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BOTTLE MOLD DESIGN IN THE BLOW MOLDING PROCESS USING MASTERCAM X5 AND INVENTOR

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ABSTRACT

In its development, every manufacturing industry increasingly makes humans think more creatively and is faced with new problems, especially in making new innovations. The purpose of these production problems is to achieve faster and more efficient production targets. Manufacturing processes in the plastic field at the present time make products that are in great demand by the public.

The development of technology in the dies manufacturing sector due to demands from consumer demand for better quality encourages the Industry to innovate, the process of making dies using metal molds with the aim of improving the quality of the components. Blow Molding is one of the manufacturing processes with the working principle of applying air pressure to plastic material that enters the mold cavity. The mold used is made of metal, either steel or aluminum, to improve the quality of the blow molding process results using a CNC machine where the program created is the result of the Mastercam X5 application.

A design process has been carried out to make a mineral water bottle packaging mold using Mastercam X5, to produce Code G which will be used to make molds on a CNC machine, the material used is Aluminium 2024.

Keywords: Mastercam X5, Packaging Bottle, Aluminium, Cad Cam.

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Introduction

CAM applications for manufacturing planning are those where computers are used indirectly to support production functions, but there is no direct connection between the computer and the process. Computers are used to provide information for effective planning and management of production activities [9].

The Manufacturing (Machinery) industry is currently developing rapidly along with the needs of service users or manufacturers, companies are required to innovate to develop technology to make it more effective and efficient. One of the manufacturing industries that are required to continuously innovate is an industry engaged in machining. One of the machining products which is considered difficult to manufacture is gear components, so we need a technology that is able to reduce the occurrence of human error.

Based on technical drawings, where the geomatric specifications of a machine component product are asked, one or several types of machining processes must be selected as a process or sequence of processes used to make it. For this reason, it is necessary to understand the five basic machining processes, namely:

Cutting speed (Cutting speed); V (m/min)
Feeding speed; fz(mm/min)
Cutting time (Cutting time); tc (min)
Furious earning speed ; Z (cm ^{3}/min)

The basic elements of the machining process are calculated based on the dimensions of the workpiece and tool as well as the size of the machine tool. The basic elements of the turning process can be known or calculated using the formula [5].

Basic elements can be calculated with the following formulas:

Cutting speed:	v=(π.d.n)/1000	;m/min
Feeding speed:	fz=V_f/z.n	;mm/min.
Cutting time :	tc=l_t/v_f	; min.
Furnace Production Speed:	Z =V_f.a.w/1000	; cm^3/min

Blow Molding Dies

Blow molding is a plastic manufacturing process for making hollow products (bottles) where the parison resulting from the extrusion process is expanded in a mold by gas pressure. Basically, blow molding is a development of the pipe extrusion process with the addition of molding and blowing mechanisms [16].

Blow molding is a method of forming hollow objects from thermoplastic material by blowing on a bottle preform or parison that has been heated and then placed in a closed mold and the resulting shape of the product will adjust to the flow of the mold. An example of a product produced from the blow molding process is bottles which is its main application.[1]

There are many ways to make blow-molded plastic components, here are the stages of the blow molding process:

1. Plasticizing (melting) resin
2. Production of parison (extrusion) or preform (injection)
3. Inflation of the parison or preform followed by cooling in the mold
4. Ejection of the part from the mold
5. Cutting or finishing parts

The stages of the blow molding process can be seen in Figure

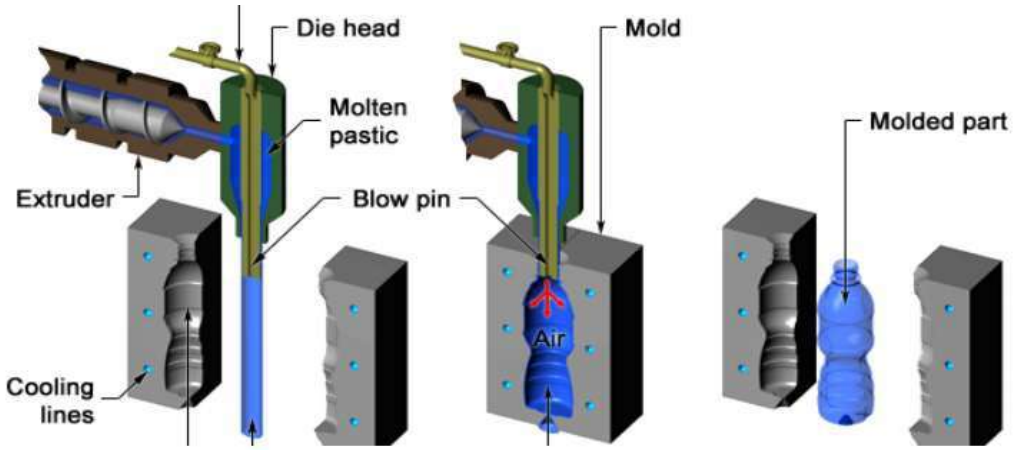

Figure Basic Blow Molding Process [16]

As an industrial segment, approximately 80% of polyethylene (PE) and the majority of polyethylene terephthalate (PET) materials are used for bottles and packaging by the blow molding industry.

