MICROSTRUCTURE AND MECHANICAL PROPERTIES OF FLYASH PARTICLE REINFORCED ALUMINUM COMPOSITE

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ABSTRACT

In this work a metal matrix composite with the pure aluminum is a base metal and fly ash as filler material. Aluminum and fly ash composite have been made with stir casting process with different composition of fly ash from up to 9% in steps of 3%. The effect of the presence of fly ash on microstructure evolution and the mechanical properties like hardness, impact and wear tests are carried out for each composition of fly ash. Hardness of the composite increases with increasing of fly ash composite by 46%, whereas impact strength decreases with increasing of fly ash composite 60% and wear resistance increases with increasing of fly ash by 59%.

Keywords: Metal Matrix Composite, Fly ash, Mechanical Properties, stir casting


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1. INTRODUCTION

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strength and compressive strength. Su et al, [7] studies the application of ultrasonic vibration in production of metal matrix composite during the solidification and studied microstructure refinement and mechanical properties. Thamtan et al, [8] prepared Master Metal Matrix Composite (MMMC) by addition of milled powders, in semi-solid state and above the melting point and grain refinement was studied. Akbari et al, [9] studied the effects of milling process and milling time on mechanical properties of metal matrix composites, concluded that the composites, reinforced with Al₂O₃-metallic mixed powders, showed higher mechanical performance compared with that of the pure Al₂O₃ nanoparticle reinforced composite. Jokhio et al, [10] studied the effect of elemental metal such as Cu-Zn-Mg in aluminum matrix composite produced by stir casting and improvements of mechanical properties were identified.

In the literature metal matrix composites have been made, Aluminum as matrix and particle like Al₂O₃ are used as reinforcement. In the present study, aluminium-fly ash composites were produced with different proportions of fly-ash by weight using stir casting process to investigate the mechanical properties like hardness, impact strength, Tensile strength etc.,

2. EXPERIMENTATION
The required amount of ash has been collected from Vijayawada Thermal Power plant. It has been washed with pure water to remove carbon content and dried at 110°C. It has been sieved to fine particles. The final size of the particle is 53 microns. The figure 1.1 shows the fly ash before and after processing. The aluminum of 99.8 pure has been collected and used as base metal. The fly ash with different compositions i.e 3%, 6% and 9% by weight has been mixed with aluminum and composites are made with stir casting process. The prepared composites are shown in Fig 2.2.

Figure 1.1 (a) Fly ash before processing (b) Fly ash after processing
3. RESULTS AND DISCUSSIONS

The distribution of reinforcements was done by Optical microscopy after casting. The specimens cut at the middle of the cast ingots. The specimens were polished with different grades of emery papers and then diamond paste polishing. After polishing, the specimens were chemically etched with Keller’s etchant (a mixture of distilled water (190 ml), hydrochloric acid (3ml), nitric acid (5ml) and hydrofluoric acid 2 ml). The etchant was placed on the surface of the specimen for 20 s and was cleaned with ethanol. The microstructure of the dried specimens was then observed using an optical microscope (Leica, Germany).

![Image of samples](image)

**Figure 3.1** Optical microscope images of the samples obtained a) pure Al, b) Al-3%Flyash, c) Al-6%FlyasA, d) Al-9%FlyashA

The Fig 3.1 shows that the dispersion of flyash particles and dispersion is uniform. The fly ash particles distributed at the boundaries of the dendrites structure. The hardness of sample have find with Micro Vickers Hardness Tester. It is found that the hardness value increases with increase of fly-ash in the composite by 46%. The variation is shown in Fig 3.2 (a)
The strength of aluminum and fly ash composite decreases with increase of composition of fly ash. The variation of Impact strength is shown in Fig 3.2(b).

4. CONCLUSIONS

Pure aluminum fly ash composites were produced by stir casting route successfully. There was a uniform distribution of fly-ash particles in the matrix phase. The optical microscopy reveals that distributions of fly-ash particles are uniform. The hardness of the composites increased with increasing the amount of fly ash than the base alloy by 46%. The impact strength decreases with increasing of fly ash composite by 60%. Wear resistance increases with increasing of fly ash composite by 59%.

REFERENCES


