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Design and Analysis of A5 Rocket Adaptor Using ALS

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***Abstract*— To improve the stiffness and strength of the adaptor used in rockets various tests were conducted and the results were noted. In the previous cases the prototype were built, but still the stiffness was still 10% low and also the cost to build the prototype was very high. They planned to create the next prototype with higher stiffness to meet the final requirements. 3 point bending test was conducted to check the bending strength and also the bending stiffness of the sandwich beam, tensile test was conducted to test the material as well as the mechanical properties of the specimen, and the final test was the impact test. Also the adaptor was designed using CATIA software and analyzed using ANSYS 12.0. FEM analysis were used to evaluate stiffness matrix results.**

Keywords: Aluminium Sandwich Structure, Payload Adaptors, A5 Rocket Adaptors, Impact Response of ALS

I. INTRODUCTION

The European A5 rocket uses two cone-shaped adaptors to support the payload. At present they are made of al-honeycomb sandwich structures and cost for processing is very high. This paper shows how the certain tests and analysis helps to give good results by this EN-AW 7075 and Jute fiber combination. [1]

II. WROUGHT ALLOYS AND TEMPERS

There are two categories of aluminium alloys for structural applications: wrought alloys and another one iscasting alloys. The most important alloy used for aerospace applications are the wrought alloys, represented as EN-AW.[2-3] Following are the series of alloys for structural applications The 1xxx series for pure aluminium and the 2xxx series which are ignored.

The group of wrought alloys can be further divided into anon heat-treatable and heat-treatable alloys. The 3xxx and 5xxx series were non heat-treatable alloys, and the 6xxx and 7xxx series are heat-treatable one. The 8xxx series can be treated as both non heat-treatable and heat-treatable alloys. The non heat-treatable alloys gain their strength from a combination of alloying and cold-deformation, so-called work-hardening.[3] The heat-treatable alloys gain their strength from alloying and precipitation hardening.

III. PROPERTIES OF JUTE FIBER

That favors moderately high specific strength and stiffness also it is high performance composite which has higher tensile strength. Developed with different thermoplastic and thermoset polymers such as jute reinforce polyester, epoxy composite and jute reinforced polypropylene.

High in mechanical properties The percentage of fiber volume affects the composite mechanical properties such as tensile, strain.[17]

IV. APPLICATION OF JUTE FIBER

Give advance in strength, lightweight and noise absorption commercially important in the automotive and building industry, i.e roofing.

Table 1.CONFIGURATION

EXISTING		NEW	
Face Sheet	ENAW 6060	Face Sheet	ENAW 7075
Foam	AlSi6Cu10	SandwichCore	Natural fiber
Overall thickness	25mm	Resin	Polyamidoamine/Mercaptane with Quick Set Epoxy
cover layers thickness	1.5mm		

Table 2.Mechanical Properties of Jute Fiber:

Fibers	Modulus (GPa)	Strength (MPa)	Density (g/cm^3)	Specific Modulus	Specific Strength
Jute	20-55	200-500	1.3-1.5	~27	~250

Table 3.Mechanical Properties of Face Sheets:

Alloy´s Character

Alloy	EN AW 7075
Type of Alloy	heat treatable

Table 4.Properties**:**

Yield strength [MPa]	220 – 460
Ultimate tensile strength [MPa]	360 – 540
Elongation [%]	1 – 6
Hardness HBW [2,5/62,5]	104 – 160

Table 5.Mechanical Properties of Resin:

Glass transition temperature (Tg)	120 - 130 °C
Tensile strength	85 N/mm²
Tensile Modulus	10,500 N/mm²
Elongation at break	0.8%
Flexural strength	112 N/mm²
Flexural Modulus	10,000 N/mm²
Compressive Strength	190 N/mm²
Coefficient of linear thermal expansion	34 10-6
Water absorption - 24 hours at 23°C	5-10 mg (0.06-0.068%) ISO62(1980)

Figure 1.EN-AW 7075 (Al plate)

