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Influence of Nano Boron Carbide Reinforcement on Wear Behavior of ADC 12 and Al 7075 MMC

[1]Manas Ranjan Das, [2]Satya Ranjan Das, [3]Priyabrata Pattanaik

Abstract--- *The metal matrix aluminum composites are of great interest to researchers in metal industries; this is a result of the light weight of aluminum & extra properties of reinforcement. This study targets to manufacture aluminum 7075 and ADC 12 – boron carbide composite concentrated with various percentages of B4C. Both composites were added with false size B4C nanoparticles and wear properties were compared. The experimental study is done is with a Pin-on-Disc method with different loads applied, sliding velocity and slow sliding distance. This analysis can be used to replace the monolithic aluminum components which have high wear with the Matrix Metal Aluminum Composite with superior properties.*

Index Terms--- *Al-7075 alloy, metal matrix composite, ADC-12, B_4C, dry sliding wear*

I INTRODUCTION

Aluminum is lighter in weight, high strength, greater strength to weight ratio, good functionality, good resistance to rusting and recycling ability can be the best candidate for involvement in heavier materials (steel or copper) is used extensively in the car/automobile industry, but due to lesser wear resistance in addition to low seizures, aluminum is not directly used [1] [2] [3].

Because of these characteristics, the AMMC is frequently used in airplane, satellite, coastal, and missile applications. The most important commercial application so far is the MMC diesel engine piston produced by Toyota. This parallel/composite piston provides better protection equipment and a high temperature than all the iron products/merchandises that have been substituted. It is estimated that 300,000 of these pistons were manufactured and retailed in Japan each year. This development is very imperative as it exhibits that the MMCs are as a minimum not very costly for very expensive bid [4] [5].

At the identical time, in sense of economic background of AMC, the cost of this special reinforcement is especially similar to monolithic materials but with better features. Whilst AMCs may have higher manufacturing costs such as continuing reinforcement [6] [7].

Composites Matrix Metal Aluminum (AMMCs) became important because of the improved penetrating/tribological characteristics that replace largely monolithic comparisons in car applications, airfield and energy applications. Their stand for dressing with the strength & modulus qualities made them crucial for many

Department of Engineering, Siksha 'O' Anusandhan (Deemed to be University), Bhubaneswar,
manasdas@soa.ac.in, satyadas@soa.ac.in, priyabratapattanaik@soa.ac.in

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engineering situations, where slide communication is expected. Along with the work on wear & tear, the dry properties of aluminum have been extensively reviewed [8] [9].

And this study has come to a conclusion – boron carbide be situated thought to be a favorable reinforcement attributable to the low density (2.52 g / cm3), very high hardness, high strength and better chemical stability that makes it as a one of suitable rehabilitation and good substitute. To other fortifications like silicon carbide (SiC) & Aluminum (Al2O3) [10] [11].

By adding that SiC and Gr add to the Alloy9, it is best to use the alloy features of the Al359. The wear of the Al359-SiC composite is up to 1.5 m / s at 2000 m slipping distance. Extensive researches for the fluorescent composites. This effort is to manufacture AMMC's (Al-7075 and ADC-12) with particulate Boron carbide [12] [13].

II MATERIALS AND METHOD

Aluminum - 7075 and ADC-12 (also known as LM 2) with not the same percentages of reinforcement strength were made use of stir casting technique. These altars were chosen for the examination because they work in the automotive industry. The composite Al-7075 has a wide application in aerospace industries, rock climbing apparatus, & hand glider airframe. Similarly, ADC-12 is inclusive application in fabricating parts of the automobile.

The chances of wettability is reduced because of the low density of the Boron carbide, which can be used in stir casting technique to manufacture fine composite. Herein, mesh-400 type boron carbide is used for the experiment. The confirmation was also pre-emptied in an attempt to remove moisture or removable effects.

Due to a low density of Boron carbide, the stir casting procedure can produce smooth mild objects. The accessibility of boron carbide emissions in this test is of magnitude size - 400. The confirmation was also pre-emptied in an attempt to remove moisture or removable effects.

The examples given here are 2% and 3.5% of relative reinforcement by weight. This composition was chosen for both materials. The samples were stirred mechanically for 15 minutes using a combination of steel to achieve homogenous mixture. The temperature was the highest for the response of 850 degrees Celsius. After the samples of Metal Die were obtained, the samples were turned and reduced in pin form to the normal (10mm in diameter) diameter as presented in Figure 1 of the Pencil-based tribe-meter. Before considering pins for the experiment, the surface of the samples on corner used abrasive paper at levels 600 and then 1000 and 1500 to achieve a similar boundary for each sample. The trials were carried out in accordance with the ASTM G99-95a test rates for the movement of 960m sliding distance and the sliding speed guide - 2m / s with the 30N load applied.

