EFFECT OF REINFORCEMENT ON WEAR BEHAVIOR OF AL 7005 HYBRID COMPOSITE

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Abstract:

Now a days Metal matrix composites are the most promising material in different fields like automobiles,aerospace, due to the advantage of light weight, greater stiffness and wear resistance etc. The casting method is an effective method for the production of metal matrix composites. In the present study. Aluminum matrix alloy reinforced with different weight percentage of S Glass of 1%, 3% & 5% and Fly ash 2%, 4% & 6% was prepared by stir casting method. The effect of S Glass and fly ash reinforcements on the wear rate of hybrid composites was examined. The wear test was examined on Pin on disc apparatus by considering speed and varying load. The sliding distance was constant. The result showed that wear resistance of Al 7005 hybrid MMCs were improved with addition of reinforcements. Also, it is noted that Al 7005 reinforced with highest percentage of S Glass and Fly ash shows improved wear results than pure Al 7005.

Keywords: Al7005 alloy; S-Glass; Fly-ash; Wear

1. INTRODUCTION

Hybrid metal matrix composites represents a new generation of material wherein strong reinforcements are incorporated into a metal matrix to enhance properties like specific strength, high elastic modulus and improved wear resistance [1-2]. In manufacturing, the production of automobile parts by conventional alloys substituting by metal matrix composites [3-4]. Wear is utmostfrequentlymet industrial issueswhich lead to replace the components frequently [5].Based on primary characteristics like wear and friction, the various components are used in aerospace industry [6]. During research, different researchers used different reinforcements like B_4C, SiC &Al_2O_3 etc [7-12]. The incorporation of fly ash and graphite particles reinforcements had improved tribological characteristics by reduced wear loss of the hybrid composites [13]. The improvement in wear resistance described by form and size of the reinforcements. R.

Karthigeyan et al.[14] deliberated the aluminium (7075) alloy composites effect with different volume fraction (V_f %) of short basalt fibre and waseffectivelyindustrialized through the stir casting process and studied for mechanical properties (hardness and the strength values) with the various amount of fibre addition.Şener Karabulut et al.[15] has assessedthe effect of B_4C particle reinforcement on various properties such as mechanical and machining properties of Al6061/ B_4C composite. The result discovered that the fracture toughness reduces and the hardness surges as the weight fraction (W_t %) of the reinforcement surges.Arun Kumar M. B.et al.[16] conducted studies on the effect of Flyash-E-glass reinforced with Al6061 alloy. It has been experiential that adding flyash pointedly improves ultimate tensile strength along with compressive strength and hardness properties as compared with that of as cast 6061 matrix.In the present case, S Glass and Fly ash used as reinforcements due to their better strength, wear resistance and cost effectiveness. The Aluminum composites are extensively used in brake disc and drums etc[17-18].

