

DESIGN OF A NEW TYPE OF SINGLE TUBE PRESSURE INJECTION MOULDING MACHINE

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Abstract

The injection moulding process is the most wide manufacturing process among plastics and plastic matrix composites in industrial applications. The conventional injection moulding machine has a huge body, units and so many parts which makes it expensive. In order to get samples for so many tests from injection moulding is also expensive for small amounts of samples. In this study a new type of injection moulding machine has been designed and made at Plastics and Composites Research Laboratory. The cost was 100 times less. It has been observed that sample quality is similar to sample from conventional counterparts.

Keywords: injection moulding, plastics, composite, design, single tube.

INTRODUCTION

Injection moulding is widely used because of the ease of automating the process, high productivity because of the short moulding cycles, and the excellent detail that can be obtained with the process. Most engineering thermoplastics are readily processed by the injection moulding because of the very high melting temperatures and high viscosities of high performance thermoplastics.

Using conventional injection moulding machines in order to get test samples is expensive and long time period as much as expensive costs.

In this unique work a new type single tube injection moulding machine design and manufactured by Dr Erdogan in Plastics and Composites Research Laboratory at Trakya University, Edirne, Turkey®.

INJECTION MOULDING

Injection Molding is a process, in which a polymer is heated to a highly plastic state and forced to flow under pressure into a mold cavity, where it solidifies. The part, called a *molding*, is then removed from the cavity:[1]

Injection moulding is used for the formation of intricate plastic parts with excellent dimensional accuracy. A large number of items associated with our daily life are produced by

way of injection moulding. Typical product categories include housewares, toys, automotive parts, furniture, rigid packaging items, appliances and medical disposable syringes.

Advantages of Injection Moulding

- ◆ Accuracy in weight of articles
- ◆ Choice of desired surface finish and colours
- ◆ Choice of ultimate strength of articles
- ◆ Faster production and lower rejection rates
- ◆ Faster start-up and shut down procedures
- ◆ Minimum wastage
- ◆ Stability of processing parameters
- ◆ Versatility in processing different raw materials
- ◆ Option in article sizes by changing the mould.
- ◆ Minimum post moulding operations exposition

A conventional injection moulding machine is illustrated in Figure 1.

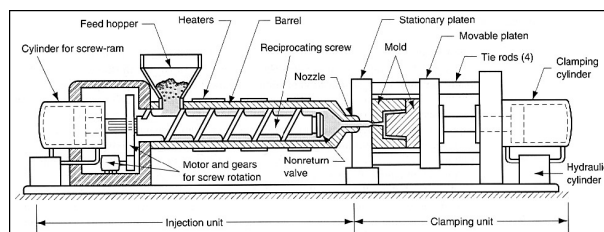


Figure 1. Conventional injection moulding machine

Injection moulding cycle

A typical sequence of operations from startup is as follows:

1. Starting with an empty cylinder, raw material from the feed hopper falls onto the rear flights of the screw which conveys material to the front of the cylinder. During its passage along the cylinder it is plasticised to a fluid state with the help of external heaters on the barrel. Some material may escape through the nozzle but the back pressure is generally sufficient to push the screw back in the cylinder and to provide a reservoir of fluid plastic in the front of the cylinder for injection.
2. The mould closes and the cylinder moves forward units carriage until the nozzle is in contact with the entrance of the mould.
3. The screw is moved forward by the hydraulic cylinder at the rear of the machine and the injection takes place.
4. After a short interval (the holding time), the screw rotates, creating some pressure in the barrel, which offers it back against low pressure in the hydraulic cylinder, until the limit switch operates, stopping the rotation. This plasticises material ready for the next shot.
5. The mould opens, the article is ejected and the mould closes again ready for the next cycle.
6. Stages (2) to (5) repeat (Figure 2.)

The injection moulding cycles are given in Figure 2 [2].

