



Injection moulding - The Process

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Throughout my years involved in injection moulding I have become aware that very few people on the shop floor and other areas are actually looking at injection moulding as a process over the next few paragraphs and articles I would like to try to explain in plain terms why it should be viewed as a process.

The three main components of the process are Materials, Mould and Machine the three M's let us start with the materials.

Almost all materials today are delivered in bulk or in sacks, which are then supplied to the machines via a vacuum loading device or by using an automated supply system to the machines in some rare cases hand loading of the machine is still used.

If the material is delivered, stored and handled correctly before reaching the machine then all things being well it should perform as intended however in some instances this is not the case.

In order to maintain a consistent stream of performing material the material must be dry not wet or dried to the recommended specifications as supplied by the manufacturer, it must not be brought from a cold damp warehouse into a hot production hall with a large temperature difference it should be at the same temperature as the room, it should not be contaminated with foreign matter so how it is stored and dispensed to the machine is another important factor to be aware of.

It should be where possible be from the same batch any new batch must be tested before acceptance into the production, the material must be approved for the process and have traceability right back to the supplier.

In other words, the material must be good quality and treated with very good care at all times, it is an expensive part of the process so look after it and it will look after you.

You would not use any old petrol in your car would you?

Years ago, you could buy off specification material, which is what is created during the transition from one grade to another I recently came across a material supplier in China who supply three versions of a polypropylene of the same grade, grade 1 is the good version, grade 2 is? and grade 3 the last grade is sweepings from the floor not my words but the supplier's specification sheet.

What goes into the process will determine what comes out rubbish in rubbish out.

I can now move onto the mould, we have numerous computer simulations programmes available which graphically show how the mould will fill, where are the hot spots and where

the location of the water should be yet we chose to ignore them for reasons I will not go into in this article.

The mould must be constructed from approved materials and have approved treatments carried out to the materials, there must be traceability of all items, avoid non standard parts if possible and use off the shelf components, the mould should come with some spare parts that will be subject to wear.

You have paid for any parts to be made like electrodes they are your property.

Use good design practices and make use of any of the accepted design tools like mould flow to make changes after is very expensive, make sure your supplier supplies a general assembly drawing so that you can approve the design and that the mould will meet your requirements.

Ask for a warranty or guarantee of how many parts the mould will produce and a full list of drawings so spare parts can be made if the mould is from overseas, it is also good practice for the maker to supply maintenance instructions for the mould to maintain it in perfect order.

If the design and construction of a mould is, correct then the results of what comes out of it should be what is required of the product specification time after time.

Validation of the mould proves that the mould is fit for purpose and can consistently perform at a given cycle time, this can and should be carried during the mould acceptance stage of approval.

Failure to carry out a mould acceptance trial can also prove very costly in the future; validation must be carried out on the machine that it is going to produce the parts.

I can now move on to the machine, like the material if the environment that the machine is in is variable then what comes out of the machine will also vary if the room temperature is hot so the machine will be hot, if it is cold again the same result ideally machinery runs better in a stable constant controlled environment that is not fluctuating wildly.

The evolution of the production hall is still in its infancy most companies start with a building that is empty, and then we put in moulding machines which generate heat so we put some fans in the roof to draw out the hot air then we increase the number of machines, which generate more hot air.

All the workers get hot during summertime so we open doors or put more fans in instead of starting with a controlled atmosphere from the start.

As machines have improved in capability and reliability over the years numerous optional extras have evolved one of these is process monitoring this should be specified on any machine you buy as it is critical to controlling the process.

In order to be able to control a process it needs to be measured at various points in the process this indicates the reliability of the process. We can then start to establish a processing window once we have determined that the process is meeting all product specifications. If our inputs of material and mould are stabilized and repeatable, we are half way to controlling the process using the repeatability of the machine to arrive at a processing window.

The processing window is established by taking each of the parameters which affect the process in turn and finding out by adjusting the process one parameter at a time to find the

upper and lower limit of the parameter at what point it affects the parts specification once all the parameters have been established you have your processing window for that particular part.

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