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Figure 1. Pin Samples

III ABRASIVE WEAR

The cast was finished in cylindrical pins with a flat surface of diameter of 10mm. These pins were tested for wear by using a tribe-meter of discs under the dry slide movement. Prints of the pins were examined by using a linear variable differential transducer (LVDT) which is connected to the machine lever. The fixers take the procedure to connect to the disk. Equipping the surface of pins takes a minimal change throughout the price, thus removing the lever for a very short time. This displacement in lever arm perform as an input effort to LVDT for quantifying the individual wear.

The combination of tone between the pin symbols and the circulation doses was measured using friction sensors. The rubbing coordination was measured after regular intervals and was noted. The average of these values gives a fair approximation of a combination coordination.

Figure 2. Morphology of composite

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The image illustrated in Figure 2 is displaying the morphology of composite pins after the wear test was accompanied, the wear/rust tracks and the outer surface decimation is unmistakably noticeable in the image, the wear track experiential point out the abrasive wear mechanism. Due to high friction and temperature only oxide wear was seen.

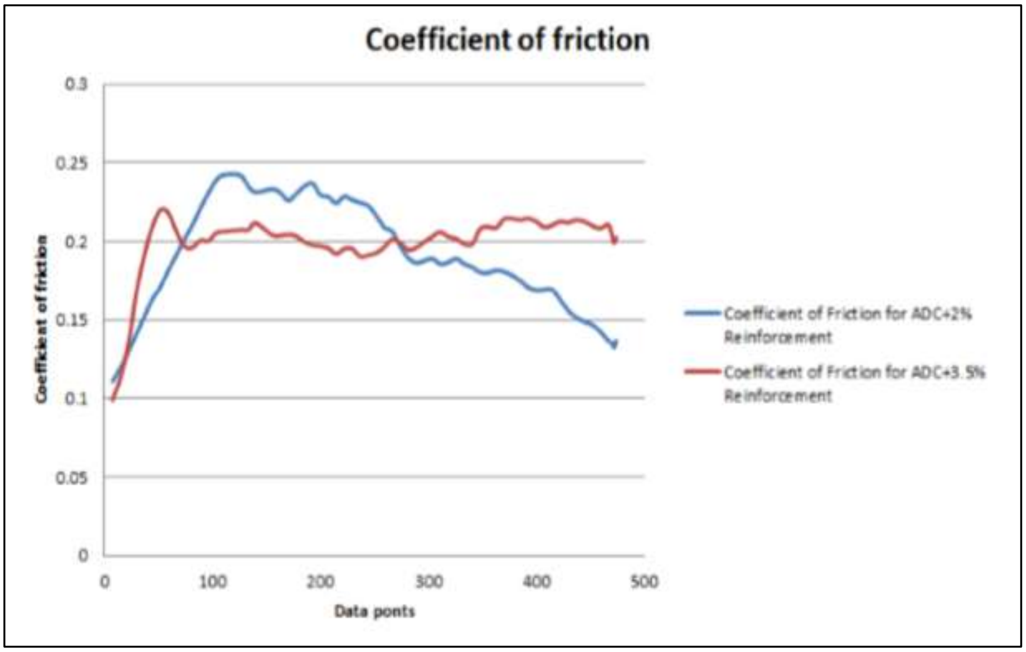

Figure 3. Co-efficient of friction for ADC-12

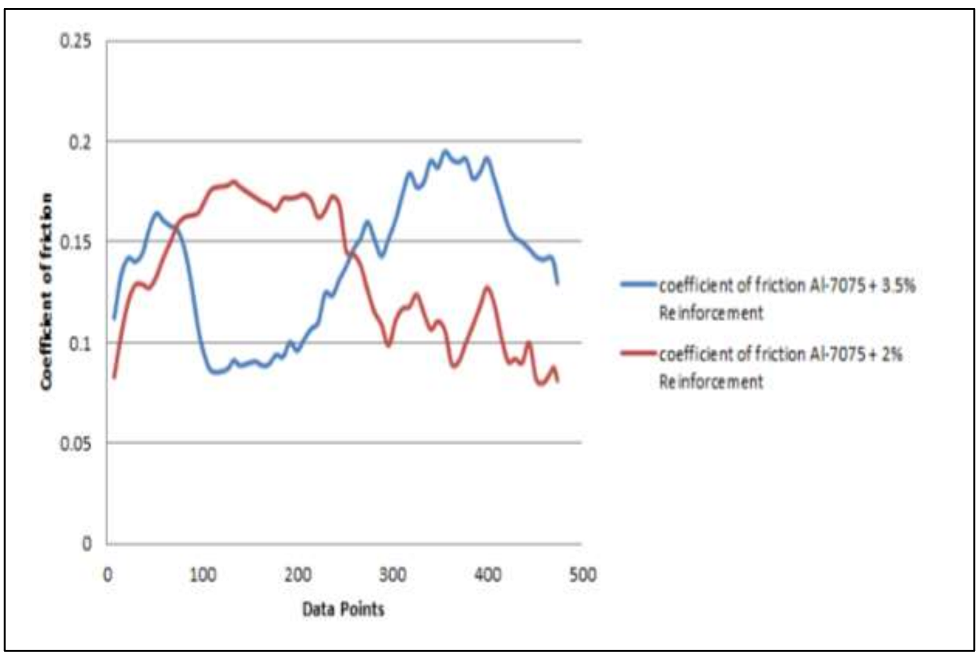

Figure 4. Co efficient of friction in Al-7075

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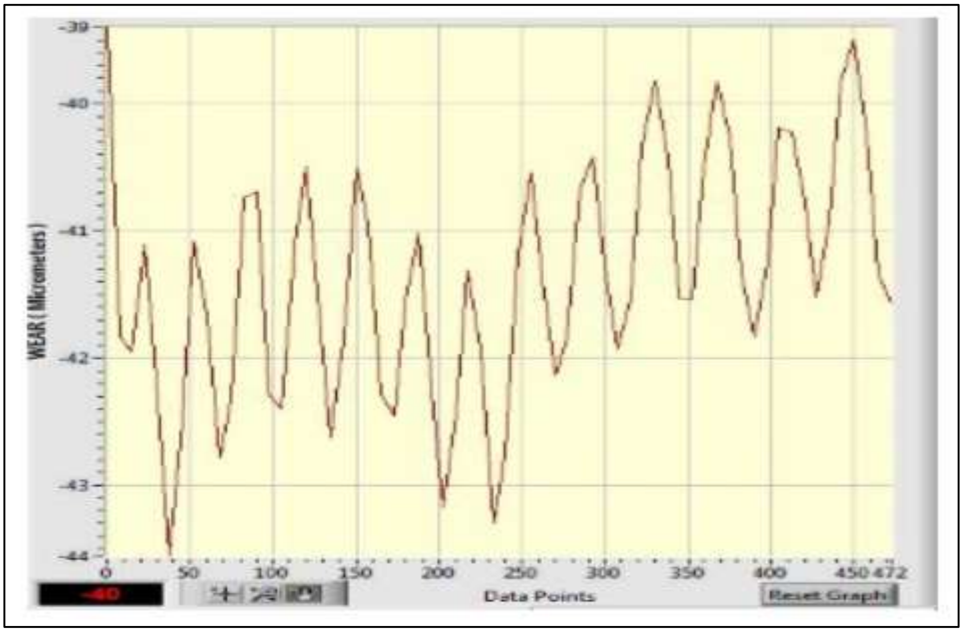

