Dr. Thomas Birr
Entex; DE-Bochum

GRANULATION CAPABILITY OF ADHESIVES THROUGH ACTIVE COOLING WITH THE PLANETARY ROLLER EXTRUDER

For the processing and subsequent granulation of pressure-sensitive adhesives, efficient and precise temperature control is essential for the extrusion process. With the increasing development of very temperature-sensitive adhesives, the active cooling of extrudates in defined process zones is becoming ever more demanding and important in complex extrusion processes. Precise temperature control as well as the energy-efficient and economical use of temperature control systems are the key parameters here.

The planetary roller extruder (PRE) is a particularly efficient heat exchanger and dynamic mixer, with which large quantities of tempered masses of different viscosities can be heated up in a continuous process with short throughput times, but also actively cooled down very effectively. Planned cooling is important for many reaction and degassing processes, but effective cooling is also relevant to ensure target viscosities for optimal further processing, e.g. granulation. With the PRE, the cooling of adhesive melts with a delta T of up to 150 K can be realized over a short process distance.

Thanks to a number of unique selling points and its unique operating principle, the PRE is technologically superior to other extruder systems, not only for many compounding processes, but also for cooling processes in particular.

Most established extruder systems are heated purely electrically using heating cartridges. Furthermore, these systems work with a lot of shears, which regularly leads to inaccurate heat distribution and so-called "hot spots". Cooling occurs by means of cooling water that is pumped through various holes in the process section. Due to the thick walls of such systems, the cooling is sluggish, imprecise and inflexible. In addition, this type of cooling leads to an asymmetrical temperature distribution and is therefore not well suited for active cooling process zones.

The well-known advantages of the PRE, such as the full-surface, liquid-based temperature control as well as the extremely large energy exchange surfaces, create the technological prerequisites to enable an intensive thermal energy transfer between the temperature control medium and the extrudate. The thin-walled design between the circulating tempering medium and the extrudate provides an excellent energy exchange for heating and cooling processes. Both each roller cylinder and the central spindle have independent temperature control circuits with circulating liquid tempering medium.

As a result, thermal energy can be introduced into the compounding process and removed again using the same principle. By using suitable temperature control units with appropriate heating and cooling capacity, the temperature of extrudates can be actively and systematically lowered in the PRE, even in individual process zones, over short distances. Through the efficiency of active cooling, consistent target viscosities can be set for optimal further processing of adhesives. Targeted cooling processes of this quality are not possible with other extrusion systems due to their much smaller internal surfaces, the sluggish temperature control and the less gentle material treatment caused by the high mechanical shear stress.