ALL ON EDGE

Development of Objective Test Methods for Furniture Edges and Rims

Workpackage C „Long-term Prognosis methods“

Agenda

- Short introduction
- Overview and explanation of methods used
- Material overview
- Results
- Summary

3. WP-C: Long-term prognosis methods (Leader: IHD)

- **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)

3. Task-C2: Investigations on aging behavior of coatings and glues under the influence of temperature and humidity (IHD)

- Long-term storages of coating constructions, **edge materials and glues to characterize the influence of incident light, different temperatures as well as constant temperature with different humidity**
- For determination of aging effects very sensitive methods are necessary which are available at IHD and will be used after defined times of described aging factors:
    - **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

Material overview

ADHESIVES

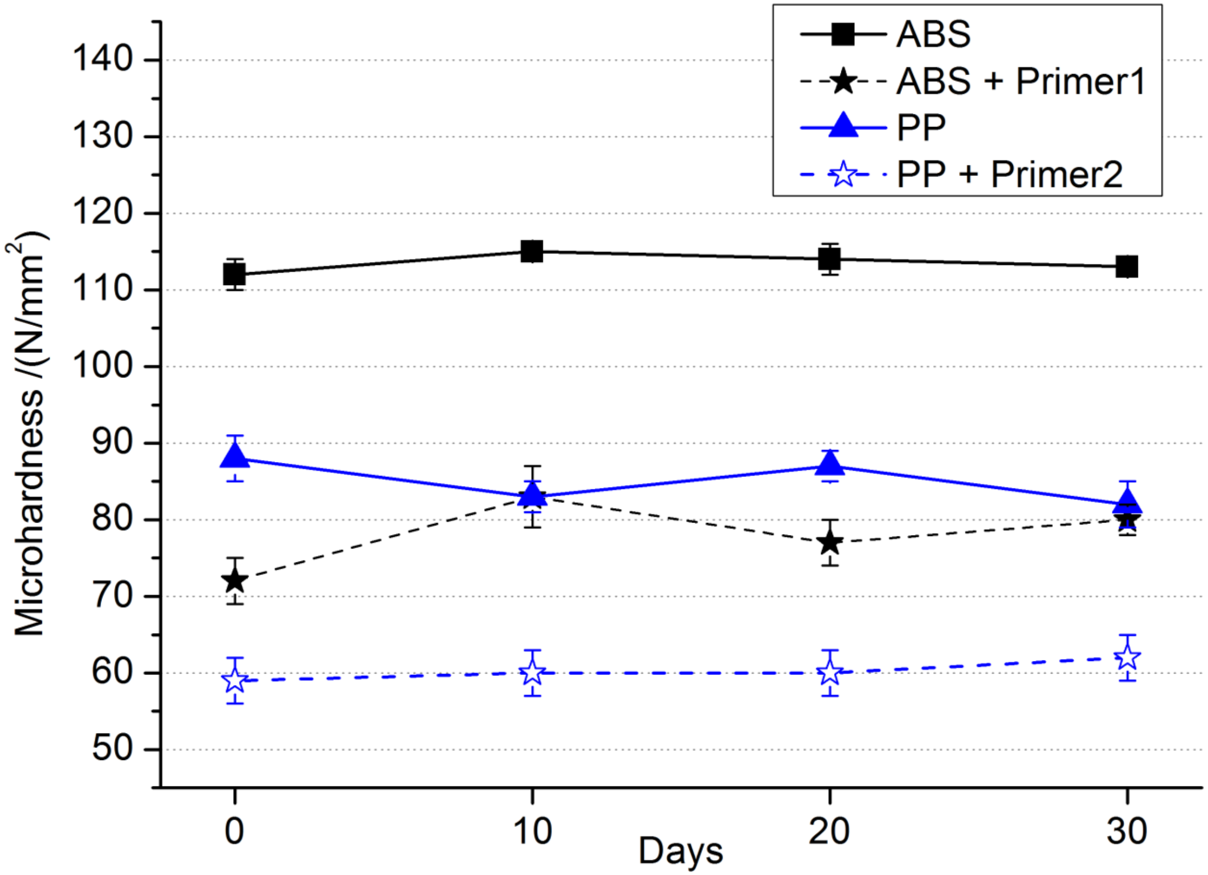
- PVAc dispersion
- PU dispersion (without added hardener)
- 2 EVA hotmelts
- PUR hotmelt
- PO hotmelt (polyolefin)

