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Study of Characteristics of Nano Particles Reinforced With Metal Matrix Composites

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Abstract - Metal Matrix composites is well known for its wear resistance, fatigue, fracture toughness, stiffness .In this work SiC and Nano particles are reinforced in the aluminium metal matrix to improve its properties. This is fabricated by powder metallurgy. SEM and mechanical properties are analysed.
Keywords – Composite materials, Nano particles, Reinforcement, Powder Metallurgy

I. INTRODUCTION

Composite materials (also called composition materials or shortened to composites) are materials made from two or more constituent materials with significantly different physical or chemical properties, that when combined, produce a material with characteristics different from the individual components. The individual components remain separate and distinct within the finished structure. The new material may be preferred for many reasons: common examples include materials which are stronger, lighter or less expensive when compared to traditional materials. Composite materials are generally used for buildings, bridges and structures such as boat hulls, swimming pool panels, race car bodies, shower stalls, bathtubs, storage tanks, imitation granite and cultured marble sinks and counter tops. The most advanced examples perform routinely on spacecraft in demanding environments

II. EXPERIMENTAL WORK

Atomized aluminium powder is used as the metal matrix. The Silicon Carbide and Carbon Nano Tubes are used as reinforcement. The flow rate, apparent density and particle size distribution of the materials was studied. Pure Al, Al+10%Sic, Al+10%Sic+0.2%CNT, Al+10%Sic+0.3%CNT powder mix were blended on a milling machine to obtain a homogeneous powder blend. The formed homogeneous mixtures are compacted using the Universal Testing Machine (UTM) with suitable punch and die assembly. The compacts were sintered in an electric muffle furnace at the temperature of 560^0C for a period of 105 minutes and allowed to be cooled at room temperature.



Fig.1 UTM and die assembly



Fig.2 Pure Aluminum

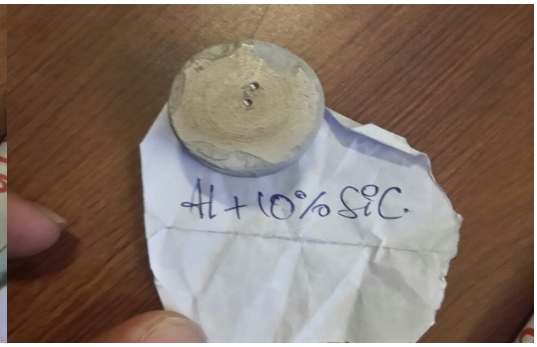


Fig.3 Al+10%Sic

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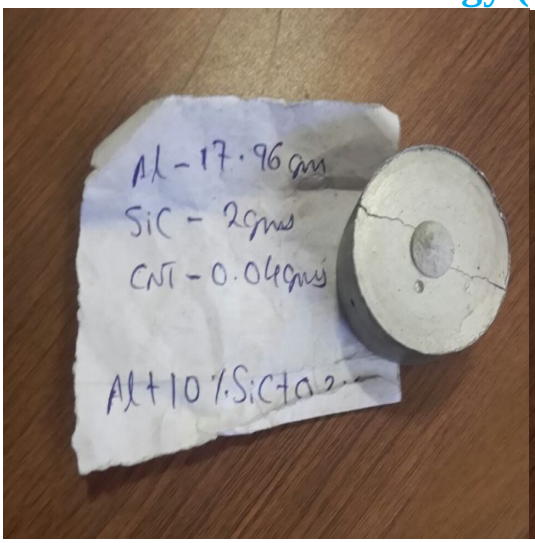


