

Properties of PBS

Thermal properties

The review of the thermal characteristics of all PBS polymers produced in SUCCIPACK highlighted that the **melting points (T_m) ranged from 109 to 115 °C**, with the lowest values documented in the case of bio-based PBS grades (bPBS). Fossil-based PBS grades (fPBS) proved to be more homogenous compared to bPBS grades, as indicated by their sharper melting endotherms and their practically negligible melting point deviation (fPBS: stdev ~ 0.1°C/ bPBS: stdev ~ 2.9 °C).

Therefore, the development of techniques towards increasing PBS melting point and/or homogenizing material thermal properties emerged during the project as an important issue to be considered for the range of polymer application and commercialization. To this direction, solid state polymerization/treatment (SSP/SST), i.e. heating the material at appropriate temperature between T_g and T_m in inert atmosphere, turned to be a valuable tool towards repairing any thermal stability issues and thus upgrading polyester quality.

In particular, for all PBS grades studied in the project – fossil and bio-based- **SSP served as a post-crystallization method**, improving the lamellae morphology by forming more stable and perfect crystals, and in parallel eliminating any metastable/imperfect species of lower melting points. As a result, sharpening of the melting endotherm and increase of the melting point were documented during PBS SSP/SST, **reaching an upper limit of ca. 124°C and accompanied in most cases by crystallinity increase**.

This improvement of PBS thermal properties occurred regardless of the molecular weight build-up in the course of the SSP process and this feature is extremely useful in case of bio-based material, where the potential presence of bio-based succinic acid impurities maybe problematic for the quality of the material. In a nutshell, **SSP represents a useful tool with great potential in the industry towards improving PBS thermal properties**.

Other strategies of copolymerization with rigid acid monomers were also tested to increase the melting point of PBS. No improvement was obtained.