EDGE MATERIALS

- ABS (with and without primer)
- PP (with and without primer)

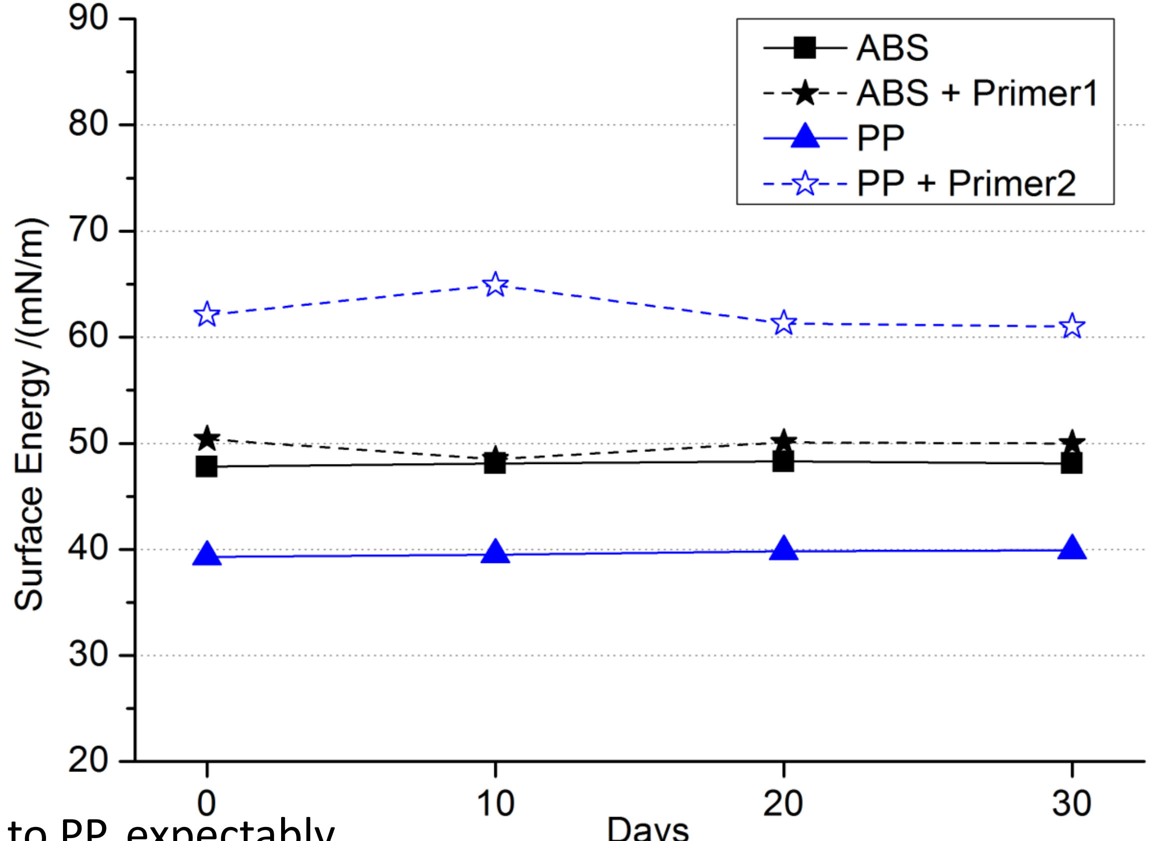
- Aging was done by the following procedure:
  - Artificial aging inside an climate chamber (without light) with the following cyclic regime for 30 d: 12 h 50 °C/50 % r. h.; 12 h 50 °C/90 % r. h.
  - Evaluation and sampling each 10 days
- As reference one produced sample was stored under defined conditions at 23 °C/ 50 % r. h.

