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EFFECT OF VARIOUS PARTICLE REINFORCEMENT ON THE DIFFERENT PROPERTIES OF ALUMINIUM MATRIX COMPOSITE: A REVIEW PAPER

R.RAMANJANEYULU
Ph.D Scholar, Department of ME,
Ksrmce(Autonomus)
Affliated,Jntua,anatapuramu
Andhrapradesh,India.
rrramanjaneyulu@gmail.com

Dr.K.RAJA GOPAL,
Professor,Department of ME,
Ksrmce(Autonomus),Kadapa-516003
Andhrapradesh,India.
rajagopalkurnool@yahoomail.co.in

Dr.B.DURGA PRASAD
Professor,Department of ME
Jntuacea,Anatapuramu,
Andhrapradesh,India.
hod.me.cea@jntua.ac.in

ABSTRACT

A unique combination of properties puts aluminium and its alloys among most versatile engineering and construction materials. All aluminium alloys are light in weight yet some have strengths greater than that of structural steel. The metal matrix composites (MMCs) possess is significantly increasing specific strength and high hardness. Aluminium metal matrix composite can be strengthened by using various reinforcement it held ceramic particles like silicon carbide (sic), alumina (al_2o_3) and boron carbide (B_4c), etc.This paper presents mainly on over view of the effect of various particle reinforcements on aluminium alloy highlighting their merits and demerits. Major issues like fiber reinforcement and matrix bonding, agglomerating phenomenon and the main problem is related to the distribution of particle sizes and discussed in this review paper, various effect of reinforcement on aluminium matrix composite. Mechanical properties, like tensile strength and compression strength discussed in detail.
Keywords: Aluminium 2024 alloys; fabrication technique; MMC; various reinforcement (sic, al2o3, B4c)

I. INTRODUCTION

Aluminium is the most widely used metal in engineering apart from iron. It has good electrical and thermal conductivities and high reflectivity to both heat and light. It is highly corrosion resistant under a great many service conditions and is non toxic. Aluminum alloys offer a combination of mechanical and tribological properties and low density that makes them highly suitable for composite manufacturing.

Several metals and alloys have been used as matrix materials; however, most Research and Development has been concentrated on aluminium and its alloys. Aluminium has a unique combination of properties among its class, i.e., light metals. It is not only less expensive than titanium and magnesium but also easier to fabricate. To tailor it properties such as strength, stiffness, hardness, wear resistance, thermal expansion etc., a suitable alloy of aluminium can be paired with appropriate reinforcement. In recent years, aluminium alloys have attracted attention of many researchers, engineers and designers as promising structural material indifferent industries like aerospace and automotive. which main mixed material are most probably like aluminium alloy and then it group, boron carbide, silicon carbide, fly ash, graphite, silicon nitride etc. The material fabricated by using different method with respected to the grain size and percentage of reinforcement, generally we go for the stir casting, ultrasonic assisted stir casting, Friction stir processing and Powder Metallurgy techniques. Finally mechanical testing of MMCs sample is done to evaluate various mechanical properties like tensile strength and compressive strength.

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Table 1: Properties of AL2024

Properties	Value
Density	2.77 (*1000 kg/m3)
Hardness	47 (HB 500)
Elastic Modulus	70-80 Gpa
Tensile Strength	185 Mpa
Elongation	20 %
Yield Strength	76 (Mpa)

Table 2: Compositions Al 2024 roughly includes

Copper	4.3 to 4.5 %
Manganese	0.5 to 0.6 %
Magnesium	1.3 to .5 %
Zinc, Nickel, Chromium, Lead & Bismuth	Less than 0.5 %

II. LITERATURE REVIEW

Ruixiao Zheng et.al. [1] Al-2024/B4C metal matrix composites were successfully synthesized by b o t t om up process following conclusions.

Mechanical milling of the powder mixture of the Al-2024 matrix and the B4C particles has produced a nano structured powder product with average grain size of the order of 35.4 nm.
The ceramic particles have also been refined from3.30um to 1.24 um.

The physically observed by SEM and TEM. Uniform distribution of the Boron carbide reinforcement and good adhesion and bonding between the matrix and the reinforcement phase were obtained. However, the grains of the matrix phase have partially grown up to micrometer size, while the grains around Boroncarbide particles remain at the nano scale.

