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Study On Machining Ability Of Polymer Composites

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Abstract - *The main objective of work is to examine the machinability of the natural fiber, polymer fiber and hybrid that is mixture of natural and polymer fiber at 0 degee orientation and also to perform stability test for the same material. Jute and glass fiber are the natural fibers utilized in this. Research raw substance Selection Selection of resin and hardener Fabrication choosing a fabrication method selection procedure for hand layout preparation for testing the sandwich cure Size Standard for Tensile Flexural Machinability Testing Building Analysis Results from a scanning electron microscope for drilling operation.*

Key Words: **Machining ability, composites, Heat dissipation, Manufacturing, fabrication, ASTM, Standards**

1.INTRODUCTION

A composite material is one that is created by combining two or more different materials, each of which has unique physical and chemical properties. Due to its low weight and affordable price, natural fibre has been taken into consideration in this article. Composites' initial phase is referred to as a matrix with a continuous character. This type of matrix material binds well, and the fibres have the desired ability to position themselves by transmitting loads to reinforcement.

The parallelism and perpendicularity of test specimens must adhere to rigorous ASTM criteria. This necessitates extremely exact machining. Cutting the samples to almost net form and then using a surface grinder to create the final specimen geometry is the simplest technique to attain high precision

1.1 Classification of Composites

Improvements are made to manufacturing processes, composite materials, and material science. Composites are versatile materials with unexpected mechanical properties that can be changed to suit the requirements of a particular application. Some composites provide exceptional defence against the worst conditions, including heat, oxidation, composition changes, and wear resistance. With the use of these varied properties, an architect can create structures with prospective results that are not achievable with common metals and materials. For applications that work well with solid materials, composites innovation also leverages a variety of laminate orientations.

About the optimum method for drilling composite test specimens, we are frequently questioned. Since composite materials are typically not included in machining handbooks, it is impossible to search up the appropriate cutting equipment or feed rates. Due to a lack of knowledge, composites machining can be somewhat of a dark art.

1.2 Machining ability

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Table -1 Properties of Resin and hardner

Properties	LY556	HY951
Viscosity@25° c	10,000-12,000mPa	10-20 mPa s
Density at 25° c	1.15-1.20 gm/cc	0.97-99 gm/cc
Flash point	>200 °C	>180 °C
Tensile strength	83-87 N/mm^2	65-71 N/mm^2

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2. OBJECTIVES OF WORK

The main objective of work is to examine the machinability of the natural fiber, polymer fiber and hybrid that is mixture of natural and polymer fiber at 0 degee orientation and also to perform stability test for the same material. The natural fiber used here is jute and glass fiber.

Based on the applications of design and development on necessary mechanical property, jute woven mats are stacked on top of each other and joined with epoxy resin to create laminated composites for usage in household and automotive equipment. According to a literature review, several researchers created sandwiched hybrid composites using the

same material and random chopped fibre. They discovered the properties that they had got, thus I suppose that some variations in fibre orientation had not been investigated by them. Therefore, I set out to expand the number of fibres with diverse orientations. This work proposal examines the mechanical qualities throughout.

