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Injection Moulding Machine using Pick And Place Robot

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Abstract: *Injection molding is the maximum not unusual manufacturing method for polymers. This paper presents a detailed description of the injection molding process, together with its technique parameters and their impact on the molded component. Gating structures play an important function in part great. The injection molding process works while plastic mass flows from gate to gate in a gate device, via gates and into the mould hollow space. Contemporary plastics enterprise uses business robots in all components of plastics manufacturing, along with injection molding related strategies. From loading components into injection molding machines to finishing and assembling injection molded components, the use of robots offers plastics manufacturers a aggressive advantage with huge productiveness gains and excessive satisfactory. Additionally, robots are an increasing number of being utilized in publish- processing outside the injection molding method. B. Welding, assembly and packaging operations because of the developing demand for more bendy answers. Pick and place robots permit agencies to pick gadgets from one vicinity and location them at any other the usage of an automatic answer. Simple responsibilities like lifting or moving an object do not require advanced concept processes. Therefore, the use of human exertions for those responsibilities may be wasted as hard work may be used for different responsibilities that require better intellectual capacity. these repetitive obligations are treated by way of choose-and-place robots. These robots are frequently equipped with sensors and imaginative and prescient systems to raise items from shifting conveyors.*

Keywords: Injection Molding, Pick and Place Robot.

I. INTRODUCTION

Injection molding technology is one of the main methods of industrial processing. Most injection machines used in industry today are screw-type injection machines. According to the driving mode, injection machines are mainly divided into electric injection machines and hydraulic injection machines. It is a powerful molding method that can mold plastic products of various shapes and sizes. It is also the preferred process for products with complex three-dimensional structures. From micron gears,micron needles,etc. to plastic bottles, plastic barrels and daily necessities that are common in daily life, they can be molded by injection molding. Injection molding technology can be used for a variety of materials, including composite materials, foamed materials, thermoplastic and thermosetting plastics and rubber, etc. There are also various forms of injection molding such as gas-assisted molding, water assisted molding, micro-injection molding, injection foam molding, low-pressure molding, injection compression molding, etc. An injection mold consists of two halves that are forced together to form a cavity in the shape of the part to be produced. Hot, liquid plastic is then injected at high pressure into this cavity. The high pressure is needed to ensure that the plastic resin fills in every crook and cranny of the mold cavity. Once the plastic has had time to cool, the two halves of the mold are pulled apart, and the part is ejected. Although designing for injection molding can be quite complicated, and the cost of the molds themselves are incredibly expensive, there is one huge reason why injection molding is still used today. No technology can beat injection molding when it comes to producing millions of identical copies of a part at an incredibly low price. Plastic injection molding is a technique used to create molded products by heating plastic materials into a molten form and injecting into a custom-designed mold. Then the material is cooled to solidify the parts. The method can be utilized to mass produce parts featuring complex, unique shapes. An injection molding project consists of three basic steps: Product design, mold design, then the actual manufacturing process. If the product is