For MMCs-A which consist of greater than 20 vol. % boron carbide, hardness and fracture strength are 260Mpa and 950 Mpa respectively, which are almost twice as high as those of the matrix alloy. Incorporationo10wt. % un milled Al-2024 powder composites can be lead.

P. Rama Murty Rajua et . al. [2] The mechanical properties like ultimate tensile strength and hardness of the cast aluminum Al2O3 particulate composites matrix are significantly changed by varying the amount of Al2O3 reinforcement. Preparation of aluminum/Al2O3 NMMCs containing the reinforcement up to 2 wt.% with an increment of 0.5 wt %.x The micrograph study reveals the uniform distribution of Al2O3 particles in the matrix's
No reduction of Al2O3 reinforcement with compounds of matrix alloy x . Found The increased reinforcement percentage in the composites. The tensile strength and hardness values of the composite c an a l so increasing.

Saikeerthi.S.P.et[3] In summary, Al 2024 matrix composites reinforced by high volume fraction of B4C particles were prepared by mechanical milling and vacuum hot pressing followed by hot extrusion. Sample-1, with 10 vol% coarse grained Al2024 addition, have a compression strength upto1115 MPa. Sample-5, with 50 vol% coarse grained Al 2024 addition, have a compression strength of 580 MPa, while maintaining a fracture strain of 10%. The hybrid structures were proved to affect the mechanical properties and the deformation mechanisms of the composites. In addition, the quantitative understanding of the strengthening mechanisms in this study fits well with the experimental results when the volume fraction of coarse grained Al2024 is no higher than 30%. Our study explains the possible strengthening mechanism exist in the hybrid structured MMCs as well as their fracture mechanisms under compressive loads, which will provide a guide line for designing high performance MMCs.

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N.Subramani et al [4].(1) The micro hardness of the Al2024/SiC composite reinforced with 40% SiC reaches HV 225 in comparison to HV 170 of the Al2024/SiC composite reinforced with30% SiC. However, for higher SiC contents (50% and60%), the lower microhardness values are obtained due to increasing porosity content. The average microhardness of the Al2024/SiC FGMs increases with increasing the number of layer.
The highest average microhardness of the FGMs coded as AS45 and AS456 is measured to be HV 190.(2) The bending strength firstly increases as the mass fraction of SiC increases from 30% to 40%, and then decreases as the mass fraction of SiC increases from 40% to 60% for Al2024/SiC composites. The decrease in the bending strength of the composites is due to the weakly bonded Al2024/SiC interface, less intermetallic formation, and lower microhardness values. The maximum bending strength obtained for AS4 composites is1400 MPa.(3) The
XRD patterns and SEM-EDX show the presence of compounds, such as Al4C3, CuAl2, and CuMgAl2 from the composites samples.
S.Rama Rao et al [5]. Temperature in the super-cooled liquid region of the metallic glass, where the metallic glasses exhibit a viscous flow behavior, resulting in c omp o s i t e s with low porosity.
A significant increase in t h e mechanical properties of the composites compared to the matrix alloy wa s a c h i e v e d at the cost o f only s l i g h t increase in density. The yield and fracture strength of the composites are 403MPa and 660MPa, respectively, while retaining a considerable fracture deformation of about 12%, leading to a remarkable combination of high strength and good plasticity. The increased mechanical properties is attributed to the grain refinement and the uniformly distribution of the FMG particles
Preetam kulkarni[6]. 1. It is clear that ultimate tensile strength increases with increase in percentage composition of constituent material with Aluminium 2024
2. The increase in ultimate tensile strength is due to the glass fiber which gives strength to the matrix alloy by enhancing resistance to tensile stress. There is a reduction in the inter-spatial distance between the particles which leads to restriction of plastic flow due to the random distribution of the particulate in the matrix
3. It is seen that the compressive strength of the hybrid composites also increases monotonically as reinforcement contents are increased. The presence of E-glass fibre and flyash resists deforming stresses and thus en
4. **Tensile strength:** Al 2024 with 5% Flyash and 6% E-Glass possesses maximum Tensile Strength of 278.65 Mpa
5. **Compression strength:** Al 2024 with 7% Flyash and 6% E-Glass possesses maximum Compression Strength of 495.48 Mpa
T.Ravitejaet al. (1) The 2024 Al alloy, conventionally used for wrought products, can successfully be cast using direct squeeze casting process. [7] proposed a principle in which another NN yield input control law was created for an under incited quad rotor UAV which uses the regular limitations of the under incited framework to create virtual control contributions to ensure the UAV tracks a craved direction. Utilizing the versatile back venturing method, every one of the six DOF are effectively followed utilizing just four control inputs while within the sight of un demonstrated flow and limited unsettling influences. Elements and speed vectors were thought to be inaccessible, along these lines a NN eyewitness was intended to recoup the limitless states. At that point, a novel NN virtual control structure which permitted the craved translational speeds to be controlled utilizing the pitch and the move of the UAV. At long last, a NN was used in the figuring of the real control inputs for the UAV dynamic framework. Utilizing Lyapunov systems, it was demonstrated that the estimation blunders of each NN, the spectator, Virtual controller, and the position, introduction, and speed following mistakes were all SGUUB while unwinding the partition Principle.
(2)Squeeze casting of 2024 Al alloy, caused the refinement of the microstructure and the reduction of DAS of thealloy and therefore decreased the porosity and increased the den- sity and tensile properties of the cast alloy.
(3) The elimination of porosities was the main reason for increasing the tensile strength of the alloy up to 50 MPa, however above 50 MPa applied pressure, finer microstruc- ture due to higher cooling rates seemed to be the cause of increase in tensile properties.
M.Kok[8]. (1). Al2024 alloy MMCs reinforced with different sizes and weight percentages of -Al2 O3 particles have been successfully fabricated .
(2). Observations of the microstructures showed that the coarser particles were dispersed more uniformly, while the finer particles led to agglomeration and segregation of particles, and porosity.
(3).The density of the composites increased with increasing weight percentage and size of particles, whereas the porosity of the composites increased with decreasing size and increasing weight percentage of particles.
(4).The wet ability and the bonding force between Al alloy/Al2 O3 particles were improved by the applied pres- sure after the casting and the porosity was also decreased because of this pressure.