Fig.4 Al+10%Sic+0.2%CNT

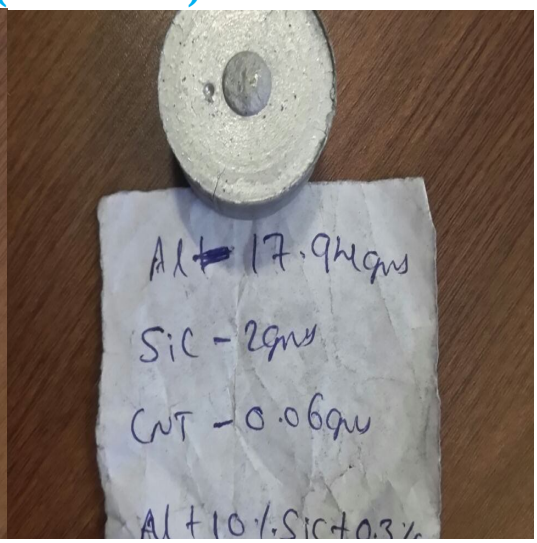
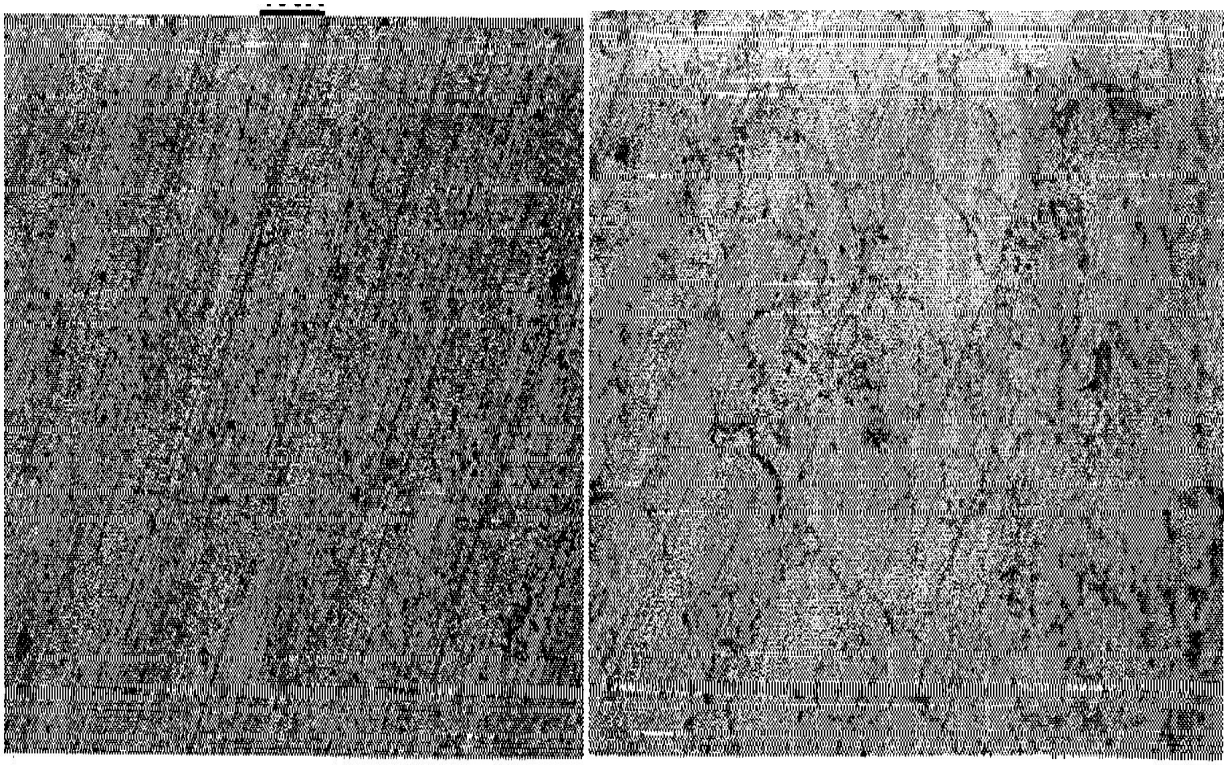


Fig.5 Al+10%Sic+0.3%CNT

III. RESULTS AND DISCUSSION

The purpose of the microstructure examination were to investigates of grain size and shape morphology and distribution of the silicon carbide particles and carbon nano tubes interfacial integrity between the matrix and reinforcement Microstructure and characterization of composites with optical microscopic images.

