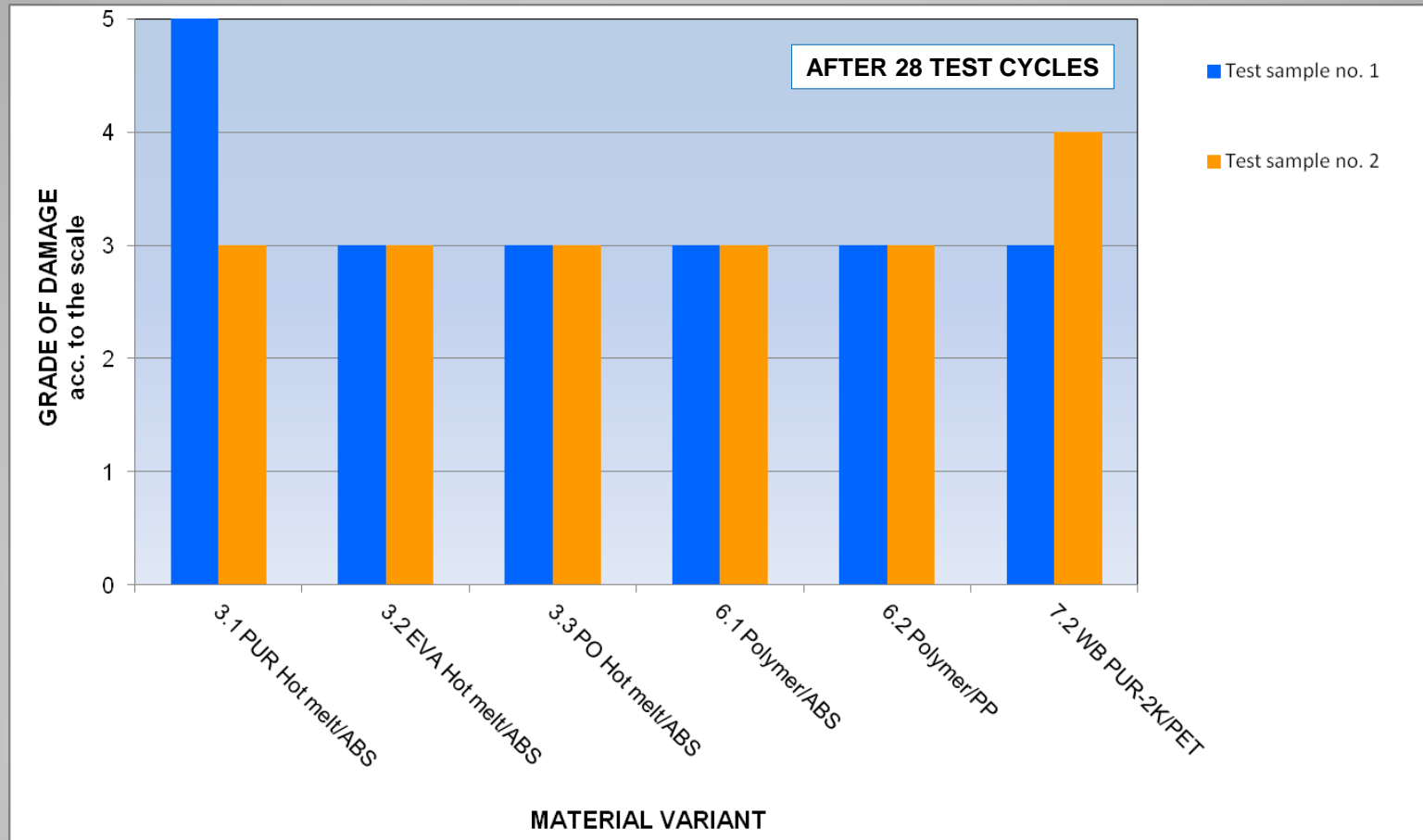
Results – Repeatability – TEST „B”

Repeatability of damage grade for edges and rims of particular materials subjected to climate test regime B



Results – Repeatability – TEST „B”

Repeatability of damage grade for edges and rims of particular materials subjected to climate test regime B



Summary

- Types of samples' damages mostly observed as results of both changing climate procedures, were: swellings along the edge / rim and swellings at the corners.
- Differentiation of damage grades of tested composite materials subjected to test „B“ was greater than differentiation of these ones observed for the materials tested by test „A“.
- At the end of both tests all samples (test „A“) or almost all samples (test „B“) were characterized by damage grade „3“.
- Repeatability of damage grade stated for test samples was greater for these ones tested by test „A“ after 14 test cycles (half time of test duration) as well as after 28 test cycles (end of the test).
- Proposed working scale for rating damage intensity should be considered as alternative way of evaluation in relation to zero-one approach.
- The way of evaluation defined within changing climate test method should be correlated with criterion of the test termination (eg. number of cycles without any sample damage or definite number of cycles with damage intensity evaluation by rating scale).

Thank You for your
attention!

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Questions – Remarks

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