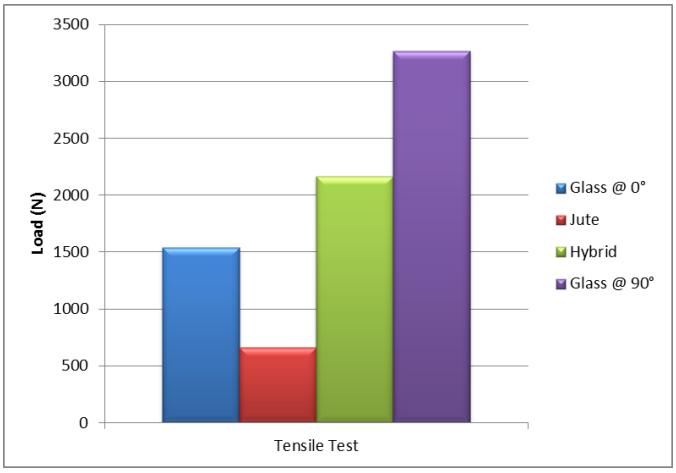

Chart -1: Tensile test result

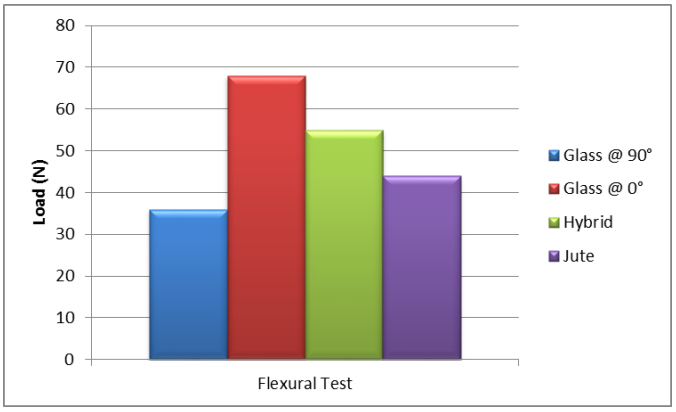

Chart -2: Flexural test result

Machining ability Typically, when machining metals, the waste material chips away, but with composites there isn't so much of a chipping effect, as a shattering process. Rather than shearing the material away, the impact of the cutting tool edge fractures the carbon fibers. Because the material doesn't chip away and due to the low thermal conductivity of composite materials, there are significant difficulties in dissipating heat when machining, leading to high local temperatures. This can lead to local damage and distortion of the composite as the matrix melts. With this in mind, it is highly recommended that machining operations are water cooled. Alongside the heat dissipation benefits, the water prevents the fine carbon fiber dust becoming airborne and the associated health effects that would bring. Machining ability deals with the core concerns of tools, damage risk, and important aspects of the machinability of polymer matrix. It is suggested that the development of a series of router milling tools for the high-performance milling of Carbon Fiber Reinforced Plastics (CFRP) is a simple application of general principles. The new milling tools are formed by numerous left- and right-hand helical edges that produce minute pyramidal edges along the cutting length. Different substrates and coatings were used for the tests. The ultimate result of the analysis of testing and adjustments on tool prototypes was a series of routing end mills optimised for carbon fibre composites, detailing the impact of each milling tool feature on tool performance.

The first machining ability of composite material of glass fiber was tried and smoothnees of the material was sandwiched. The grinding wheel used is Very fine grit and grain size is 240size.

Fig -1 Grinding of Glass fiber

Shows the half-frounded shape on the jute material which is composed sandwich from handle a process and the curvature observed is done using half round file. Filing is the widely used cutting tool operation in the work shops it is the hard and piece of high grade Steel with slanting row of teeths it is generally used to cut smooth fit metal parts. Generally classifide by the shape & by the type.

Fig -2 Milling of glass fiber

Similar to drilling, milling is a machine-in-process in which the tool removes material in a rotary motion. Because of the high rotational speed of milling, which results in higher accuracy and surface finish of the machined particles, a wide variety of tools with various diameters and hardnesses can be used in this operation.

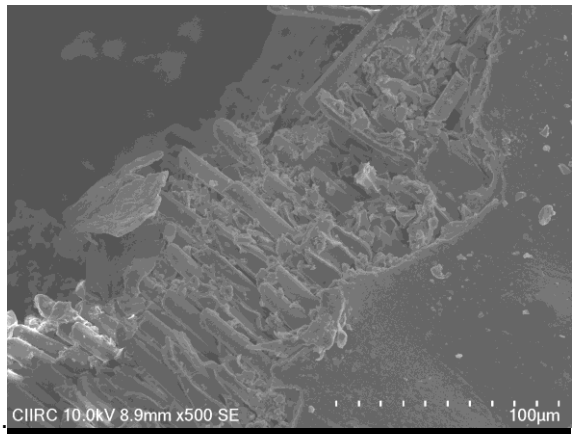

Fig -3: Glass and jute fiber and hybrid Drilled hole in SEM

Fig-1 shows the grain structure of hybrid fiber at cutting edge of the specimen when it has undergone drilling operation and grain of fibers are observed as damaged. Since in Hybrid Jute and glass fibers are alternately arranged this observed at 500x.

Fig -4: Glass fiber, jute fiber and hybrid Drilled hole

Hole in the left shows signs of delamination. Centre hole shows splintering/fraying of jute fibre. Hole on the right is an example of a good quality hole.

Heat Dissipation: When cutting metals, the waste material often chips away, but when cutting composites, the process is more like shattering than chipping. The impact of the cutting tool edge fractures the carbon fibers rather than shearing the material away. Due to the inability of the material to chip away and the limited thermal conductivity of composite materials, it is very difficult to remove heat during machining, which raises local temperatures. As the matrix melts, this may cause localised damage and deformation to the composite. In light of this, it is strongly advised that machining operations be water cooled. The water also helps to dissipate heat while preventing airborne fine carbon fiber dust and the negative health impacts that would result from that.

Additionally, it might be challenging to stop breakout where the drill bit enters and leaves the laminate. It is important to remember that drilling holes in unidirectional laminates might lead to longitudinal splitting. Better exit quality is often produced by a decreased drill tip angle. A tool's edge strength may suffer from a point angle that is too tiny, though. A point angle of 90 degrees seems to be the ideal compromise for CFRP. The composites drill is "pointier" in comparison, with a point angle of 135 degrees being more normal when drilling metal.

Increasing the feed rate can frequently lessen entry flaws, but it also runs the risk of making exit defects worse. The ideal feed rate strikes a balance between quality on the entrance and exit sides. Use of a sacrifice piece of composite material above and below the laminate that needs a hole drilled in it is one of the solutions we at R-TECH have devised. As a result, the sacrificial samples have both entry and exit flaws. To prevent further harm to the composite samples, it is crucial to employ coolant throughout the drilling operation, much like with machining.

3. CONCLUSIONS

This leads to the conclusion that the peak load of 2.1 KN for tensile stress has grown by three times its original value when it is hybrid, and for flexural test the strength has improved by five percent. Flexibility, strength, and other properties will alter under high heat dissipation machining.

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