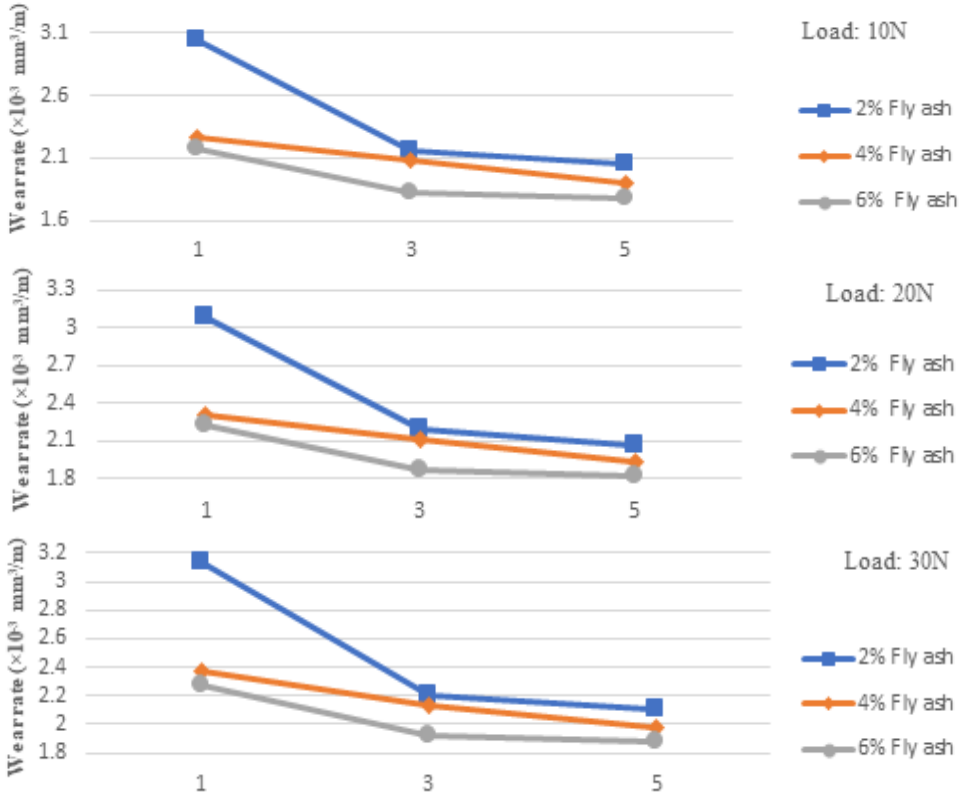
2. EXPERIMENTAL DETAILS

The Al 7005 hybrid composites was prepared by stir casting process. Al 7005 is a matrix alloy and S Glass and Fly ash are the reinforcements. Dry Sliding wear test was carried out using a pin-on-disc apparatus as per **ASTM G99** Standard at room temperature. During test, the test specimens of cylindrical shape having diameter 6 mm & 30 mm height slides against EN32 steel disc of hardness 65Rc. The time duration of 10 min and A track diameter of 80 mm has been used for all the tests. The test specimen was polished by different abrasive papers to ensure proper contact with steel disc and cleaned by acetone after each test.Wear test was carried out under varying applied load ranging from 10N to 50N in a step of 10N with a different speed of 200, 400, 600 RPM and sliding distance 1200 m constant.The wear loss of the specimens was measured as height loss and this height loss is converted in to volumetric loss by multiplying it by area of cross section of the specimen. Finally, the wear rate was calculated by dividing

volumetric loss by sliding distance. The wear rate was based on the average value of 3 tests to get a representative data.

4. RESULTS AND DISCUSSIONS

Figure 1,2 & 3 shows the wear rate for different hybrid metal matrix composites at adifferent speed of 200, 400,600 RPM and varying load of 10,20,30,40 & 50 N.