Extrusion Blow Molding

The extrusion blow molding process is a process where thermoplastic material that has been melted in a heater is released into a hollow pipe-like shape called a parison. The next process is that the parison is inserted into the mold, then after the parison is inserted into the mold it is pushed by a screw towards the die head to produce a pipe-like shape, which is then captured by the mold and the process of blowing pressurized air from the compressor flow is carried out so that the parison forms according to the mold. [3]

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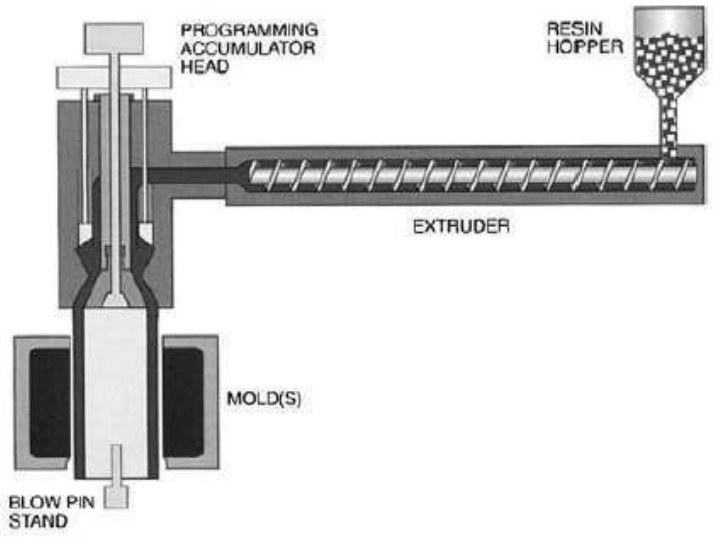

Figure Extrusion Blow Molding Process [2]

Research Method

Research Flow Diagram

To simplify the design process for making bottle molds and the simulation process using Mastercam X5, a flow diagram was created as follows:

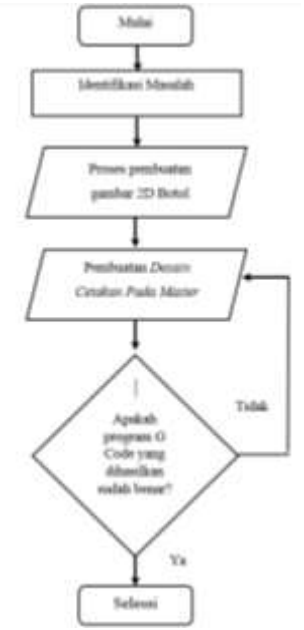

Figure Research Flow Diagram

Mold Design Steps

The design and simulation of making this packaging bottle mold using Mastercam X5 to produce G-Code is explained in several stages:

Figure Packaging Bottles

The process of creating 2D drawings using AutoCAD

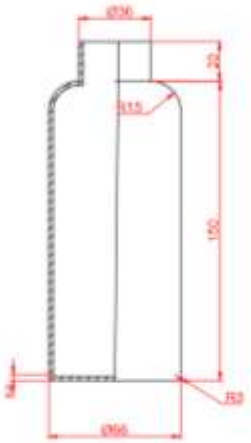

Figure Dimensions of packaging bottles

Results of the simulation process for the pocket section.

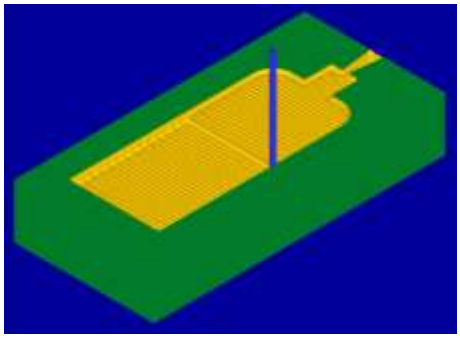

Figure Mold Simulation Process

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Drilling Process
Select Toolpath, then select the drill command, the drill diameter used is 10 mm. In the Cut Parameters section, select the dwell command, fill in 2. Next, select the linking parameter command, fill in the data as in the table below, when finished, select the green check button.[4]

machining process path to make molds.

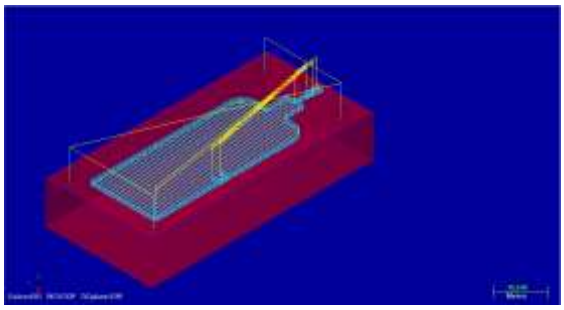
Figure Tool Path in Mold Making

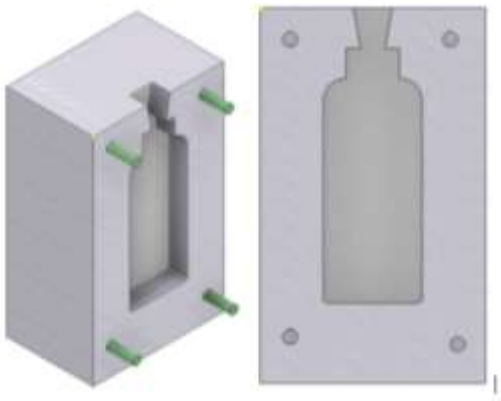
Figure Mold after completion of manufacture and assembly

Conclusion
Plastic currently has an important role in the manufacturing industry, many products use plastic raw materials as an alternative in terms of quality and quantity. One product that uses plastic raw materials is packaging bottles for drinks or for storing other materials for long periods of time. The process of making packaging bottles can use the blow molding process, namely a press molding process that uses air blowing into the mold cavity with a certain pressure so that the product shape conforms to the shape of the mold. The mold making process has now progressed by using CNC machines to obtain good quality of the products made. The process of making molds using a CNC program requires quite high precision, so the Mastercam x5 program is used to get the G-Code that will be used on the CNC machine. The research carried out was to simulate the process of making packaging bottle molds using aluminum molding material with a design using Inventor.

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