Nylon 6 Screw Design

Print
(10) » Screen Pack Pressure Drop » Blown Film Air Cooling » **Nylon 6 Screw Design**
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Questions Sent to the Consultants Corner
"What are the best screw designs for the extrusion of Nylon 6 resin into film on a single screw extruder? Representative resins would be Custom Resins' Nylon 615 and Allied's Capron 8207. Some of the problems encountered now are low output and pumping air. What output rate could one expect from a 2½", 30:1 L/D "best" screw at 1200-1400 psi back pressure and 480-500°F melt temperature? Or from a 31½", 30:1 screws?

Robert B. Gregory offered the following answer:

The word "best" screw assumes that a qualitative comparison test has been conducted between all of the commercially available designs and from that test, one of several of the best performers has been determined. To my knowledge, no such test has been conducted and I doubt that a definitive answer is available to this question from any source.

Some of the problems cited in Mr. Haffner's letter are "low output and pumping air". One must assume that the "low output" relates to some quality variable other than "pumping air" which limits the productivity of the extrusion process. My experience indicates that some of the possible variables might be rate stability, mean temperature. temperature homogeneity, or resin degradation.

Each of these variables may be affected by some attribute of a screw design. Rate stability often has a feed related cause while mean temperature and resin degradation are interrelated and tend to vary inversely to the design output per RPM. Temperature homogeneity is affected by the total level of dispersive and distributive mixing involved with the design.

The problem of "pumping air" is definitely a feed oriented variable. It is not unique to Nylon 6, but is known as a problem with the extrusion of many other polymers. The design which is capable of melting a solid bed of Nylon 6 without allowing the solid bed to break up will probable be the best candidate for solving the air entrapment problem.

Finally, Mr. Haffner requests that some estimate of output rate be given for 2½" and 3½" 30:1 L/D extruders based on a specified melt temperature and pressure. Unfortunately, the answer must relate to much more information than has been given by the questioner. What is the end product and what variables establish quality limits on which the output rate will be judged? Finally, describe the extruder, its drive, torque level, etc.

If all of the required information is in hand, an experienced screw designer may be willing to "guess" at an output rate. More than likely his estimate of rate versus quality will be reasonably close based upon field and laboratory experience. I recommend that anyone purchasing an extruder screw discuss his problem in detail with more than one competent screw designer and obtain from each an estimate of usable productivity from the extrusion process using a screw from that source.

See also:

- Extrusion of nylon 66 simplified …
- Nylon - the great misconception
- Purging of extruders
- Technical developments

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