



CVT Piece Slide Molding Using Injection Molding Hand Press

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Abstract. The purpose of this study is to develop automotive frictional parts, especially continuously variable transmission (CVT) blocks by using a composite material using injection molding. CVT is made using handpress injection molding, using PPHI as the matrix and nature (pineapple and hemp) as reinforcement. This CVT slide piece mold has several stages of work, starting from designing the molding process with Solidwork software, after that making a program from design using Mastercam software, finally doing the machining process with CNC and EDM machines. The assembly process is carried out from parts that have been previously machined. The results of this study are CVT mold have good repeatability, with P1 8.9 mm, P2 13.52 mm, P3 8.4 mm, P4 3.2 mm, P5 6.15 mm, and P6 7.62 mm.

Keywords: composite, automotive, slide piece, PPHI, fiber

INTRODUCTION

Currently, automatic motorcycles are suitable for use because there is no need to change gears because they are set automatically [1], [2]. This type of motorbike is very easy to use as a means of daily transportation or a racing motorbike [3]. This automatic scooter uses a CVT (Continuously Variable Transmission) transmission [2], [4], by using the basic principle of the centrifugal force received from the roller against the primary pressing cap of the pulley, so that the slide piece serves to prevent the puller primary pressing cover from being separated from its path due to the radial force of the roller [5]–[7]. Therefore, research is needed regarding the frequent replacement of slide pieces on automatic motorcycles, therefore the selection of materials is chosen with tougher materials, which can better withstand substances that can interfere with the performance of the slide pieces such as oil, dust, and others [8], [9]. Good mechanical properties, physical properties [10]–[13], thermal [14], [15]and processability [16]are needed in determining components.

With these advantages, natural fiber-reinforced polymer composites are renewable materials [17]. Material development is carried out using technology that utilizes natural fiber reinforced polymer composite materials [18], [19]. Natural fibrous composite materials can be made using the Injection Molding Hand Press method, namely by filling the Polypropylene High Impact (PPHI) mixture with natural fiber reinforcement with a volume fraction of 10%.





RESEARCH METHODS

A. Production planning process

The production planning process from the components that are made and the components that are already available can be seen in the following Table 1:

No	Component	Raw	Process
		Material	
1	Mold	Aluminium 7075 T7	Machining CNC & Machining EDM
2	Slide Piece	Composite (PPHI + nature fiber)	Injection Molding
3	Cavity Plat	Aluminium 7075 T7	Machining CNC & Machining EDM
4	Core Plat	Aluminium 7075 T7	Machining CNC
5	Base Plat	Aluminium 7075 T7	Machining CNC
6	Wall Plat	Aluminium 7075 T7	Machining







B. Machining Process Parameters

The machining process parameters, in Fig 1 are needed to produce the desired production results with production time efficiency, the machining parameters are cutting speed, feeding speed, cutting depth, cutting time.





					OPERATION			
NO	PROCESS	COMPONENT	TOOLS					TIME
				TLNO	Z	FEED	OPERATION DESCRIPTION	(MINUTE)
		Cavity Plate	Face mill dia. 25 mm	T01	38	1018	rounding facemill	13.44
			endmill dia. 16 mm	T02	6	1018	corner rounding facemill 1	4.03
			endmill dia. 8 mm	T03	5	414	corner rounding facemill 2	0.80
1			endmill dia. 2 mm	T04	25	350	corner rounding facemill 3	14.20
T			bore dia. 8 mm	T05	4	200	tooling hole	0.26
			bore dia. 6 mm	T06	4	200	tooling hole	0.43
	2 avic CNC		bore dia. 5 mm	T07	4	200	tooling hole	0.23
	Machino		bore dia. 2 mm	T08	4	100	tooling hole	2.47
2	Machine	EDM Electrode	endmill dia. 2 mm	T09	50	350	corner rounding endmill 1	10.00
		Core Plate	endmill dia. 10 mm	T01	150	1018	corner rounding endmill 1	24.30
	3		bore dia. 2 mm	T02	6	100	tooling hole	1.23
2			bore dia. 10 mm	T03	4	200	tooling hole	0.26
5			bore dia. 5 mm	T04	4	200	tooling hole	0.23
			endmill dia. 16 mm	T05	6	1018	corner rounding endmill 2	4.03
			bore dia. 8 mm	T06	1	200	tooling hole	0.11
			TOTAL PROCESS	TIME				76.01

FIGURE 1. Process Worksheet

C. Mold Making Process

This mold is made of aluminium alloy with 7075 T7351 series, detail seen on table II.

No	Figure	Description
1		The length is 150 mm, the width is 150 mm and the thickness of each cavity plate and core plate is 20 mm.
2		leveling the surface of the raw material using a face mill chisel, at this stage the process is carried out on the cavity plate
3		Contour making in the cavity mold is to use an endmill chisel measuring 2 mm and an endmill chisel measuring 8 mm

TABLE I. Mold Making Process







D. Test Function

After the components of this mold have been made and assembled, the next step is the process of making slide piece components, in the process of making these components using natural fiber and PPHI compositions, shown on table III.



TABLE 3. Function Test











RESULT AND DISCUSSION

The materials used in this research are PPHI and natural fibers. The composition used in the composite is 10% natural fiber, namely pineapple fiber and hemp fiber. slide piece dimensions measurements are shown in Fig 2.



FIGURE 2. Slide Piece Measurement

The results of the Injection process for the mold in the cavity are compared to each component, each sample with a different natural fiber composition is measured to determine the difference in size of the component, as a position parameter for measuring the slide piece, it can be seen in TABLE IV and TABLE V.

TABLE 4 . Slide Piece Dimension Using Hemp Fiber						
	Original (mm)	Hemp Mesh 120				
Position		Cavity 1	Cavity 2	Cavity 3		
		(mm)	(mm)	(mm)		
P 1	8.70	8.90	8.90	8.90		
P 2	8.70	8.90	8.90	8.90		
P 3	8.70	8.90	8.90	8.90		
P 4	8.70	8.90	8.90	8.90		
P 5	8.70	8.90	8.90	8.90		
P 6	8.70	8.90	8.90	8.90		

TABLE 5 . Slide Piece Dimension Using Pinneaple Fiber					
	Original	Pineapple Mesh 120			
Position	(mm)	Cavity 1	Cavity 2	Cavity 3	
(mm)	()	(mm)	(mm)	(mm)	
P 1	8.70	8.90	8.90	8.90	
P 2	8.70	8.90	8.90	8.90	
P 3	8.70	8.90	8.90	8.90	
P 4	8.70	8.90	8.90	8.90	
P 5	8.70	8.90	8.90	8.90	





	Original	Pineapple Mesh 120			
Position	(mm)	Cavity 1 (mm)	Cavity 2 (mm)	Cavity 3 (mm)	
P 6	8.70	8.90	8.90	8.90	

The results of the cavity measurement on the slide piece mold, the value is uniform. These results show that the repeatability of the system is good.

CONCLUSION

The total operating time needed to make slide piece molds is 76 minutes. The material used is Al7075 T7, consisting of three cavities. Molds can be used for different fibres types. The assembly process is carried out from parts that have been previously machined. The results of this study are CVT mold have good repeatability, with P1 8.9 mm, P2 13.52 mm, P3 8.4 mm, P4 3.2 mm, P5 6.15 mm, and P6 7.62 mm.

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