Calculating Extruder Performance

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It is of tremendous help and saves a great deal of time and money to get your extruder operating satisfactorily if you have available a good program that can calculate extruder performances. Such a program is a very valuable tool and open new horizons as to what can be accomplished in screw design. It must not, however, be considered a panacea for all problems. It is a method of screw design and must be properly used.

In addition to designing new screws it is often helpful in studying performance of an existing setup. In several cases we found that product temperature readings were inaccurate as taken in both plant and laboratory. In some cases we have found that horse power readings were incorrect and, of course, this is in addition to fulfilling the main purpose which is to design a screw that will meet predetermined performance requirements.

In analyzing the performance of pellet and powder fed extruders it is often important to determine the melting capability of the screw and make sure that all of the material issuing from the extruder will be molten. Also, it is important to determine the temperature uniformity or temperature variation in the extruded material. In an analyzing a melt fed extruder it is usually found that attaining the desired rate and pressure is the most critical problem, although in some cases, holding the extruder below the maximum allow able temperature may be of prime importance.

In developing a completely new design it is usual to go through three main areas of work; whereas, modifying on existing design may eliminate the first step:

Step #1 could be called a brain storming session. Here one checks the performance of widely different designs and then narrows the field of operations until the diameter and length appear fixed and an RPM range has been determined. In the case where there is more than one material involved, this is done on the material which is expected to offer the greatest problem and is then checked on an other material with different characteristics.

Step #2 consists of making a detailed analysis of screws having relatively minor variations, one from the other, until an optimum design is selected that is anticipated to give the best overall performance across the range of materials and operating conditions.

Step #3 constitutes a thorough study and analysis of the performance of the selected screw design on all of the materials to be covered and on all of the operating conditions that may be encountered. If this analysis is not satisfactory it may be required to re turn to step #2 and make a modification in screw design and then return to the analysis of step #3 until the desired extruder performance is obtained.

In some cases it is necessary to make from 50 to 100 runs through the computer to optimize the design of one screw. This is because of the tremendous number of different designs that are available, and from these the best is to be selected.

This method permits us to simulate the performance of dozens of extruders and screw designs under a variety of operating conditions such as RPM, heating and cooling temperatures, head pressures wear, etc. that would take years to do in actual performance on one or more extruders. The cost saving is tremendous. The simulation can be carried out at a fraction of 1 % of the physical cost. Today it is possible to approach optimum performance rather than, as often happened in the past, be compelled to be satisfied with a screw design of questionable value. Now we can find that "good" design that formerly we couldn't afford to look for.

- Louis F. Street

See also
- Defining screw performance
- Extruder controls

- Extrusion evaluation through pressure and melt temperature
- Performance of twin screw extruders
- The programmable calculator

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