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Design, Analysis And Fabrication Of Connecting Rod and its Charecterization With Graphite-Granite Particles Reinforced A 7075 Hybrid Metal Matrix Composites

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Abstract: **Connecting rod is a structural member in the engine, which transfers reciprocating motion into rotary motion of crank shaft. The Connecting Rod is designed according to the specifications. After the designing, the model is subjected to certain conditions. According to the conditions we have checked the stresses acting on it and checked the failures of the model. After the analyzing the changes are done to the model if required. In the analysis a model of Connecting Rod is generated using CATIA software. The finite element model is generated using Ansys. It is applied with loads and boundary conditions.Granite powder emerges as the major waste material during cutting of granite stones which consists a major amount of AL_2O_3.It is generally agreed that resistance to wear of MMCs is created by reinforcement and also the wear properties are improved remarkably by introducing hard intermetallic compound into the aluminum matrix. The reinforcing materials are generally SiC, Al_2O_3 etc and are costly. The present research work has been undertaken with an objective to explore the use of granite powder and graphite as a reinforcing material as a low-cost option. This is due to the fact that granite alone contains all these reinforcement elements and is plentifully available. Experiments have been conducted under laboratory condition to assess the mechanical characteristics of the aluminium blast furnace slag composite under different size particle conditions. This has been possible by fabricating the samples through usual stir casting technique. To enhance the mechanical properties the surfaces of the samples were studied under optical microscope to get an idea about the effect of particulate reinforcement on the micro structure behavior of the composite. Dispersion of granite and graphite particles in aluminium matrix improves the hardness of the matrix material and also the mechanical behaviour of the composite.**

I. INTRODUCTION

The connecting rod is the intermediate member between the piston and the crankshaft. Its primary function is to transmit the push and pull from the piston pin to the crankpin and thus convert the reciprocating motion of the piston into the rotary motion of the crank. The usual form of the connecting rod in internal combustion engines is shown in Fig. 32.9. It consists of a long shank, a small end and a big end. The cross-section of the shank may be rectangular, circular, tubular, *I*-section or *H*-section. Generally circular section is used for low speed engines while *I*-section is preferred for high speed engines.

II. LITERATURE

S. Luo and A.N. Netravali [1] studied the tensile and flexural properties of the green composites with different pineapple fiber content and compared with the virgin resin. H. Belmares, A. Barrera, and M. Monjaras [2] found that sisal, henequen and palm fiber have very similar physical, chemical, and tensile properties. M. Cazaurang, P. Herrera, I. Gonzalez, and V.M. Aguilar [3] carried out a systematic study on the properties of henequen fiber and pointed out that these fibers have mechanical properties that are suitable for reinforcing thermoplastic resins. E.M. Ahmed, B. Sahari, and P. Pedersen [4] carried out research work on filament wound cotton fiber reinforced for reinforcing high density polyethylene (HDPE) resin. A.A. Khalid, B. Sahari, and Y.A. Khalid [5] studied the use of cotton fiberreinforced epoxy composites along with glass fiber reinforced polymers. M.Y.A. Fuad, S. Rahmad, and M.R.N., Azlan [6] investigated the new type wood-based filler derived from oil palm wood flour (OPWF) for bio-based thermoplastics composites by thermo- gravimetric analysis and the results are very promising.S.M. Sapuan, M. Harimi and M. A. Maleque [7] presented the tensile and flexural properties of composites made from coconut shell filler particles and epoxy resin. The tensile and flexural tests of composites based on coconut shell filler particles at three different filler contents viz. 5%, 10%, and 15% were done. J. Sarki, S.B. Hassan, V.S.

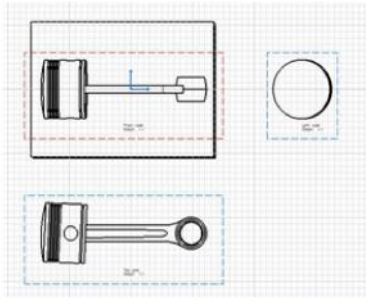
Aigbodion, J.E. Oghenevweta [8] studied coconut shell filled composites which were prepared from epoxy polymer matrix containing up to 30 wt% coconut shell fillers. The effects of coconut shell particle content on the mechanical properties of the composites were investigated. P.BMadakson, D.S.Yawas and A. Apasi [9] concluded that the coconut shell ash can withstand a temperature of up to 5 ˚ with a density of 2. 5g/cm³. That means this ash can be use in production light weight MMCs component with good thermal resistance. B. Ramaraj, P. Poomalai [10] studied the Poly (vinyl alcohol) (PVA) composites with 10, 20, 33, and 55 wt % of coconut shell (CCS) powder and it was observed that the introduction of CCS powder varies the tensile strength and affects percentage of elongation, tear and burst strengths, moisture content, density, and swelling capacity