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(5).The hardness and tensile strength of MMCs increased but the elongation of them decreased, with decreasing size and increasing weight percentage of the particles.

Narayana Yuvaraj et al [9] An aluminium 2024 matrix composite reinforced by MWCNTs is successfully produced through an industrial fabrication method that combines mechanical milling and the press and sinter process. Compared to the unreinforced aluminium alloys powder, the composite exhibit significant increase in tensile strength, elongation to failure and young's modulus. In particular the AL2024/4volume. % MWCNT composite show of yield strength of 700Mpa,1.5% elongation to failure, and young's modulus of 86.4Gpa with high density. the increased mechanical properties are attributed to the grain refinement.

III. SUMMERY

Several of confront must be surmounted in order to strengthen the engineering usage of aluminium matrix composites such as processing the different methodology, Effect of various particle reinforcement on the different properties of aluminium matrix composite (Partial size and chemical compositions of AL2024) on the various properties of aluminium matrix composites. Mechanical properties like Tensile strength and Compressive strength are found for the developed composites of different weight percentage of Flyash and E-Glass in Al 2024 [6].The major conclusions derived from the prior are view carried out can be summarized in Figures and tables1, 2, 3, 4, 5, 6, 7&8.

A. Tensile test results for AL2024 Hybrid Metal Matrix Composite

Table1: Tensile test results for Al 2024+2% E-Glass + Varying % of Flyash

Tensile Strength (N/mm^2)	Percentage of Flyash (%)
247.24	**1**
256.21	**3**
265.12	**5**
271.98	**7**

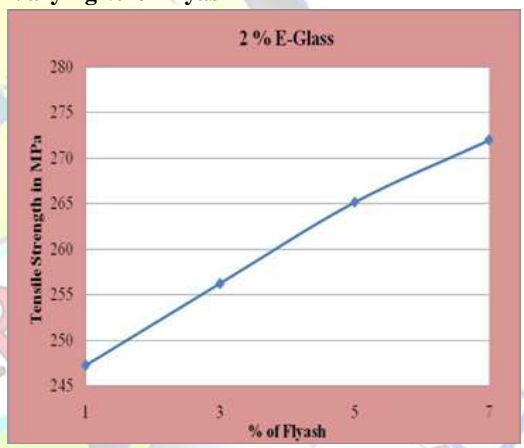

Figure1: The graph is Tensile test results for Al 2024+2% E-Glass + Varying % of Flyash

Tensile Strength (N/mm^2)	Percentage of Flyash (%)
253.56	1
259.45	3
271.38	5
275.48	7