Microhardness of edge materials depending on aging



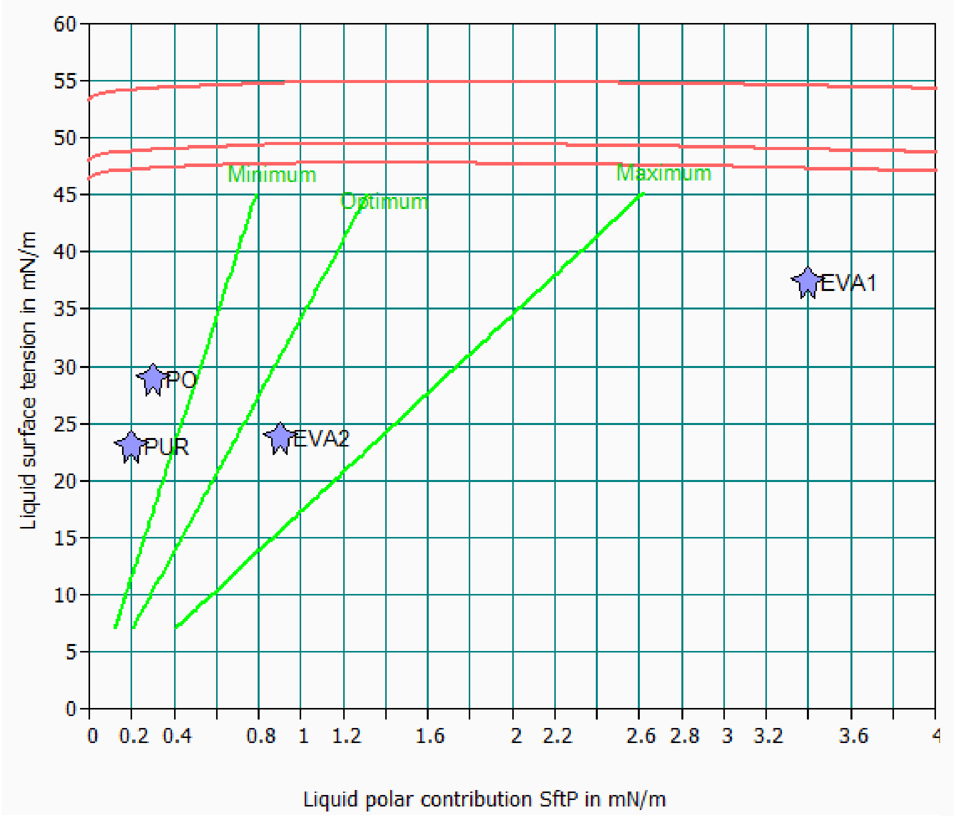
- ABS is much harder than PP due its aromatic structure, expectably
- Prime of edge materials decreases hardness in any case
- Aging has no significant effect on edge materials or primers