The following Figures shows the optical microscopic images of pure aluminum, Al+10%Sic, Al+10%Sic+0.2%CNT, Al+10%Sic+0.3%CNT respectively. The distribution of the Sic and CNT particles in the aluminum matrix is noticeably uniform. Further these figures reveal the homogeneity of sintered components. Homogeneous distribution of the reinforcement in the matrix is essential to form a composite with uniform mechanical properties.


Fig.6 Optical Microscopic Images of Pure Aluminum (100X & 500X)

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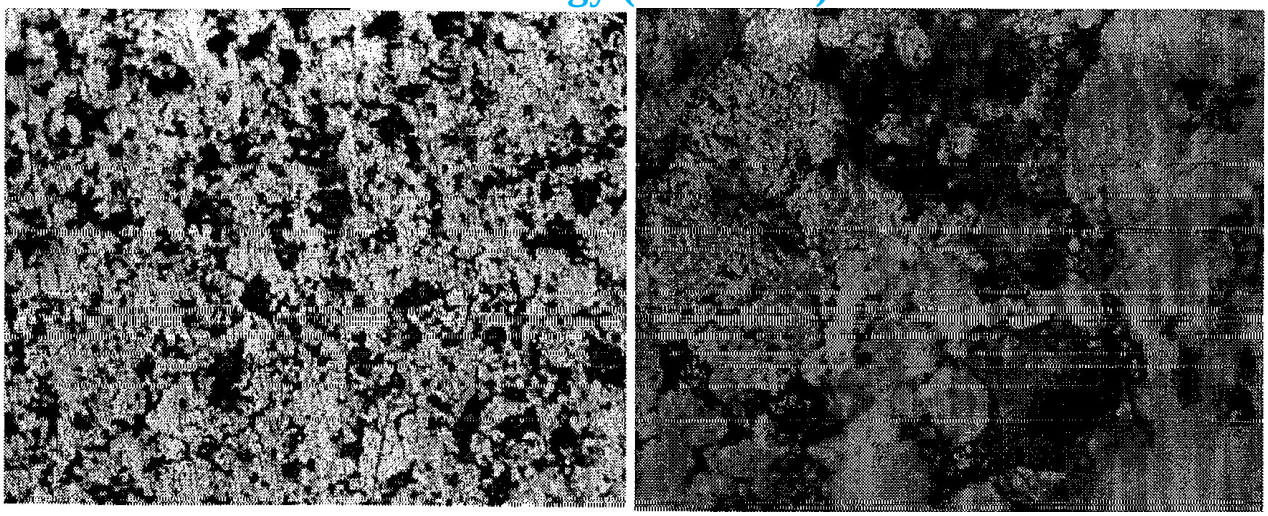


Fig.7 – Optical Microscopic Images of Al+10%Sic (100X & 500X)

