Polyester backsheet solutions with enhanced hydrolytic stability

Solar backsheets function as electrical insulators and protect the solar cells from humidity and harsh environments. Whereas conventional backsheet types contain outer fluoropolymer layers, also numerous alternative types of backsheets without halogen are also available. Due to its advantages in terms of environmental compatibility and cost competitiveness, the all-PET backsheet is probably the most preferred alternative solution compared to the conventional backsheet type. Pic. 2 shows a typical set-up of an all-PET backsheet.

In order to maintain sufficient electrical insulation performance for the whole lifetime of a PV module, polymer degradation effects caused by humidity or UV radiation must be reduced to a minimum, these being the main causes of polymer degradation in polyester backsheets.

All-PET backsheets generally consist of two layers of BOPET thickfilm. The first one is a UV and hydrolytically stabilized outer BOPET layer (50 micron) and the second one is a 188 or 250 µm inner BOPET layer with enhanced hydrolytic stability.

As there is a wide range of highly effective UV absorbing additives like triazines, benzotriazoles or benzophenones available on the market, the UV stabilization of polyester films does not pose a big challenge. In fact, it is more a matter of optimizing the cost-value ratio between a sufficient UV stability at the lowest possible costs.

On the other hand, the stabilization of polyester films against hydrolytical degradation is a more challenging task in terms of optimizing the resin, material mixtures and film processing parameters. Regarding the resin properties, a low content of carboxyl end-groups and higher intrinsic viscosity materials are favorable. Preferred material mixtures may include a minimum content of added recycled material or by adding chain extenders or crosslinking agents by masterbatch technology. Critical processing parameters in order to enhance the hydrolytic stability of BOPET films comprise among others the extrusion section as well as the stretching sections.

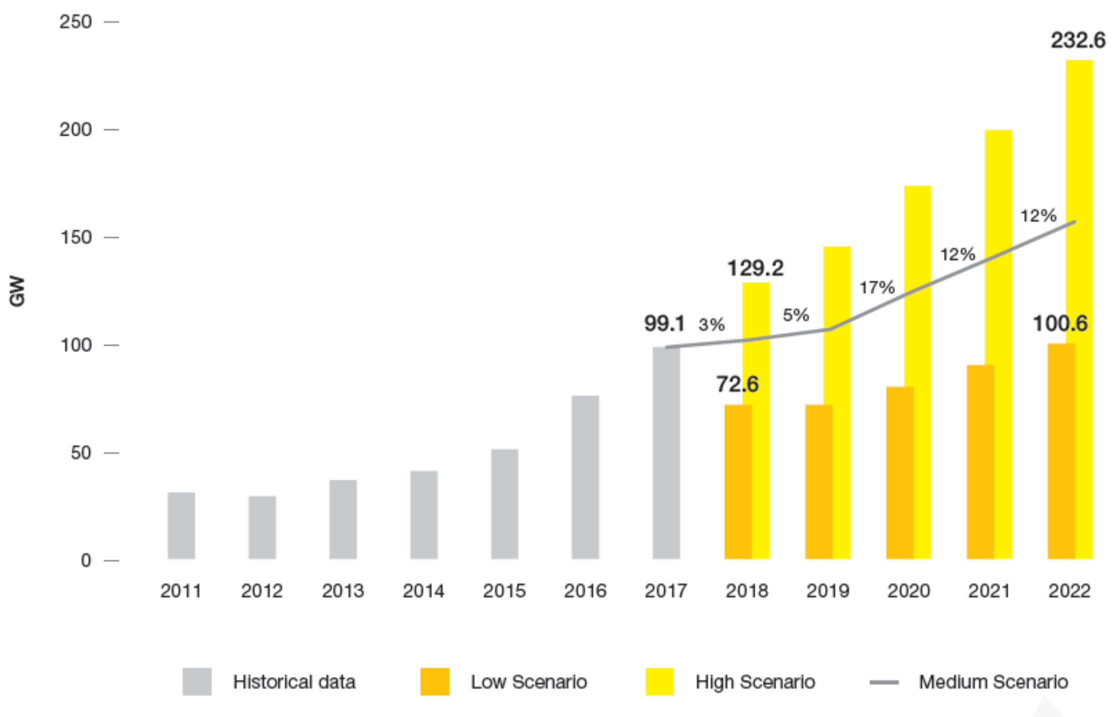
The elongation at break retention is a measure for the hydrolytic stability of polyester film. It is defined as:

$$elongation\ at\ break\ retention = \frac{elongation\ at\ break\ \ after\ pressure\ cooker\ testing}{elongation\ at\ break\ before\ pressure\ cooker\ testing}$$