Total surface energy (SE) of edge materials depending on aging

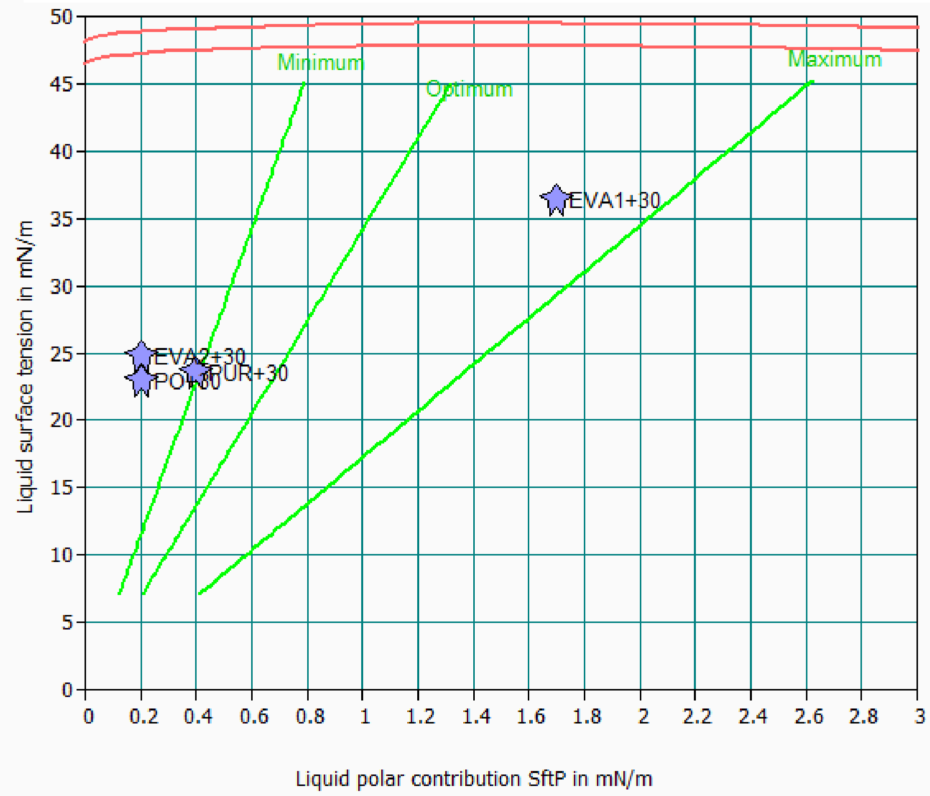


- ABS has a higher SE comparing to PP, expectably
- Primer 1 raises SE of ABS slightly, whereas Primer 2 enhances SE of PP strongly
- Primers increase the polar part of both materials
- Aging has no significant effect on edge materials or primers
- SEs higher than 35-40 mN/m are usually uncritical for wetting with liquids

Comparison of adhesion prediction of several hotmelts on ABS without primer before and after aging