Table 2:Tensile test results forAl2024+4%EGlass +Varying % of Flyash

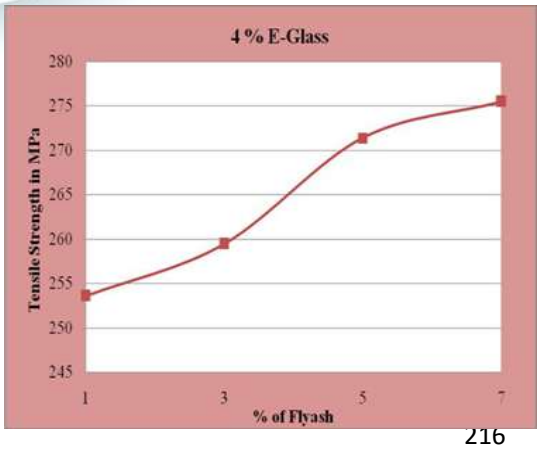

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Figure 2:The Graph is Tensile test results for Al 2024 +4% E-Glass + Varying % of Flyash

Table 3: Tensile test results for Al 2024+6% E-Glass+ Varying % of Flyash

Tensile Strength (N/mm^2)	Percentage of Flyash (%)
255.67	1
262.37	3
278.65	5
277.28	7

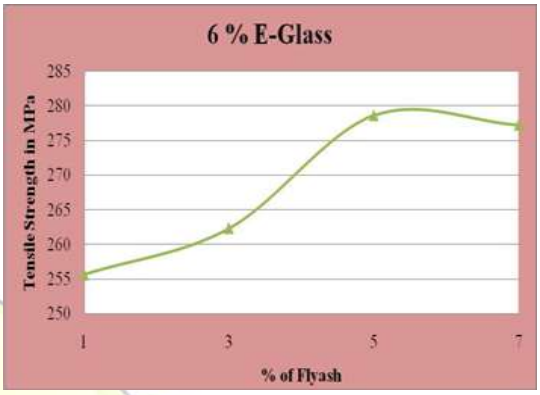

Figure 3: The graph is tensile test results for Al 2024+6% E- Glass+ Varying % of Flyas

B. Comparison of Tensile strength (MPa) Results for Al 2024 Hybrid Metal Matrix Composites

Table 4: Comparison of Tensile Test Results for Al 2024 Hybrid Composites

E-Glass 2%	E-Glass 4%	E-Glass 6%	% Flyash
247.24	253.56	255.67	1
256.21	259.45	262.37	3
265.12	271.38	**278.65**	5
271.98	275.48	277.28	7

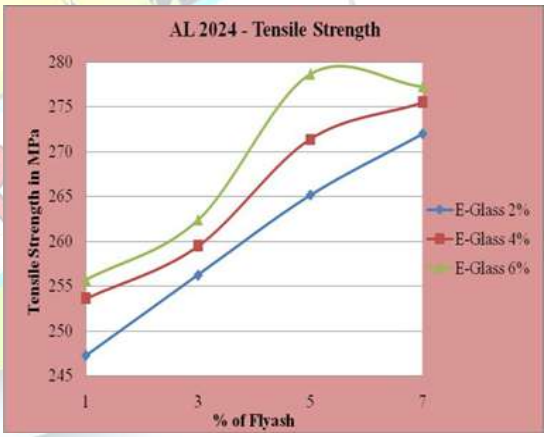

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Figure 4:The graph is Comparative charts of Tensile test results For Al 2024 Hybrid Composites

C. Compression strength results for AL2024 Hybrid Metal Matrix Composite

Table 5: Compression strength results for Al 2024 +2% E-Glass+ Varying % of Flyash

Compression Strength (N/mm^2)	Percentage of Flyash (%)
458.25	1
468.35	3
471.67	5
473.53	7

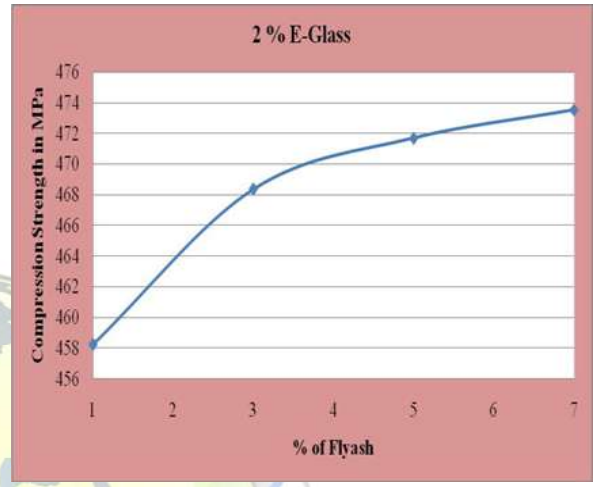

Figure 5:The graph is Compression strength results for Al 2024+2% E- Glass+ Varying % of Flya