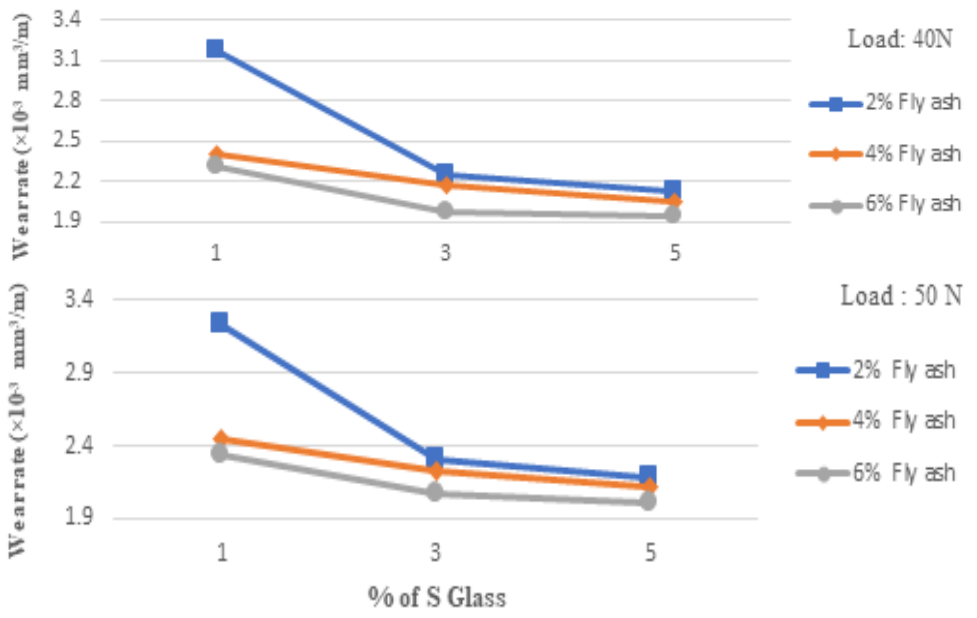
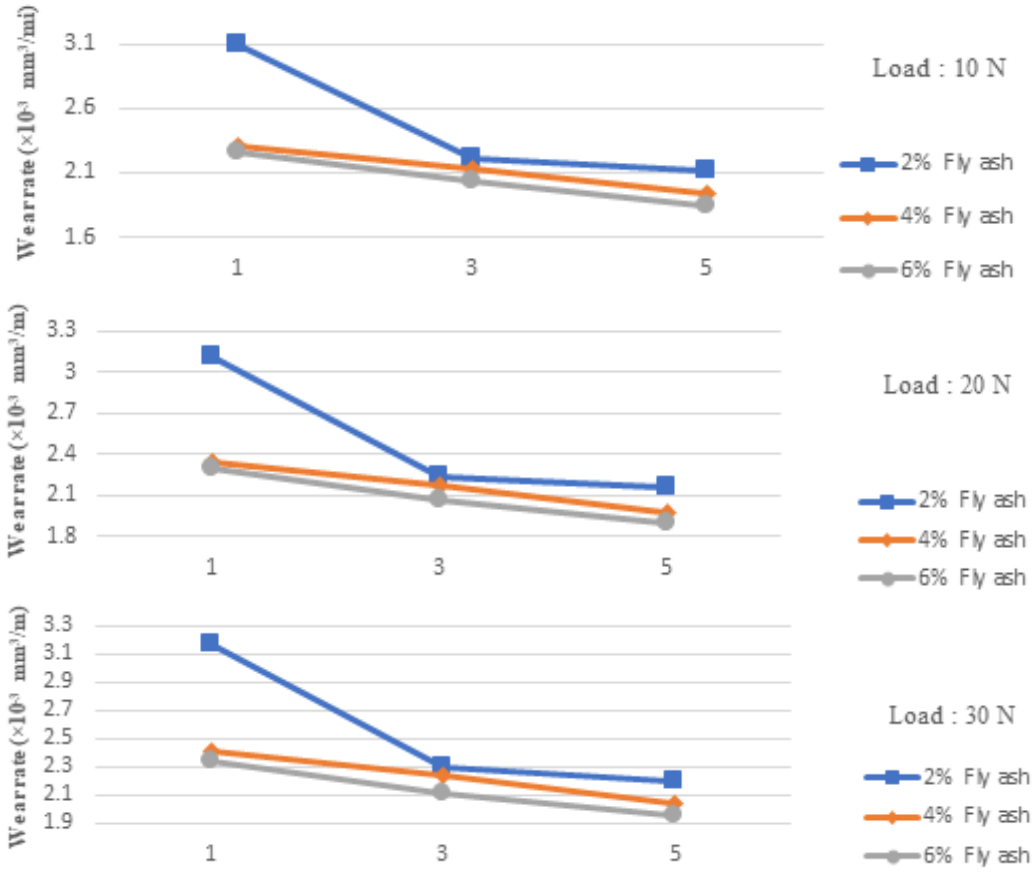


Figure 1: The effect of S Glass and Fly ash reinforcements on the wear rate of hybrid composites at a speed of 200 rpm with varying load