Figure 5. Wear of ADC-12 + 2% Boron carbide

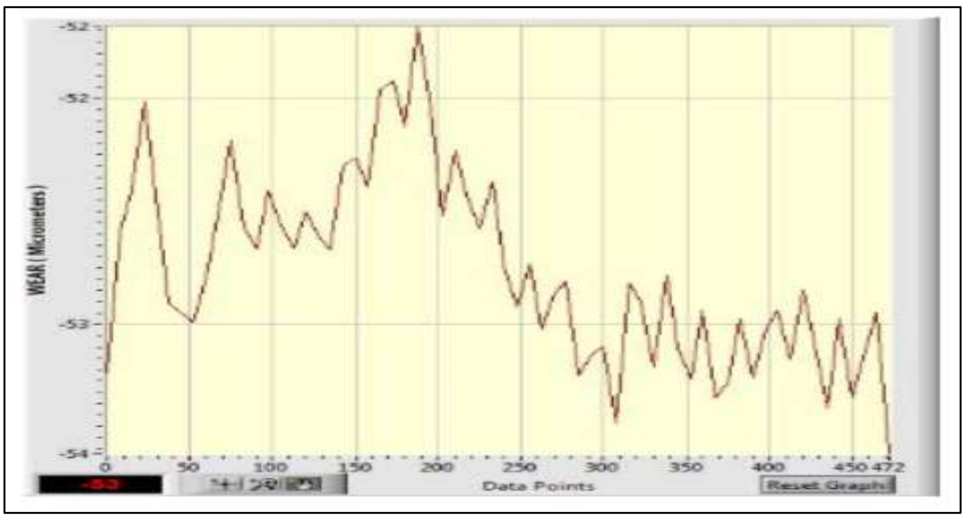

Figure 6. Wear of ADC + 3.5% Boron carbide

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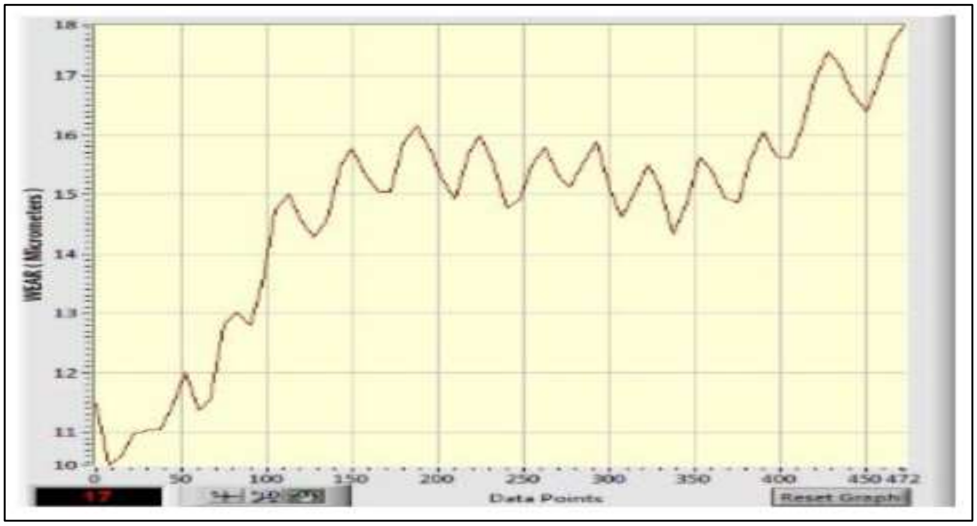

Figure 7. Wear of Al-7075 + 2% Boron carbide

Figure 8. Wear of Al-7075 + 3.5% Boron carbide

IV RESULTS

Specification of the composite material is illustrated in Figure 9 the specification is assigned for the purpose of ease. In present work composite has been formed with composition as- ADC-2, ADC-3.5, Al-2, and Al-3.5.

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Sample	Material
A2	ADC12+2%B_4C
A3.5	ADC12+3.5%B_4C
Al2	Al-7075+2%B_4C
Al3.5	Al-7075+3.5%B_4C

Figure 9. Specification of the material

V EFFECT ON THE WEAR

V.I. A2 illustrates the increasing tendency of wear, while the A3.5 shows the overall decrease in the wear. (Figure *5*, and *Figure 6*)

V.II. Al2 showed a rise in consumption (wear) and one with Al3.5 also increased but with a falling rate. (*Figure 7*, & *Figure 8*)

VI COEFFICIENT OF FRICTION

ADC-12 + 2% showed their first increase and then decreased but it was present between 0.13-0.23. Although, with 3.5% apparently displayed a similar coefficient (approx. 0.2) as displayed in Figure 3. The friction coefficient initially decreased with the presence of boron carbide material in the composite. AL -7075 + 3.5% the overall increase for (0.13 to 0.18). But the 2% had a different coefficient between (0.8-0.165) as demonstrated in Figure 4.

VII CONCLUSION

In this process of processing and the assessment of metal matrix Al7025-B4C by stir casting procedure, the following conclusions are taken:

- The descriptions of composite of ADC-12 (2% B4C) showed decreasing the track in the coefficient of friction but an increase in the percentage, (3.5% + B4C) show a similar friction coefficient to that of a run. (0.2) thus, increasing the percentage of boron carbide will give enhanced wear characteristics.
- While the composite of an Al-7075 (2% B4C) illustrated initially increasing record, trailed by decreasing but in general coefficient of friction was increasing.

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