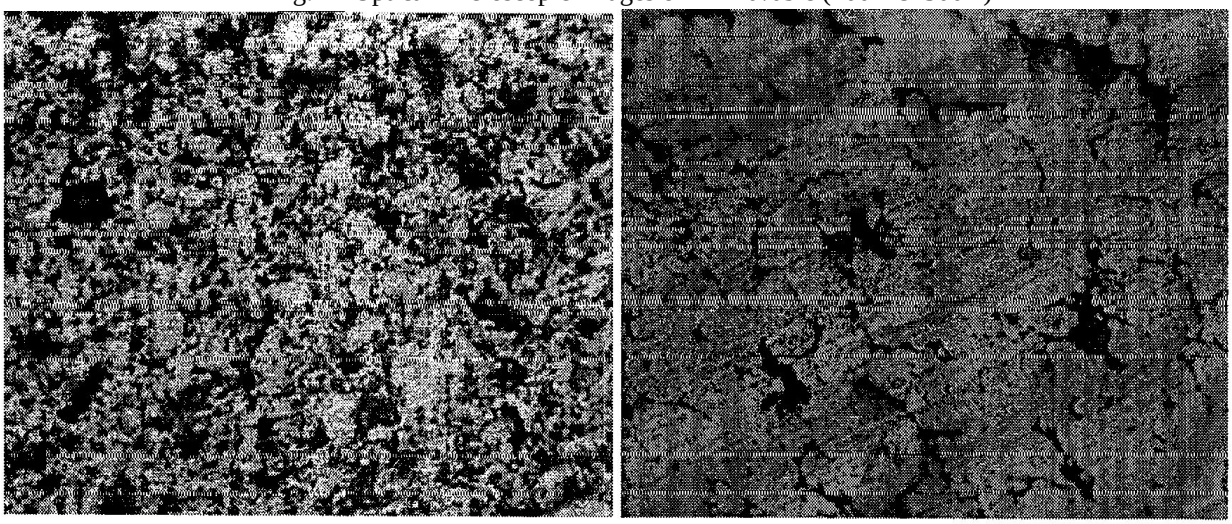


Fig.8 Optical Microscopic Images of Al+10%Sic+0.2%CNT (100X & 500X**)**

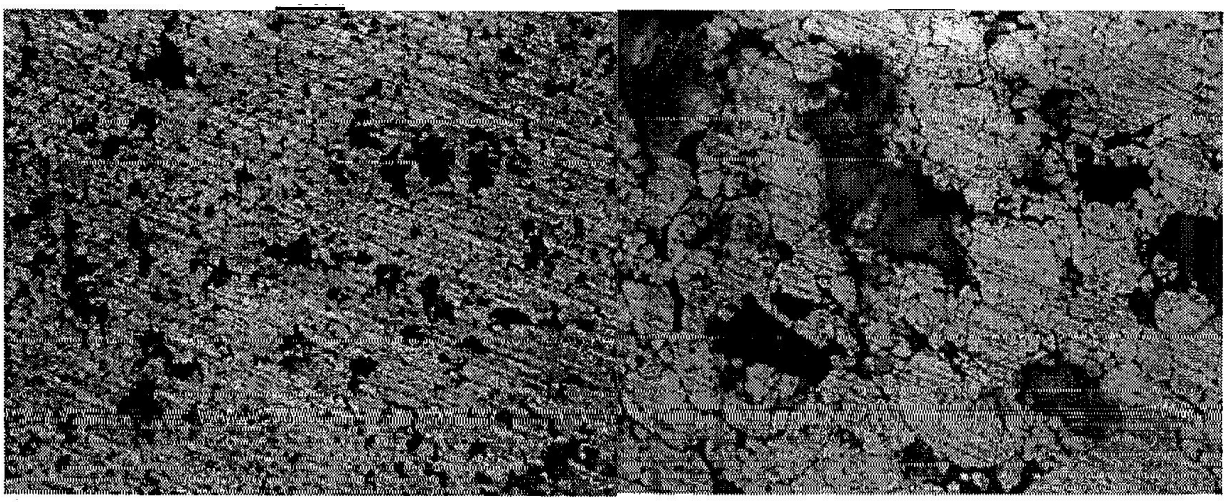


Fig.9 Optical Microscopic Images of Al+10%Sic+0.3%CNT (100X & 500X)

The following table shows the hardness value of pure aluminum, Al+10%Sic, Al+10%Sic+0.2%CNT, Al+10%Sic+0.3%CNT respectively.

