PET direct crystallization – Energy savings in a reliable process

Combi-Crystal-PET® (CC-PET®)

CC-PET® combines pelletizing, drying and crystallization in a common process. Downstream treatment of the pellets, usually in a Solid State Polymerisation (SSP), is simplified very much. The semi-crystalline end product cannot stick any more upon post-processing. CC-PET® can be applied in the virgin polymer production and in recycling applications, both with stranding or underwater die face pelletizing lines, with production capacities ranging from 750 kg/h up to 15,000 kg/h. Optionally, the output of one reactor can be diverted to several pelletizing lines and then again concentrated to one single crystallizer.

FUNCTION OF THE CC-PET® SYSTEM

- The PET melt is discharged from the reactor or the extruder by a melt pump 1.
- The material is processed by an underwater pelletizer SPHERO® 2 or by an underwater strand pelletizer USG 3.
- The hot process water rapidly transports the pellets to the dryer 4, where the water is separated from the plastic pellets.
- The crystallizer 5 processes the PET pellets utilizing the residual heat, as well as additional heating as required.
- After crystallizing, the pellets are suitable for any kind of post-processing 6.
- The process water is tempered, filtered and returned to the points of use in a closed duct 7.
From Melt to Crystalline PET Pellets
Immediately after conventional processing PET pellets are amorphous. Such amorphous pellets become sticky upon heating at temperatures above 70 °C and thus are not suitable for subsequent processing like:

- Post-condensation in the SSP – the pellets must be processed for several hours at approx. 210 °C.
- Drying prior to downstream processing – due to its hygroscopic properties PET must be subjected up to 6 hours intensively to hot air at 160 – 180 °C.

Therefore, the PET pellets must first be crystallized, since only this status is not sticky. For crystallizing, the pellets must be heated for a limited period of time to a temperature of approx. 130 - 180 °C. In order to avoid agglutination during the crystallizing operation, the pellets must be kept moving, e.g. by vibration, stirring or fluidizing.

The crystallization process is exothermic – the reaction heat in combination with residual heat can often satisfy the energy needs of the process. At this point, CC-PET® helps to preserve as much as possible internal heat from upstream processing steps in the pellets.

CC-PET® integrates the crystallization of PET directly into the pelletizing operation, using either SPHERO® for underwater pelletizing or USG for underwater strand pelletizing. The end product does not stick in subsequent downstream processing operations. This results in:

- reduced energy consumption,
- lower investment costs and
- increased operating profitability.
Furthermore, CC-PET® provides for controlled nucleation, as well as the supply of additional heating as required, for a wide range of raw material types. This ensures constant crystallization conditions which are not sensitive to fluctuations in material properties, guaranteeing highly uniform product quality.

Benefits with CC-PET®
- Reduced investment costs compared to conventional PET processing
- Lower production costs due to high energy savings; additional heating often required only upon production start-up
- Spherical or cylindrical, nearly dust-free and non-sticky pellets
- High bulk density for downstream processing of the material
- Flexibly adaptable to variable process conditions
- Stable process, independent of material properties; targeted heat supply makes it also independent of residual heat from upstream processes
- Crystallization temperature and dwell time continuously adjustable
- Reliable setting of material properties: acetaldehyde content (AA), pellet temperature, residual moisture

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