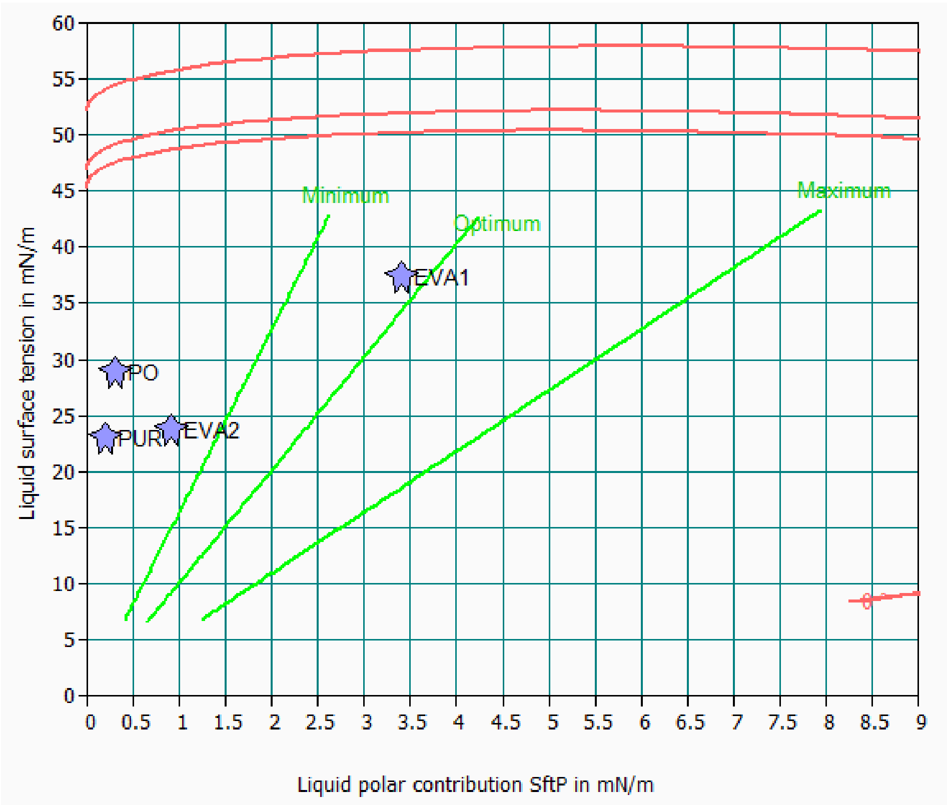


Without Aging

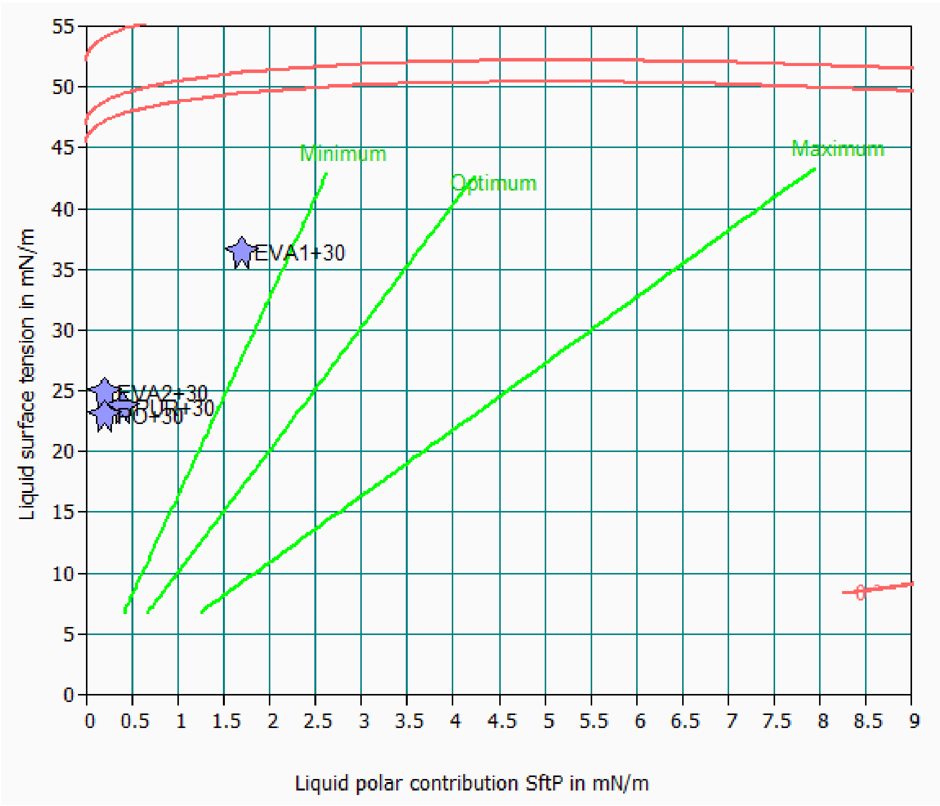


+30 days aging

Comparison of adhesion prediction of several hotmelts on ABS with primer before and after aging

