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Experimental Investigation of LM24/GR/B_4C Hybrid Composite for Piston Material

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***Abstract:** In engine, piston is an important element which is considered as the main working part. So it is important to be technical in selecting materials which are used to manufacture a piston. As it the main working part in the engine, automatically it will be subjected to more damage which depends upon the usage of the engine. Commonly the pistons are made up of aluminium alloys, because of its enormous strength and for other mechanical properties. In this project aluminium alloy is replaced with the composite of Aluminium (Lm25), Boron carbide (b4C) and Graphite (G). These hybrid composites are formed using stir casting method in three different ratios. All the three specimens with different ratios are subjected to tensile, hardness and wear tests. The observed values are tabulated and represented graphically. Those values are analysed and determined that the formed hybrid composite material is suitable for the manufacturing of piston rod.*
***Keyword:** LM24; Graphite; Boron Carbide; Piston Material; Composite*

I. INTRODUCTION

Engine pistons are one of the most complex components among all automotive and other industry field components. The engine can be called the heart of a vehicle and the piston may be considered the most important part of an engine. There are lots of research works proposing, for engine pistons, new geometries, materials and manufacturing techniques, and this evolution has undergone with a continuous improvement over the last decades and required thorough examination of the smallest details. Not with standing all these studies, there are a huge number of damaged pistons. Piston endures the cyclic gas pressure and the inertial forces at work, and this working condition may cause the fatigue damage of piston, such as piston side wear, piston head cracks and so on. To recover this problem, in this project the materials which are being used to manufacture piston has been changed. The material which is commonly used in manufacturing of piston is aluminum alloy. In this paper the aluminum alloy has replaced with the composite hybrid material which composite materials are the mixture or the combination of two or more constituents differing in form or material composition and that are essentially insoluble in each ther. All the constituents maintain their identity as they do not dissolve melt in each other, and act in such a way that a new material results whose properties are better than the sum of the constituents, contains aluminum (LM25), graphite powder and boron carbide powder. All these materials are mixed with different compositions, and three different composites were formed. Stir casting method is used to form the composites of different ratios, as it is the cheapest and easiest method to form aluminum composite.

II. LITERATURE REVIEW

Prem kumar et al:Connecting rod is one of the important components of the whole engine assembly as it acts as a mediator between piston assembly and crankshaft. Its converting the reciprocating motion of the piston to rotary motion of the crank. Also it faces a lot of tensile and compressive loads during its life time. Generally connecting rods are manufactured using carbon steel and in recent days aluminium alloys are finding its application in connecting rod. In this work connecting rod is replaced by aluminium based composite material reinforced with Boron carbide. Sivasankar et al: Al-Si alloys as a tribological component has been expanding widely in automobile, marine castings, cylinder block, piston for IC engine, etc. The composition of the Al-Si cast alloy assessed using spectro analysis. It is conformed as LM2 grade. After the conformation of Al-Si cast material are melted, and then cleaned and cast to make small size ingots. The mechanical properties and wear properties of these Al-Si alloys are vary on the heat treatment process. The hardness varies from 55.60HR15T to 60.40HR15T of before and after heat treatment respectively. The heat treatment process is also improving the tensile strength and wear resistance properties. Sathishwable et al: The automobile engine connecting rod is a high volume production and critical component. Connecting rod is the intermediate link between the piston and the crank. And is responsible to transmit the push and pull from the piston pin to crank pin, thus converting the reciprocating motion of the piston to rotary motion of the crank. Generally connecting rods are manufactured using carbon steel and in recent days aluminium alloys are finding its application in connecting rod. In automotive engines, the connecting rod is subjected to high cyclic loads.