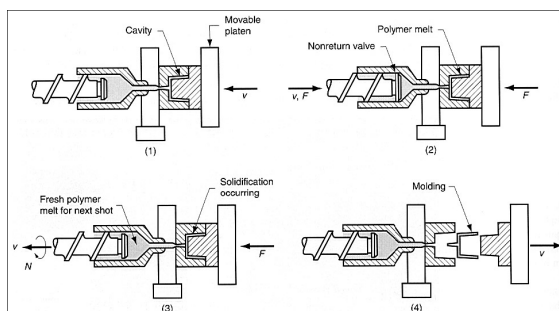


Figure 2. Injection moulding cycles

DESIGN AND MANUFACTURING A NEW TYPE SINGLE TUBE INJECTION MOULDING MACHINE

A new type single tube injection moulding machine has been designed for same functional operations but in different principals of the operation. Conventional injection moulding

machine has a rotating and moving forward and backward screw to melt then mix and push the molten material to die. In this study, the single tube injection moulding machine has a tube and piston to melt and push forward the die. A CAD program has been used used for the design, Figure 3.

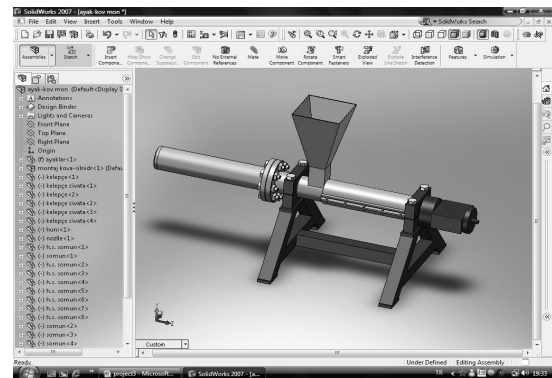


Figure 3. A new type single tube injection moulding machine

Design Parameters

In this stage the values of single tube injection moulding machine are given below:

- The pushing force=1500 kgf
- The piston diameter=65 mm
- The hydraulic pressure=100 bar
- The securing value=2
- The gear pump flow rate=4,2 l/min
- The motor power=1 kW

Illustration of piston is given in Figure 4.

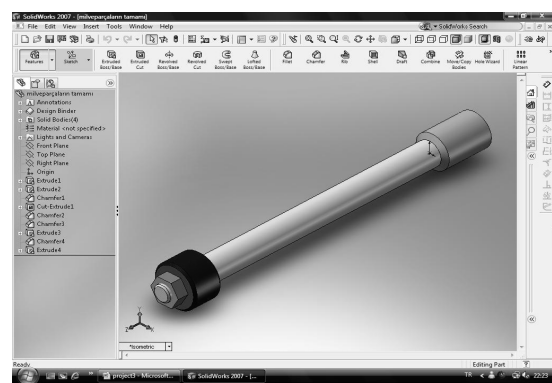


Figure 4. Piston

In Figure 5, hydraulic system is shown.

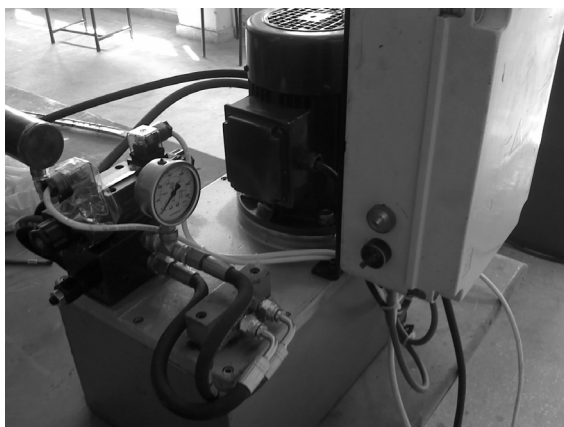


Figure 5. The hydraulic system of the new type single tube injection moulding machine

Working Principals of Single Tube Injection Moulding Machine (STIMM)

The STIMM is contained hydraulic unit, hydraulic tube, the piston, materials tube, nozzle and the die. The hydraulic unit pumps hydraulic oil for operational pressure. The piston which is in the hydraulic tube, moves

backward and forward for get back and push the molten material send the die. Any type of die can be attached to tip of nozzle.

CONCLUSION

A new single tube injection moulding machine are considered to use and to make test samples to determine mechanical properties of injected plastic and plastic matrix composite materials. It has been observed that samples are like samples from conventional injection moulding machine. Thus, the cost and time can be saved. The STIMM is much more cheap than the conventional counterparts.

REFERENCE

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