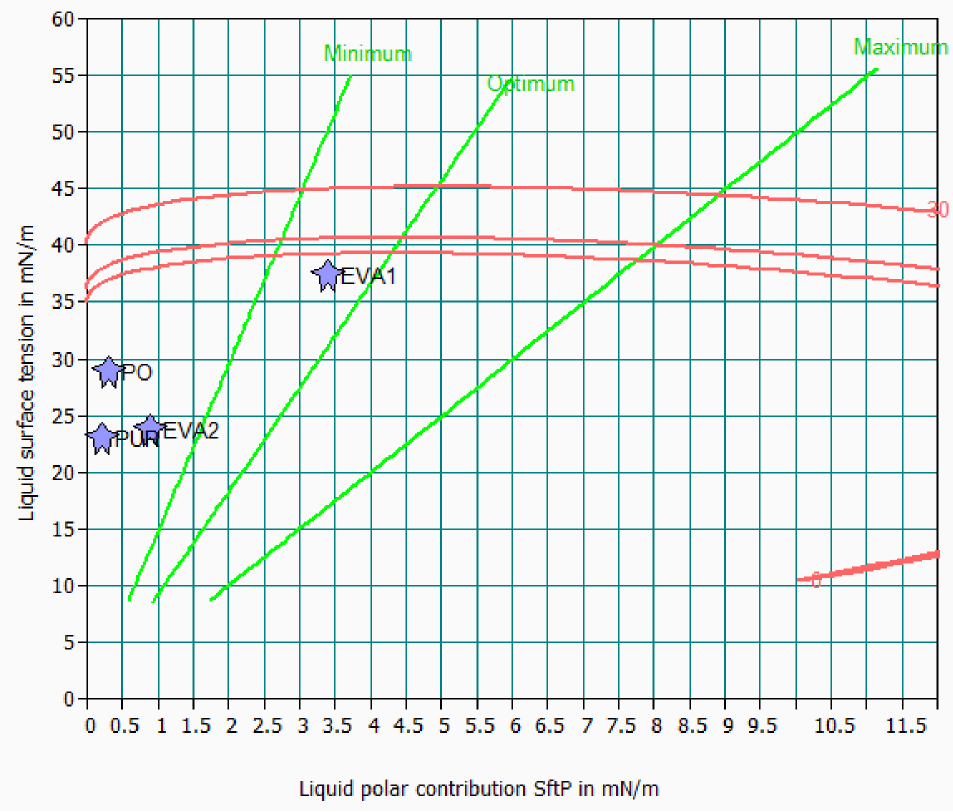


Without Aging

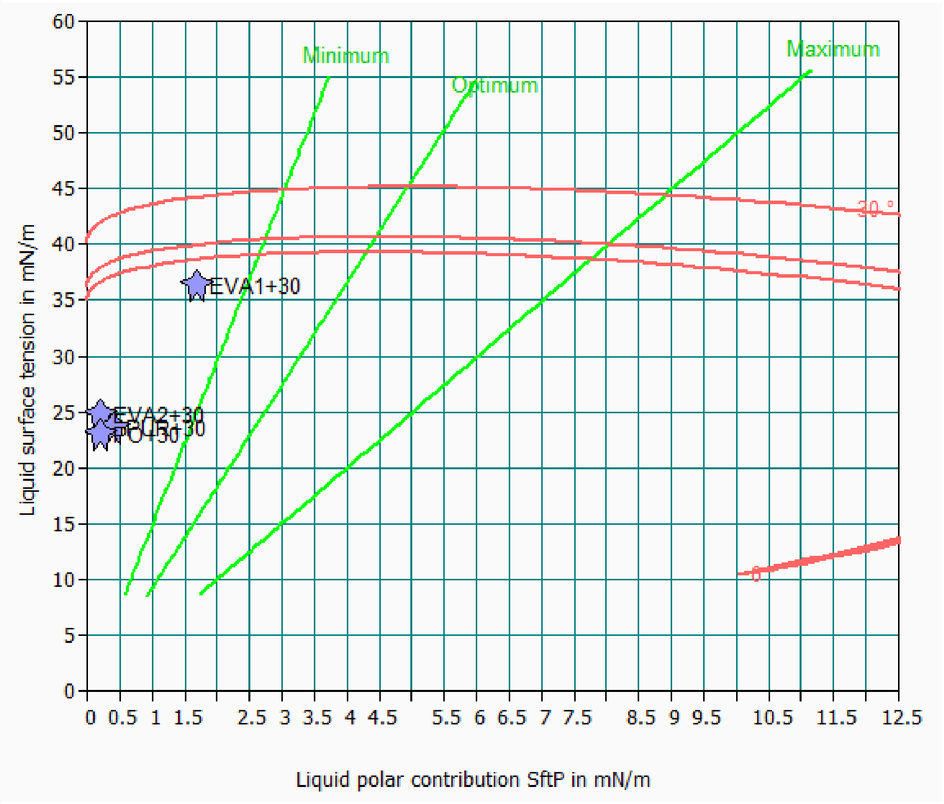


+30 days aging

Comparison of adhesion prediction of several hotmelts on PP without primer before and after aging

