A case for shorter heating zones in the feed section of extruders

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(10) » The importance of periodic audits of extrusion performance » Nylon - the great misconception » **A case for shorter heating zones in the feed section of extruders**

By far the largest portion of energy used in plasticating extruders is applied via the screw through mechanical shear of the resin. Only a relatively small portion is applied in the form of transferred heat from the heater bands around the extruder barrel.

Nevertheless, for the extruder operator, the heater band temperature settings are an essential means for controlling extruder performance and for determining the temperature of the extrudate. This aspect of extruder control, therefore, deserves proper attention.

Most of the heat transfer through the barrel takes place along the feed section, where heat is lost through conduction to the cooled hopper section, and to the unmelted granules entering the screw channel.

By the time the resin reaches the shallower channel and the higher shear rates in the metering section, little, if any, additional heat is furnished through the heaters. Therefore, the opportunity to influence the operation through barrel temperature changes along the front of the machine is restricted.

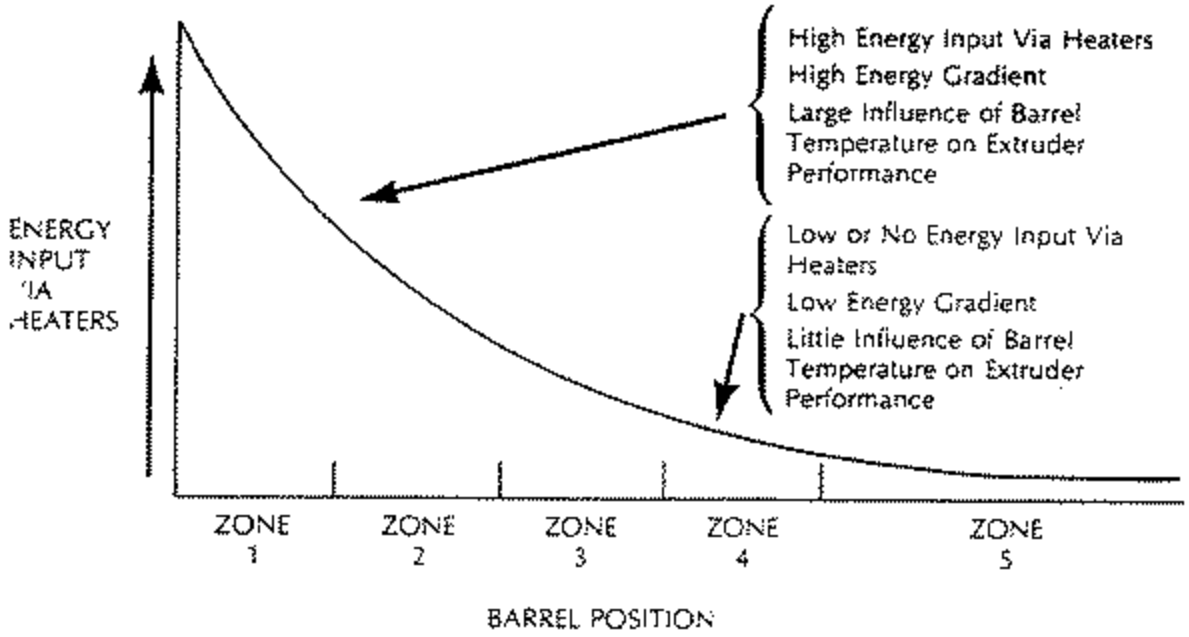
The temperature settings on the instruments controlling the heater bands do not give an indication of the relative energy input to the various barrel sections. If, for example, the instruments controlling all zones along the length of the barrel are set at the same temperature, the energy input to the various zones would not necessarily be the same. The heaters in the feed section are likely to demand far more electric current to maintain the set temperature, than those further downstream.

In the feed section, along the initial flights of the screw, the temperature of the inside surface of the barrel influences the adhesion and the friction of the granules against the cylinder surface, and thus plays a key role in governing the characteristics and the stability of conveying. Temperature control along this section, therefore, has a significant influence on the overall operation of the machine.

Since the rear section of the barrel not only requires the closest control, but also has the steepest gradient of heat energy input, it follows that shorter heating zones and refined instrumentation along this section of the extruder will contribute to better control of the extrusion process.

Experience has confirmed that improved operating control at no additional cost can be obtained by shortening the heating zones along the rear of the extruder, and making the front zones correspondingly longer. This simple change can make sensitive extrusion operations more stable and manageable.

- Ernest C. Bernhardt



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- Heat transfer in extruders - an introduction
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- On/off barrel cooling controls
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