Figure2.Sandwich Structure

Testing Machines

Figure 3. Machine used for Bending Test

Figure 4.Machine used for tensile test

Figure 6.Specimen after bending test

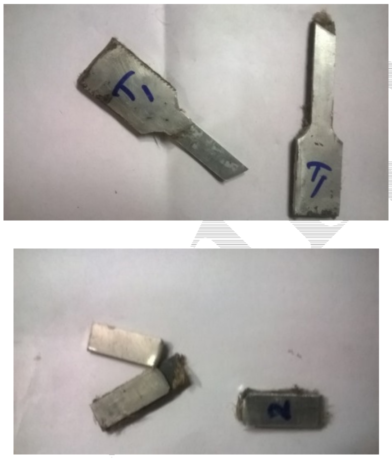
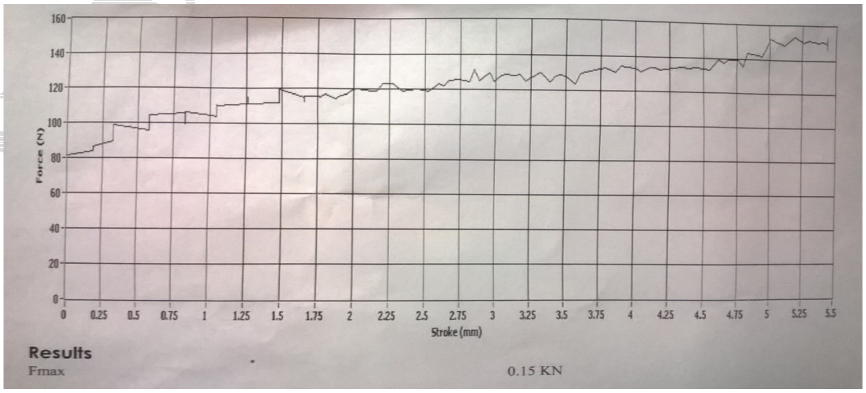
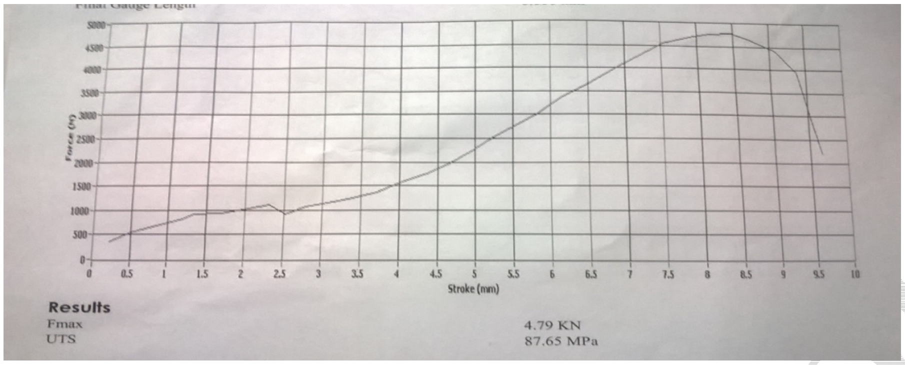


Figure 6. Specimen after Impact test



Results
Fmax 0.15 KN

Graph shows the result taken after bending test



Results

Fmax	4.79 KN
UTS	87.65 MPa

Graph shows the result taken after bending test

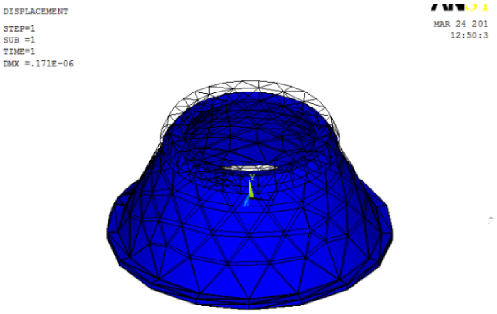
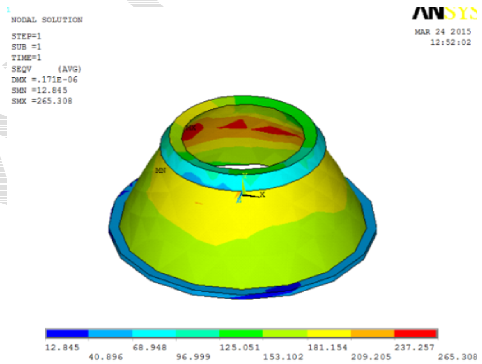


Figure 7.Displacement



Test Results:

Equipment Used	-	UTM
Tensile Strength in Mpa	-	87.65
Flexural Load in KN	-	0.15
Impact Values in Joules	-	6,8

V. CONCLUSION

In this project work more than fifty journals related to ALS, Sandwich structures, AF and Space applications were discussed. The ALS specimen is tested in UTM machineand shows bending results, tensile results and impact testing results in certain manner. Finally it shows the better stiffness and also process well suitable for cost reduction purposes. Previous prototype has tensile strength of 61.26 (Mpa). By using ANSYS software stress and deflection are analyzed.

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