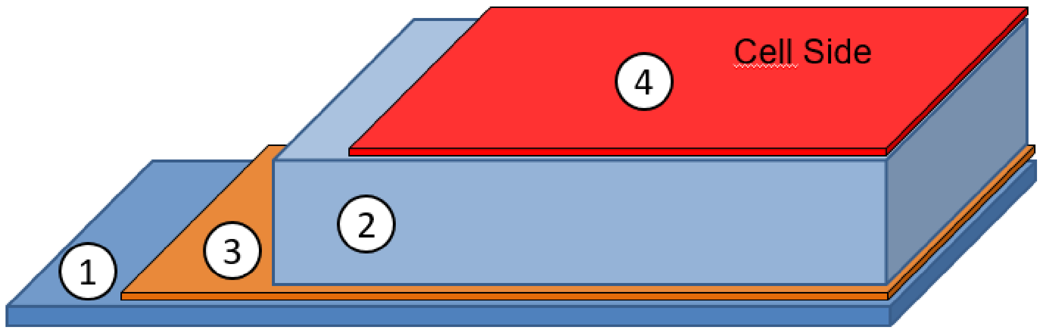
In order to quantify their hydrolytic stability, BOPET samples can be stored in the pressure cooker at 120°C, 2 bar abs in hot steam for up to 70 or 80 hours. After that the elongation at break retention is measured with a tensile tester.

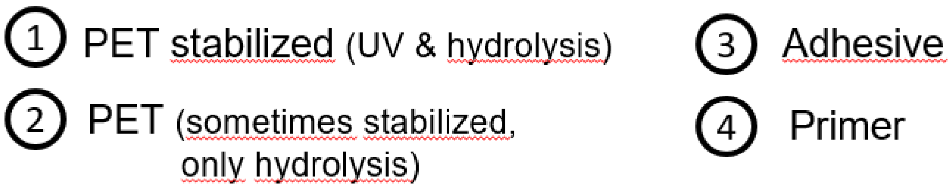
Sample rolls using different resins and additives have been produced and tested in the facilities of Brückner's unique technology center. Pic. 3 shows exemplarily the durability performance of several types of polyester films from Brückner's pilot line. It can be clearly seen that by using a proper resin and / or stabilizing additives Brückner is able to improve the elongation at break retention to over 50% after 77 hours of pressure cooker testing.

Brückner Maschinenbau has already sold several specialty lines for the manufacture of BOPET thickfilm which is used for solar backsheets. Especially the large and leading Chinese producers count on Brückner's efficient and innovative technology.

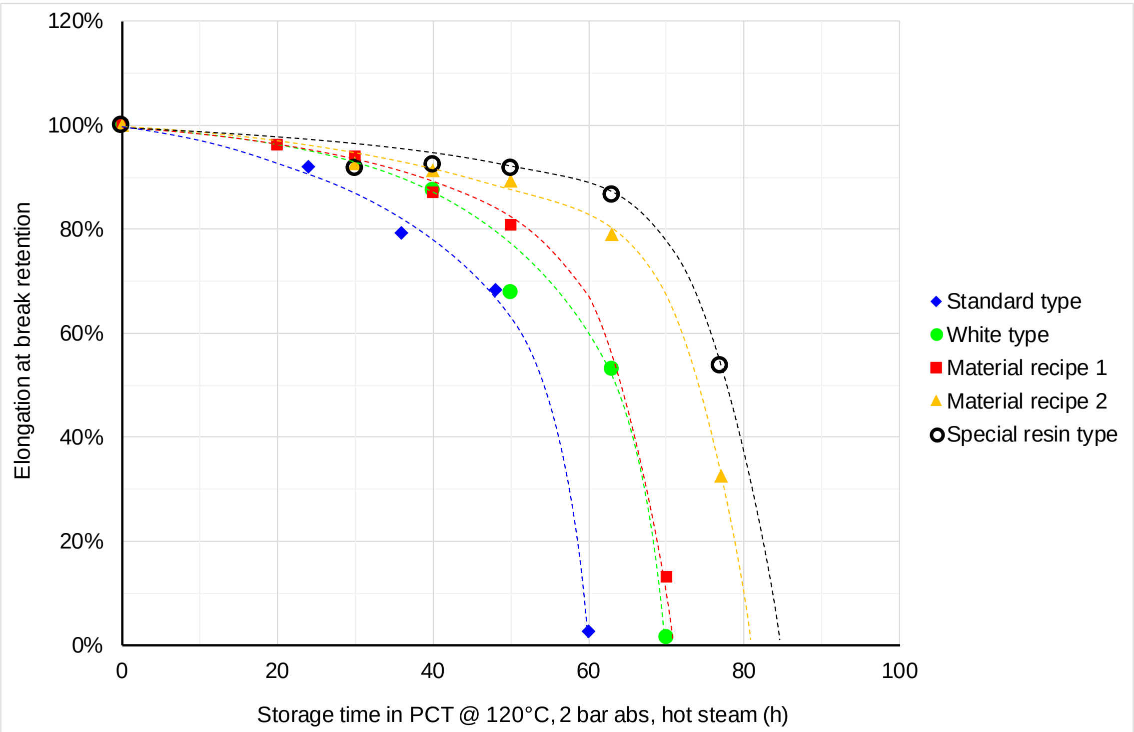


Pic. 1: World annual solar PV market scenarios 2018-2022 (Source: Global Market Outlook for Solar Power / 2018-2022, Solar Power Europe).





Pic. 2: Typical set-up of an all-PET backsheet.



Pic. 3: Performance of BOPET films from Brückner's pilot line.

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