Manufacturing Press Release

Thermoregulation for Plastics

The Plastics industry has been around in varying forms for over 100 years, but it is really from the mid 20th century (and driven from the demands of the second world war) that developments helped plastics become the base material for many commodities. From child's toys, to car and medical parts, to pipes, insulated cables and plastics bottles, there are many plastics applications we now rely heavily on in everyday use.

In 2000 there were over 20,000 different base plastics materials available for processing and that number was increasing at an average rate of 750 per year. The newer available materials are now usually alloys or blends of previously developed materials meaning that product designers can choose from a vast selection of base materials and pick one that has exactly the right properties for their end product needs. We are now seeing increasing shifts to bio plastics as environmental and sustainability concerns over creation and use of oil based plastics is rising.

Base materials (in the form a plastics pellets) are chosen by manufacturers based on the strength and function required for the final part, but also each material has different parameters, including melt points, that must be taken into account.

The tools that take the base polymer pellets, melt them and then create a finished product will usually have an electric heater to actually melt the plastic and once that takes place all further heating and cooling of the moulds, dies and the final products is usually done by thermal fluid temperature controllers (also know as thermoregulators), they support injection moulding, extrusion and blow moulding, to name just a few of the main processes within the plastics industry.

Thermoregulation for Plastics

The use of thermoregulators is roughly consistent in all three processes.

Thermoregulators are established as the temperature control technology used within the plastics industry. They offer such flexibility and precision over set point temperatures that they are almost considered standard kit.

After heating the polymers, the moulds, dies and tools are typically water or oil heated and cooled – this is the thermal fluid. Oil is used for very high temperatures up to **350ºC**, water for temperatures up to **95ºC** and pressurised water can go up to **160ºC**. The tools have channels within the body of the mould that the thermal fluid flows around to heat and cool the mould and the plastic objects within them. This is what the thermoregulators expertly control, to very specific degrees of temperature.

Where these thermoregulator units come into their own is their ability to easily yet precisely control the temperature of the thermal fluid they distribute around the tool. There are many different polymers and they all have slightly different melting points and then need cooling in certain steps and time frames. Due to their flexibility in temperatures, manufactures can use the same type of thermoregulator device right through different processes so operators have the same user interface and only have one system to learn.

To ensure the finished product meets requirements managing these temperature changes is critical.

If the temperature control is not specified for each polymer issues can be caused with the finished plastic product. Imperfections like blistering (where the tool or material are too hot), warping or twisting (where the cooling has happened over too short a time or where there is a lack of cooling around the tool) and end products with weld or knit lines (where

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the temperature is too low and the materials are cold when they meet so they don't bond properly) can be caused, increasing production costs, reducing production line efficiency and causing delays. Using a reliable thermoregulator should remove these issues.

Injection Moulding Basics

Think kids toys, medical instruments, computer parts, cutlery, car parts, basically anything plastic without thin sides.

A hopper will feed the polymer resin (pellets) down to the screw. A motor is responsible for turning the screw inside a heated cylinder which feeds the pellets up through the grooves of the screw. The heating of the cylinder melts the pellets. A gate before the mould cavity restricts the flow of the melted plastic into the mould and limits backflow.

The pressure created by pushing the pellets forward through the grooves up to the gate also produces heat on the inside of the cylinder which helps to melt the polymer and prepare it for injection into the mould.

The mould is heated so as the screw moves forward it injects polymer melt into the hot mould at high pressure (typically 10,000 - 30,000 psi) it doesn't start to cool and solidify until the process is ready for it. The screw then holds it, and adds more melt to ensure the contraction due to cooling and solidification does not leave gaps in the final product. Eventually the gate solidifies and isolates the mould from the injection cylinder and the cooling can take place.

Believe it or not, it is actually the cooling in Injection Moulding that consumes about 85% of the cycle time for the entire process.

After solidification, the clamp holding the two halves of the mould together is opened allowing the part to be removed. The injection moulding process can then be repeated.

Plastics Extrusion Basics

Plastics extrusion is used to create long consistent plastic products, like pipes, straws and insulated wire.

The process is very similar to moulding, where the plastics polymer is melted but for extrusion it is pushed through a die. The die is what gives the final product its profile and must be designed so that the molten plastic evenly flows from a cylindrical profile, to the product's profile shape. Uneven flow at this stage would produce a product with unwanted stresses at certain points in the end products. These stresses can cause warping upon cooling.

Almost any shape imaginable can be created so long as it is a continuous profile.

Blow Moulding Basics

Think plastic bottles and jars

Blow moulding, is a manufacturing process by which hollow plastic parts are formed.

The blow moulding process begins just like the other processes with melting down the plastic. It is then formed into a preform. This is a tube-like piece of plastic with a hole in one end in which compressed air can pass through.

The preform is then clamped into a mould and air is pushed into it. The air pressure then pushes the plastic out to match the mould. Once the plastic has cooled and hardened the mould opens up and the part is ejected.

Interesting fact, in the United States soft drink industry the amount of plastic containers went from zero in 1977 to ten billion in 1999.

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