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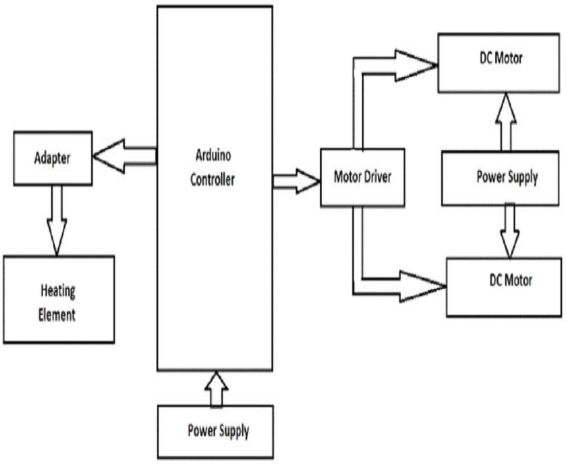
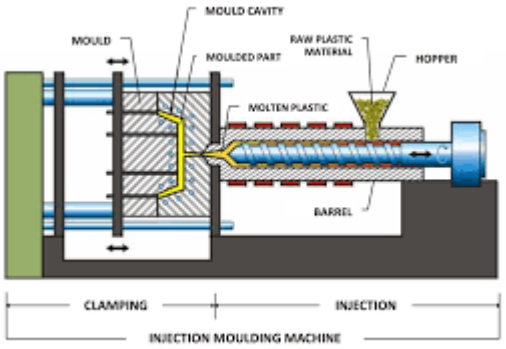
designed with ease of mold creation in mind, the mold designed and made with precision, the manufacturing process will proceed smoothly. The manufacturing process itself includes six major steps: Clamping, injection, dwelling, cooling, mold opening, product removal. Plastic injection molding companies use machines that work by melting, compressing and injecting plastic resin pellets into the runner system of a custom constructed mold. A mold can be made for making a one-time test part or a run of parts for filling a customer's order or manufacturing a more complex item.

Figures



Injection moulding machine using robotics:

Robotic technology plays a significant role for plastic injection moulding post processing. A robotic trimming cell provides superior repeatability when compared with a human performing the same task, and it increases flexibility by performing multiple operations. A robot will consistently dispense the same amount of sealant or adhesives following a highly repeatable pattern, offering greater shot accuracy, improving cycle times and reducing waste. With or without vision, robots can pick and place plastic moulded parts for further operations such as inspection, testing and hot stamping. In the assembly of injection moulded parts, robots can perform complex welding operations using laser, ultrasonic and infrared, increasing precision and driving down cycle times. Robots also meet the needs of automated finishing, ranging from PAD printing to polishing. Further, automating the end of plastic production line can make a big difference to production rates and cost effectiveness. Robots can liberate workers from strenuous and repetitive manual work such as wrapping, labelling, palletising, and provide flexibility for quality packing, storage and logistics.



Injection molding process parameters

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High-molecular polymers undergo very complicated heating cooling and mechanical shearing in the injection molding process. Due to different thermal-cold history and mechanical shearing history of polymer regions, the crystalline morphology in the thickness direction of the part is also different, and it will show a clear skin-core structure with an obvious anisotropy. The use of different injection molding process parameters will lead to different polymer microstructures. The differences in polymer microstructures are mainly manifested in the differences in molecular chain arrangement, molecular chain orientation, and crystallization. The differences in these microstructures of polymers will be different. Crystallization is also a major factor in the evolution of the aggregate structure and microstructure of the molded product, which has a significant effect on the physical properties and dimensional stability of the product. In the crystalline polymer, due to the incomplete crystallization of the melt, the polymer will contain two components: crystalline and amorphous regions.The physical quantity used to quantitatively describe the crystalline and amorphous regions is called the crystallinity of the polymer. Crystallinity is defined as the mass percentage (or volume percentage) of the crystalline phase in a polymer containing both crystalline and amorphous regions.

Advantages

Precision

Plastic injection moulding is perfect for very intricate parts. Compared to other techniques, moulding allows you to incorporate more features at very small tolerances. Have a look at the image to the right. You can hold this moulding in the palm of your hand and it has bosses, ribs, metal inserts, side cores and holes made with a sliding shut off feature in the tool. That's an awful lot of features on a small part! It would be impractical to make using plastic fabrication and impossible to make using the vacuum forming process.

High repeatability

Once your mould tool is made, identical products can be made over and over again. And again. A decently made mould tool has a very long mould tool life, as long as it's treated well by the moulding machine setters.

Low cost per part

Whilst there is an initial high investment for the plastic injection moulding tool, after that the cost per part is very low. Other plastic processing techniques may require multiple operations, like polishing, whilst injection moulding can do it all at once. If you chose to CNC machine the part above, it would cost hundreds of pounds per part. If you're looking to go into full production, injection moulding is the way to go.