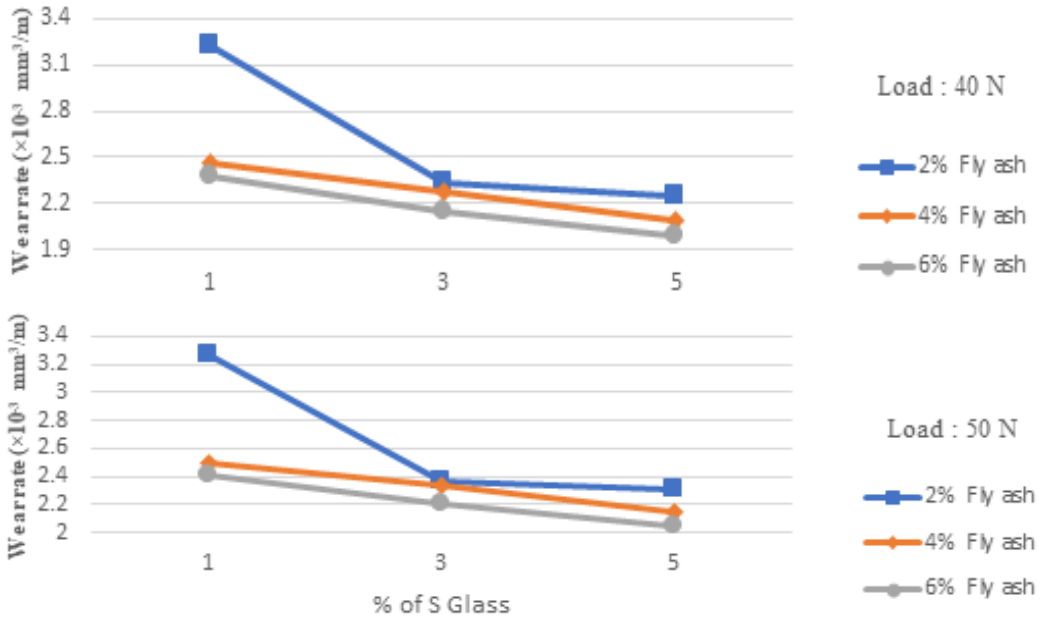
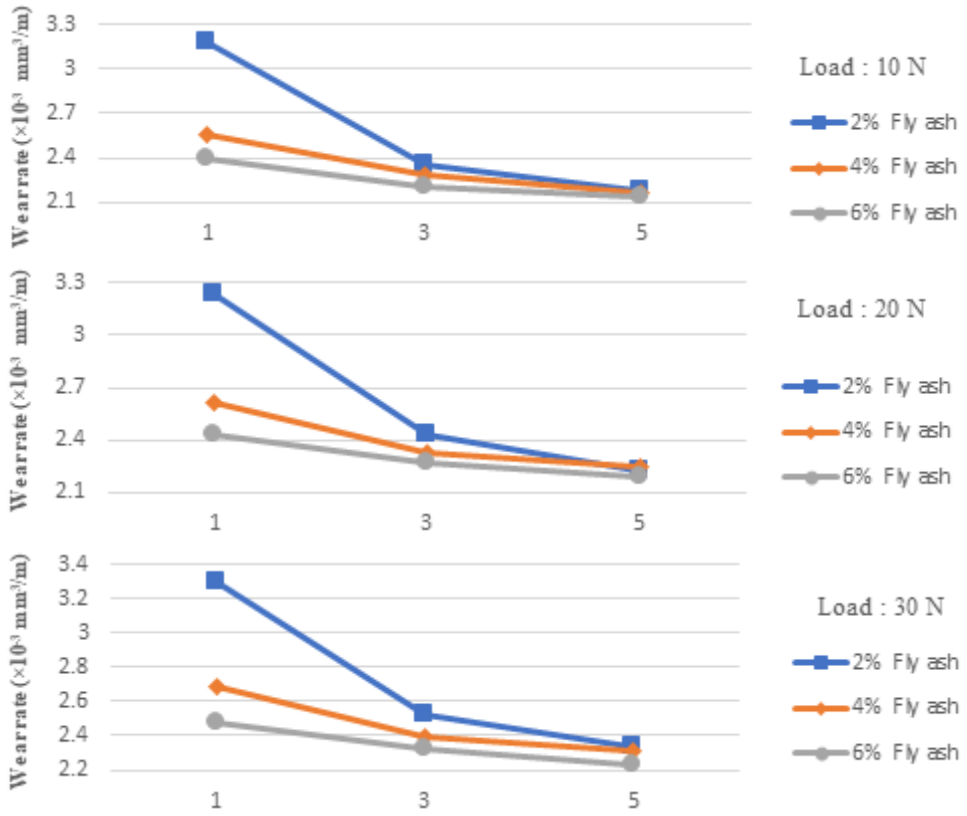


