

AN INTEGRATED SYSTEM APPROACH TO INJECTION MOLDING

K. S. Lee
Department of Industrial Engineering
HONG-IK University

S. Madhava
Department of Industrial and Manufacturing Systems Engineering
Louisiana State University

Abstract

The use of plastics has rapidly increased in recent years to replace metals for reducing product weight and production costs. Plastics have begun to move in a big way into many engineering and automotive applications. The strong advantages in shifting from metals to plastics include: savings from combining multiple parts into one-piece assembly, savings in machining and finishing costs, shape flexibility, lower part weight, corrosion resistance, and lower cost than metals.

Injection molding is a popular form of plastics manufacturing. It will enable the manufacturers to produce finished components of widely varying geometry at low unit cost. Parts of varied colors, finishes and surfaces can be manufactured from an injection molding process, which also allows the manufacturer to produce very small parts that would be difficult or impossible using other manufacturing processes like conventional machining and casting.

However, there are not many techniques developed for the injection molding and many decisions related to the injection molding require the experts who have acquired information through experiences. And in many cases the experts are not readily available for the medium to small manufacturers. Therefore, the objective of this research is to develop techniques which can be used in material selection, cost estimation, mold design, mold making and process control.

The material selection is defined as the process of selecting from available materials those which conform to suitable properties to meet

product requirements under different operating conditions and within economic constraints. The anisotropic, non-linear and time dependent viscoelastic nature of plastics makes it difficult to associate part requirements with single property listing found in the literature. This has resulted in heavy expenditure to industries in conceptual stage itself.

The cost estimation process will make the designer aware of the comparative costs of alternative design concepts, thus improving the cost effectiveness. Early cost estimation of any product - that is, determining the cost of the product in the conceptual stage itself - will help the manufacturer to avoid costly mistakes and also to select the right process. Estimating the cost manually will take away lot of time and this will result in higher wages and delay in product development.

There are many processing parameters that must be controlled between the point where the plastic is being pushed (the plunger) and the end result of this push (mold pressure). Some of these variables are the mold temperature, the plastic temperature, the plunger speed and pressure, and the plastic size, shape, lubrication and viscosity. Processing parameters have a strong influence on the quality and cost of the product. The present procedure for setting up plastic injection molding machines does not generally follow any scientific approaches. Rather, the setup procedure is an art based on the experience and preconceived notions of operators and setup.

New product development has been delayed because of this practice. Therefore, techniques about the processing parameters and trouble shooting guide were developed to help the molder to set the processing parameters in a minimum time. Further techniques were developed for choosing right material, making an early cost estimation, and also for determining the optimum processing parameters, thereby helping the manufacturer to produce the injection molded parts in an economical and competitive way.

It was found that the new techniques help the molder in taking proper decision in different stages of manufacturing and thereby produce the component in an economical and competitive manner.