Fast

Cycle times can be as low as 10 seconds. Combine that with a multi-impression injection moulding tool and you get a LOT of products very quickly. That part above takes a bit longer as it's a specialist material and has a lot of features to be moulded correctly, but at about 50 seconds you'd still get 70 parts per cavity per hour. CNC machining a one-off would take half a day - 3D printing it even longer!

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Material choice

There's a vast amount of materials available for plastic injection moulding. A range of more common materials, but also things like antistatic plastic, thermoplastic rubber, chemical resistant plastics, infrared, biocompostable...and with colour compounding or masterbatch colouring you have an endless choice of colours as well. The moulding above is boring black, but it's made out of PPO - poly(phenylene oxide) - which is an extremely rigid and flame-retardant material.

Special Surface Finishes, Engraving & Printing

In addition to a range of colours, the injection moulding tool can be made with a special finish which will show on the moulding. Just about any finish you like, for example leather look, soft touch, sparked, high shine, you name it. You can also have logos or other text engraved in the tool. Finally, you can have your mouldings printed, as a range of inks are available that will print well on plastic.

Little plastic waste

Part repeatability is very high for injection moulding. Even the sprues and runners (the leftover bits of plastic created by the 'tunnels' through which the plastic material reaches the actual mould) can be reground and the material reused. You can explore this in more detail on our environmental impact of injection moulding page.

Applications:

- Injection moulding is used to create many things such as wire spools, packaging, bottle caps, automotive parts and components, toys, pocket combs, some musical instruments (and parts of them), one-piece chairs and small tables, storage containers, mechanical parts (including gears), and most other plastic products .
- Industrial robots can be used to automate the injection molding process by using a pick-and-place robot to load plastic parts into the machine or to place the finished pieces onto a conveyor belt.
- An automated in-mould labelling /decorating uses robots to load pre-printed labels or decorated film directly into the open plastic injection mould.

II. CONCLUSION

Injection moulding has a great many applications for manufacturing, particularly for producing high volume parts. While the tooling and moulding can be expensive, the cost of production once this is completed is low. In the field of manufacturing, polymer material presents advantages such as low cost, high machinability, good corrosion resistance, and biocompatibility. Thus, the development of polymer processing technologies such as injection molding has already become one of the research hotspots and vital developing aspects in the field of polymer industry. Injection molding is one of the most important parts of the polymer industry. This technology and related machines are also a world-wide big business, almost one third of the polymer products are fabricated by this method. Injection molding is a repetitive process, in which melted polymer materials are forced injected into the mold cavities. The heating of polymer materials in the plasticizing component, the forced injection of melted polymer materials into mold cavities, and the opening of the mold to eject the molded products are three basic operations during the injection molding process. Besides the injection molding for pure polymer materials, this technology is also developed for high efficiency processing of composite material as reviewed in this paper, including metal matrix composites, cement-based composite materials, carbon composites, and other composites. Moreover, new and improved methods are successfylly being developed and applied in laboratories and industries. Although researchers around the world have already proposed a series of modified injection molding methods, significant improvements in processing efficiency and accuracy still need be made for the complete commercial viability of the process.

III. FUTURE SCOPE

The future injection molding technology will continue to progress around the innovation of injection molding equipment, injection molding materials and injection molding technology. The injection molding equipment will combine with the development of science and technology to develop more intelligent and precise equipment. At the same time, the mold technology supporting injection molding technology will also develop in the direction of new

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material molds, high-precision molds, and replaceable molds. Injection molding materials will also have different types of development. The injection molding technology of composite materials will gradually shape the research hotspot of injection molding technology. The injection molding process will also continue to be developed around the demand for high-precision, injection-molded products composed of different materials. In general, injection molding technology still has challenges in terms of equipment, materials, and processes that require researchers to continue in-depth research and continuously improve injection molding technology for different needs to gradually produce products that meet anthropological requirements.

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