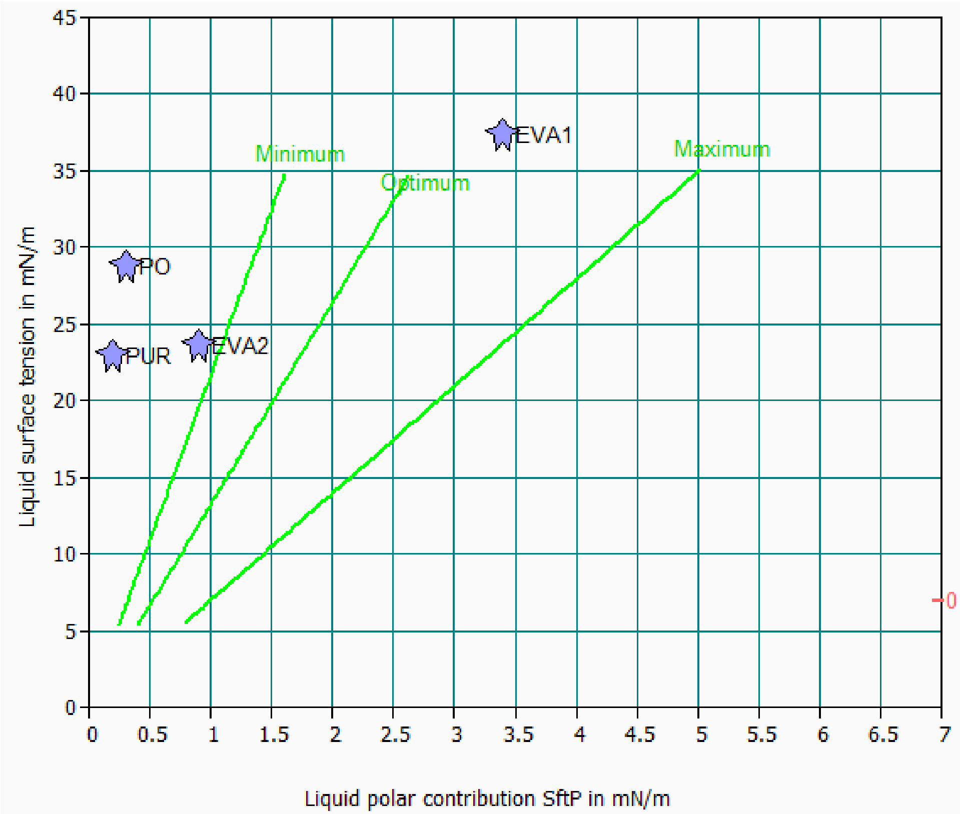


Without Aging

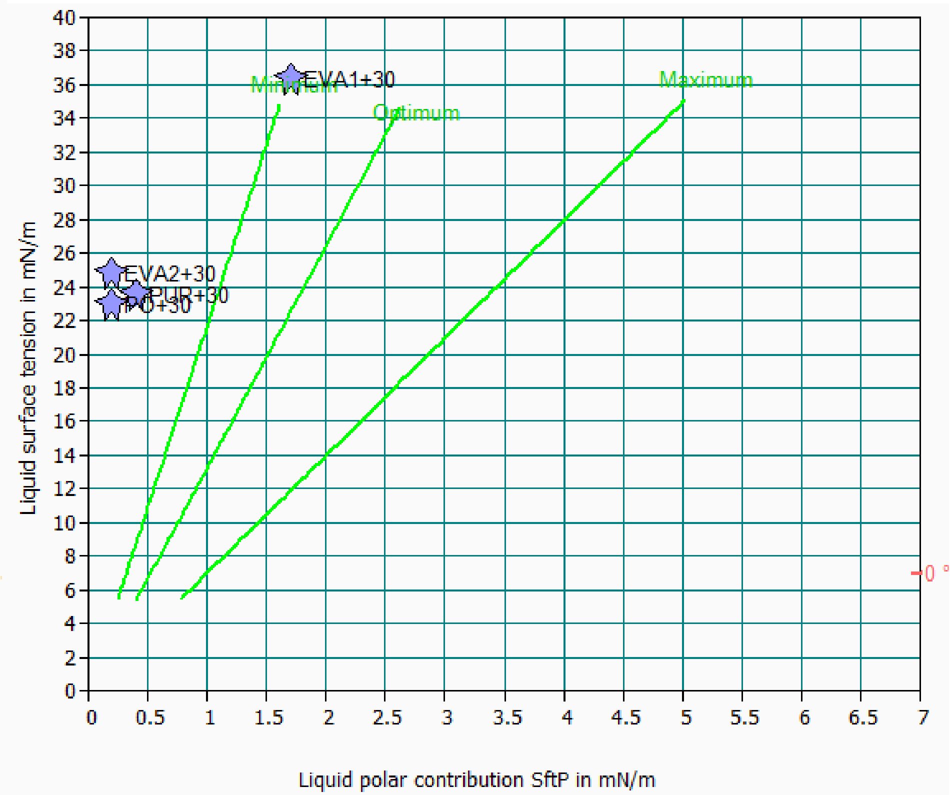


+30 days aging

Comparison of adhesion prediction of several hotmelts on PP with primer before and after aging



Without Aging



+30 days aging

Summary

- PP and ABS reveal no significant thermal- and humidity-induced aging behavior
- PP and ABS were coated with different primers
- Both primers decrease the microhardness of ABS and PP → advantageous
- Both primers raise the surface energy of the coated plastics and the polar part coincidently
- The overall SE values of both plastics (with and without primer) are high enough for a complete wetting of the surfaces by all adhesives investigated
- All hotmelts show a more or less intensive thermal- and humidity-induced aging behavior according to their chemical stability
- PUR hotmelt as the only reactive hotmelt undergoes a strong chemical changing resulting in strong decreasing polar part
  - Consequently, the adhesion behavior is strongly influenced by hardening/cross-linking
- The EVA hotmelt variants are the most suitable glues for application on the substrates investigated considering their SE values and the resulting adhesion prediction
- The SE analysis disregards effects such as penetration or chemical bonding

Next steps regarding long time comparative test

- Based on the results of the aging regime done for adhesives and edge materials only (30 d: 12 h 50 °C/50 % r. h.; 12 h 50 °C/90 % r. h.) the following cycle for complete composites was deduced for a round robin test:
  - 55 °C / 90 % r. h. / 12h
  - 10 °C / 90 % r. h. / 12 h
  - 30-60 days, evaluation after day 1 and than each 10 days
- The changes base on:
  - Slightly higher temperatures for a faster aging of the adhesives, but without exceeding the melting/softening point of relevant adhesives (result of DSC experiments)
  - Humidity of constant 90 % r. h. to accelerate the chemical aging of the glues and to force the swelling of possible substrates such as fiber- and particleboards
  - An addition step with low temperate to reinforce mechanical tensions (swelling, shrinking) between substrate, glue, and edge band which may result in delamination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"I said you had three months to live, and I meant it."

Thank you!