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Impact of contaminants on formability of mechanically recycled PET: Application to bottle blowing process

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Poly(ethylene terephthalate) (PET) is a very common packaging polymer, particularly used in manufacturing processes such as thermoforming, Injection Stretch Blow Molding (ISBM) or film stretching. The mechanical recycling process enables to avoid PET waste. It involves the grinding and remelting of the material. The PET recovered is then downcycled to create synthetic fibers useful for textile and other products. Just a few percent are reused to make other bottles but the current legislation imposes on industrials to use recycled PET (RPET) in bottles [1,2].

Many researchers have addressed the subject of PET recycling. They found that recycled plastic suffers degradation during the recycling process which impacts both its physical and mechanical properties (decrease of molecular mass, increasing of crystallinity and rigidity, reduction of elongation at break, loss of clarity, yellowness) [3-5]. Very few scientists show also the bad impact of contaminants on physical and mechanical characteristics of RPET (increasing of crystallinity, reduction of elongation at break, loss of clarity, yellowness) [6-8]. And just one publication [9] has explored the impact of recycling and of contaminants on the implementation of new bottles.

The main objective of this present study is to understand the impact of contaminants on the stretching behavior of RPET and to adapt blowing machine parameters. Two mechanically RPET from two different countries are characterized to determine the nature of contaminants, compared to a virgin PET resin. Thanks to optical microscopy, dark particles, referred as “black specks”, are visible and are more numerous in recycled material. The recycling process and the presence of contaminants enhance crystallization ability in static conditions, which has the consequence of reducing the forming range of the material. For the three studied PET, the α -transition are very close. Nevertheless, regarding ISBM process, RPET are more easily deformed than virgin because they can absorb more energy. These first results let thinking that recycled PET present their own thermo-mechanical behavior, that will result in an adaptation of blowing machine parameters.

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