Figure 2: The effect of S Glass and fly ash reinforcements on the wear rate of hybrid composites at a speed of 400 rpm with varying load



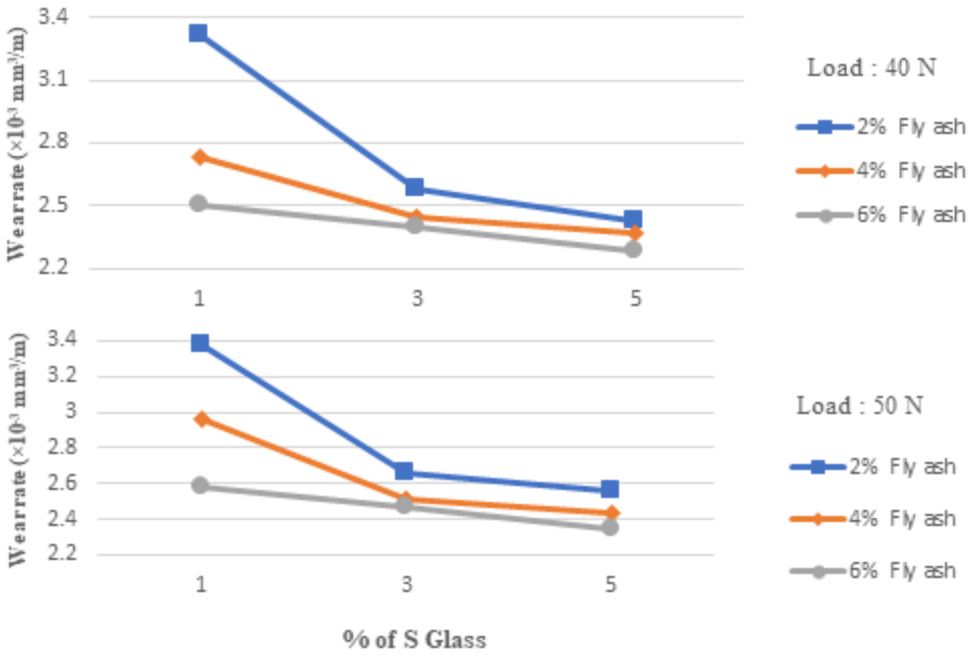


Figure 3: The effect of S Glass and fly ash reinforcements on the wear rate of hybrid composites at a speed of 600 rpm with varying load

Figure 1.2 & 3 shows the effect of S Glass and fly ash reinforcements on the wear rate of hybrid composites at a different speed of 200,400 and 600 rpm with varying load. The wear rate decreases with increase in speed and load due to increase in weight percentage of reinforcements. It is noted that hybrid MMCs has a lowerwear rate thanpure Al 7005. The lowerwear rate obtained at 5% of S-Glass with 6% fly ash composite, this may be owing to the high load carrying ability of hard phase reinforcements reduces plastic deformation of material. In the same way, the higher wear rate obtained at 1% of S-Glass with 2% fly ash composite. This may be ascribed to surge from micro cracking of subsurface as well as distortion and rupture of aspirant material. Similar results were observed by several researchers[19-25].

5. CONCLUSIONS

- Aluminum matrix alloy reinforced with different weight percentage of S Glass of and Fly ash was prepared by stir casting method&wear rate of hybrid composites was examined.
- It can be concluded that theAl7005 hybrid MMCs shows improved wear resistancethanpure Al7005 alloy.

- As sliding speed and load increases, the wear ratedecreases for the reinforced hybrid composites than pure al 7005.
- It is found that 5% S-Glass and 6% Fly-ash reinforced Al 7005 matrix alloy displayssuperior wear resistance.

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