These are represented by high compressive loads due to combustion, and high tensile loads due to the connecting rod mass of inertia. Shubhamtiwari et al: Connecting rod works as an intermediate link between piston and crankshaft. The function of connecting rod is to convert reciprocating motion into rotary motion. Since it is subjected to variable tensile and compressive load, it should be strong enough to bear that load. Manufacturing of connecting rod is one of the most important parameter that can affect the overall performance of connecting rod. Selection of connecting rod for good performance of engine is very difficult. Nanda kumar et al: The present study deals with the behavior of aluminium alloy based composites, reinforced with silicon carbide particles and solid lubricants such as graphite. The first one of the composites consists of Al. with Silicon Carbide particles (SiC) and graphite. The other composite is Al with Alumina and solid lubricant, Graphite at solid state. Both composites are fabricated through 'Stir Casting Method'. Mechanical properties of the samples are measured and validated. Suryanarayanan et al: It has been well established that advanced surface coatings on cutting tools improve wear resistance by modifying the contact conditions between the chips and tool interface. As a result of the recent developments in cutting tool industry, coated tools have made a significant contribution to the metal cutting operations in terms of tool life, cutting time and machining quality. The challenge of modern machining industries is focused mainly on the achievement of high quality, in terms of work piece dimensional accuracy, surface finish, high production rate, less wear on the cutting tools, economy of machining in terms of cost saving and increase the performance of the product. In general, the most important point in machining processes is the productivity, achieved by cutting the highest amount of material in the shortest period of time using tools with the longest life time. The present research work describes the development, Mechanical, Tribological performance of Nano material coating of AL, SIC, on Tungsten Carbide cutting tool. The Mechanical, Tribological properties of AL, SIC are to be compared with uncoated Tungsten carbide cutting tool. Neelimadevi et al: The chip formation in machining operations is commonly accomplished by a combination of several elements working together to complete the job. Among these components, cutting tool is the key element that serves in the front line of cutting action. Cutting action becomes a challenge when it comes to machining difficult-to-cut materials. Titanium and its alloys are among the most difficult-to-cut materials which are widely used in diverse industrial sectors. This chapter aims to provide a historical background and application of different cutting tools in machining industry with a main focus on the applicable cutting tools in machining silicon and aluminium alloys. Selection of appropriate tool material for a certain application is directly influenced by the characteristics of material to be machined. In this context, a brief overview of the metallurgy of titanium and its alloys is also presented. Recent progresses in tool materials, appropriate tools for cutting aluminium alloys, and their dominant wear mechanisms will also be covered in this chapter.

III. EXPERIMENTAL DETAILS

Using this method, three rods of length 300mm and 25mm diameter has been casted in three different ratios. And three plates whose dimensions are (100x100x10) mm are also formed. These plates and rods are subjected to tensile, hardness and wear tests in order to find out whether the composite formed has capability to manufacture a piston rod which should have properties to withstand the working conditions of the engine. The results of these tests have been analyzed and reported as the final report of this project.

IV. RESULT AND DISCUSSION

Aluminium metal matrix composites have been extensively used in many industrial applications due to their favorable properties such as high specific modulus, strength, hardness, low density, excellent wear resistance, low heat expansion coefficient and stability properties at elevated temperature Particulate reinforced LM25/Gr/B_4C hybrid metal matrix compositewere fabricated by the stir casting method. Wear properties and machining of LM25/Gr/B_4C hybrid metal matrix compositeare significantly changed by varying the amount of B_4C therein. The tensile strength of the LM25/Gr/B_4C hybrid metal matrix composite higher with comparison of LM25/B_4C metal matrix composite owing its presence of the soft graphite presences and the hardness of the LM25//B_4C metal matrix composite higher with comparison of LM25/Gr/B_4C hybrid metal matrix composite because owing its presence of the B_4C presences.

