

● **Soft adhesives for barrier laminates - Implementation of a testing device and evaluation of ageing behavior**

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Abstract content

Of high relevance for seasonal hot water storages are high-barrier laminates based on polyolefins and metal films. The adhesive layer in such laminates should allow for compensation of differences in thermal expansion. Furthermore, an excellent long-term stability under hot-dry and -humid conditions with maximum temperatures up to 95°C is required. Hence, novel ethylene vinylsilane co- and terpolymer grades are currently evaluated, which should be capable for covalent bonding to the metal oxide surface but also humidity induced cross-linking of the adhesive.

To assess the long-term durability of polyolefin/adhesive/glass-fabric/adhesive/metal laminates a test setup was implemented based on stainless steel flanges (s. Fig. 1). While one flange is filled with distilled water, the other contains a silicate based drying agent. In between, the laminate is positioned and sealed with O-rings. The specimen holder was placed in a convection oven at 95°C. Hence, the water vapour permeation rate and the interfacial durability could be assessed simultaneously.

Permeation values were calculated and compared to 2 mm thick polyolefin liners without barrier film. While the water vapour permeation rate was about 6 g/(m² 24 hours) for a polyolefin liner, negligible water vapour transmission was ascertained for the laminate up to maximum exposure times of 6 month at 95°C. So far, no macroscopic delamination was discernible. Monotonic peel tests revealed an increase of peel force after ageing. By IR spectroscopy, the formation of Si-O-Si-bonds at the fractured surface was confirmed. This is a clear indication for humidity induced cross-linking of the adhesive based on the ethylene-acrylate-vinylsilane terpolymer. Ultra-low-angle microtomy combined with X-ray photoelectron spectroscopy is currently performed to evaluate a potential formation of covalent bonds at the metal oxide/adhesive interface.

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Schematic view of the test setup for global ageing