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TABLE .I Hardness value

Sample type	Vickers micro hardness value
Pure aluminum	42
Al+10%Sic	49
Al+10%Sic+0.2%CNT	59
Al+10%Sic+0.3%CNT	66

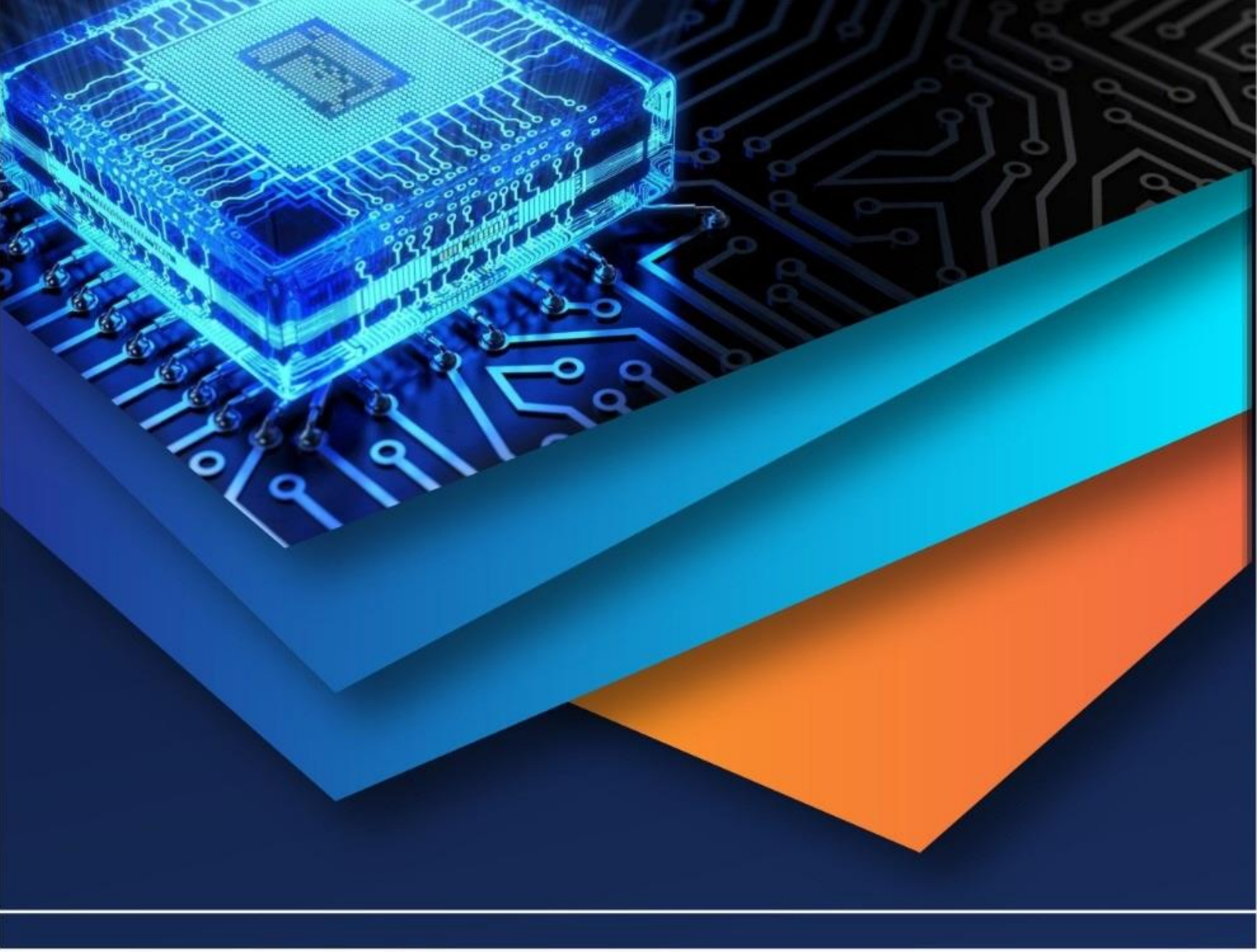
IV. CONCLUSION

In this work Isothermal compression of the powders is found to be very successful in fabrication processing. Mechanical properties like hardness is calculated and it is gradually increased with increase in quantity of the reinforcement. In SEM images we can conclude that the dispersion of SiC reinforcement and CNT is uniform.

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