Table 1 Brinell hardness number of the composite

Sample No:	Hardness HRB
1	23.8
2	27.9
3	35.8

Table 2 Tensile strength of the composite

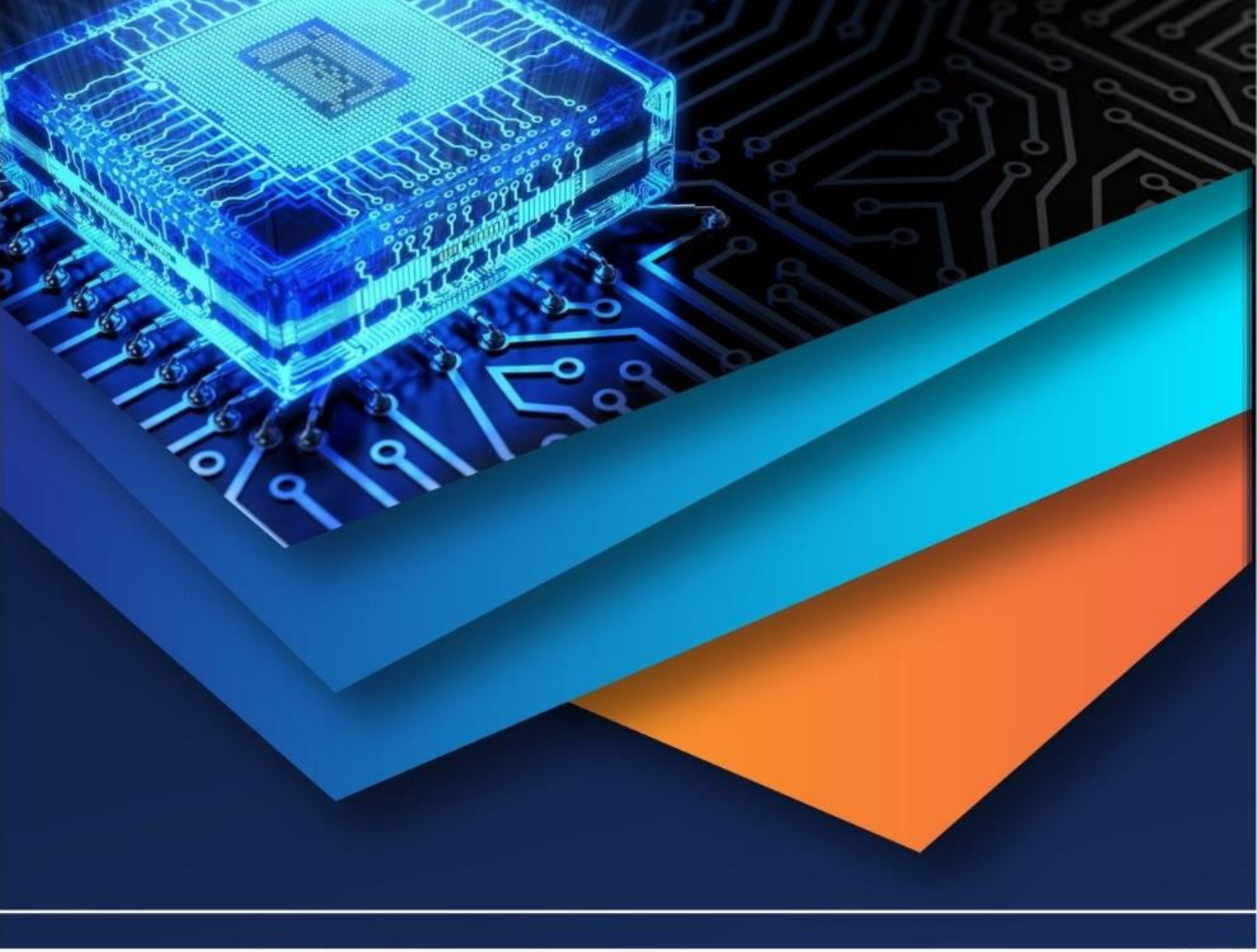
Sample No:	YS N/mm2	TS N/mm2	%E
1	13.01	105.14	2.50
2	17.09	115.21	1.88
3	28.04	128.16	2.88

V. CONCLUSION

The composites which contain Aluminium (LM25), Boron carbide powder and Graphite powder are formed using stir casting method. The formed composite materials are investigated by taking tests like tensile, hardness, wear tests in real time machines to analyse the properties of the material. The results are tabulated and reported. As per the report the form composition of hybrid composite is eligible and suitable for making of the piston.

REFERENCES

[1] A.Prem Kumar, "Design and Analysis of Connecting Rod by Composite Material".Ijrdo Journal of Mechanical and Civil Engineering ISSN: 2456-1479, Volume1, Issue 7, July -2015.
[2] R.Sivasankar, S.Maheshwaran, E.Hariharan, "characterization of mechanical properties and wear behaviour of aluminium-silicon piston alloy".SSRG International journal of mechanical engineering (SSRG-IJME)-Volume 3, Issue 1-Jan 2016
[3] ShubhamTiwari, Ajay Kumar Kaviti," Parameters Influencing Connecting Rod: A Review". ISSN: 2229-5518 International Journal of Scientific And Engineering Research, Volume 6, Issue 8, August - 2015.
[4] Sathishwable, Dattatray, Galhe, Rajkumar, L.Mangar," A Review on Design and Optimization Of Connecting Rod ". Ijariie-Issn: 2395-4396 International Journal of Innovative Science, Engineering & Technology, Volume 2, Issue 1, October 2016.
[5] Suryanarayanan,Praveen,RaghuRaman,"Silicon Carbide Reinforced Aluminium Metal Matrix Composites For Aerospace Application", International Journal Of Innovative Research In Science & Technology, Volume 2 , December 6- 2012.
[6] Neelimadevi,Mahesh,Selvaraj,"Mechanical Characterization of Aluminium Silicon Carbide Composite", International Journal of Applied Engineering Research, Volume1, November 4- 2011.
[7] Aqeelahamed, M.S.Wahab, A.A.Raus, K.Kamarudin, QadirBakhsh and Danish Ali, "mechanical properties, material and design of the automobile piston: an ample review", Indian journal of science and technology, Vol 9 (36) - Sep 2016.



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