III. FABRICATION

In the present investigation, aluminium based hybrid metal matrix composites containing granite graphite particulates of 106 µm were successfully synthesized by vortex method. The matrix materials used in this study was Al-Zn alloy (A7075) whose chemical composition was shown in table 1. The synthesis of these composites was carried out by stir casting technique. The alloy was taken into a graphite crucible and melted in an electric furnace. After maintaining the temperature at 770 °C, a vortex was created using mechanical stirrer made of graphite. While stirring was in progress, the preheated particulates granite graphite at 300^0C for 2 hrs were introduced into the melt. Care has been taken to ensure continuous and smooth flow of the particles addition in the vortex. The molten metal was stirred at 800 rpm under argon gas cover. The stirring was continued for about 2 minutes after addition of particles for uniform distribution in the melt. Still, the melt with reinforcement was in stirring condition the same was poured into sand casting mould.

IV. MODELLING AND ANALYSIS

Using modeling, you can design a complete, unambiguous, three-dimensional model to describe an object. You can extract a wide range of physical properties from the solid bodies, including mass properties. Shading and hidden line capabilities help you visualize complex assemblies. You can identify interferences automatically, eliminating the need to attempt to do so manually. Hidden edge views can later be generated and placed on drawings. Fully associative dimensioned drawings can be created from solid models using the appropriate options of the Drafting application. If the solid model is edited later, the drawing and dimensions are updated automatically. The Drafting application is designed to allow you to create and maintain a variety of drawings made from models generated from within the Modeling application. Drawings created in the Drafting application are fully associative to the model. Any changes made to the model are automatically reflected in the drawing. This associativity allows you to make as many model changes as you wish. Besides the powerful associativity functionality



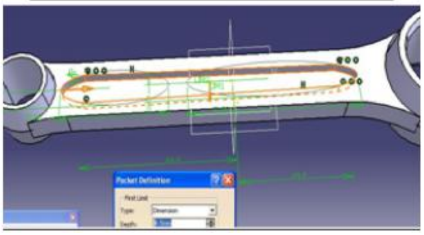


Figure 1Isometric view in CATIA

V. BOUNDARY CONDITIONS

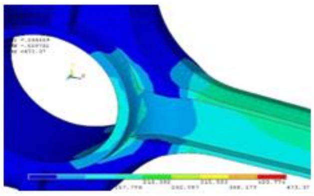
The crank and piston pin ends are assumed to have a sinusoidal distributed loading over the contact surface area, under tensile loading. This is based on experimental results. In this study four finite element models were analyzed. FEA for both tensile and compressive loads were conducted. Two cases were analyzed for each case, one with load applied at the crank end and restrained at the piston pin end, and the other with load applied at the piston pin end and restrained at the crank end. In the analysis carried out, the axial load was 26.7 kN (6 kips) in both tension and compression

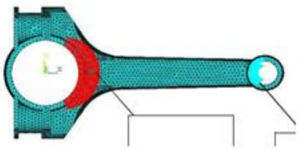
Material Property	unit	Scalar value
Modulus of Elasticity	Gpa	206.7
Poisson's Ratio	Unit less	0.30
Mass Density	Kg/m³	7820

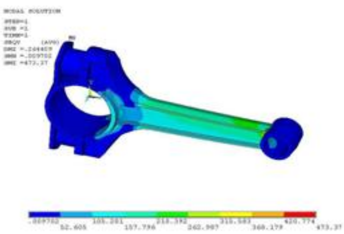
Tensile Load = 26.7kN			Compressive Load = 26.7 kN		
CrankLoad		%Diff	CrankLoad		%Diff
VonMises	VonMises		VonMises	VonMises	
Stress (Mpa)	Stress (Mpa)		Stress (Mpa)	Stress (Mpa)	
196.5	192.9	1.8	197.1	197.3	-0.1
205.0	199.4	2.7	202.9	202.0	0.4
196.5	192.9	1.8	197.1	197.3	-0.1

VI. ANALYSIS OF CONNECTING ROD

STRUCTURAL ANALYSIS







LOAD CALCULATIONS:

Inertia force on small end of connecting rod small end, $F = mr^2(\cos + \cos 2\ /n)$

Assuming is very small$F = mr^2(1+1/n)$Mass of connecting rod at piston pin ={ (mass of conrod) - (mass of conrod)*(L-L1)/L}

$n = L / r$

The values for our case are:

L = 4.667"r = 1.375"

Mass of piston assembly = 0.59937 lb, Mass of piston = 0.39436 lb

Mass of connecting rod = 0.2915 lb. Distance from mass center of conrod to big end bearing, L1 = 1.582"= Angular speed = 419 rad/sec

VII. CONCLUSIONS

In the present investigation, aluminium based hybrid metal matrix composites containing granite graphite particulates of 106 µm were successfully synthesized by vortex method.The crank and piston pin ends are assumed to have a sinusoidal distributed loading over the contact surface area, under tensile loading. This is based on experimental results. In this study four finite element models were analysed.The connecting rod was modelled in CATIA software and analysis is done in Ansys

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