Table 6: Compression strength results for Al 2024 +4% E-Glass+ Varying % of Flyash

Compression Strength (N/mm^2)	Percentage of Flyash (%)
469.46	1
475.43	3
479.89	5
478.78	7

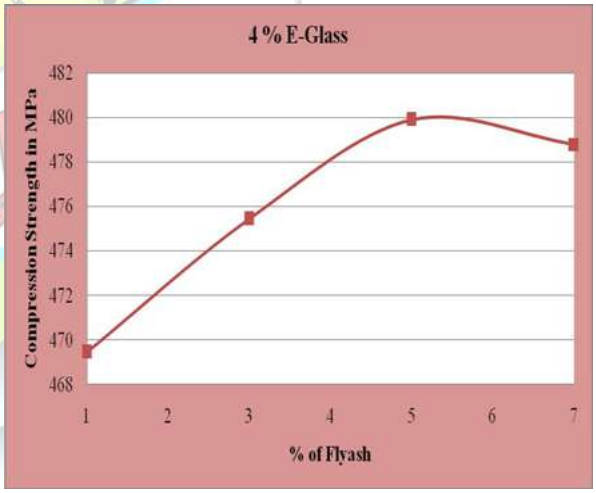

Figure 6:The graph is Compression strength results for Al 2024 +4% E-Glass+ Varying % of Flyas

Table 7: Compression strength results for Al 2024+6% E-Glass+ Varying % of Flyashs

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Compression Strength (N/mm^2)	Percentage of Flyash (%)
481.87	1
482.37	3
494.12	5
495.48	7

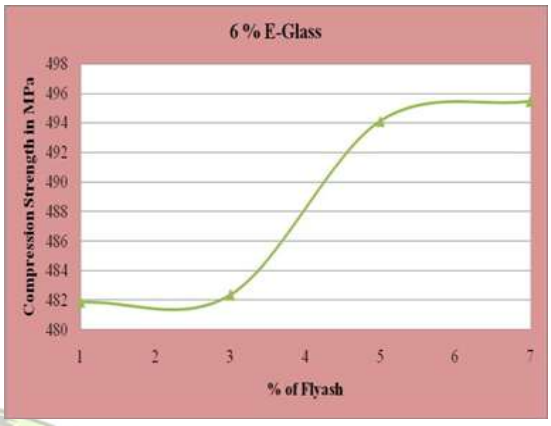

Figure7:The Graph is Compression strength resultsforAl2024+6% E-Glass+ Varying % of Flyash

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Table8:ComparisonfCompression Strength Results for Al 2024 Hybrid Composites

E-Glass 2%	E-Glass 4%	E-Glass 6%	% Flyash
458.25	469.46	481.87	1
468.35	475.43	482.37	3
471.67	479.89	494.12	5
473.53	478.78	**495.48**	7

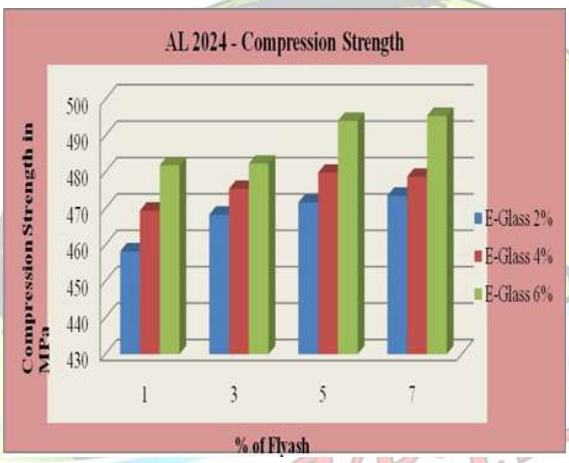

Figure 8:The graph is Comparative charts of Compression strength results for Al 2024 Hybrid Composi

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IV. CONCLUSION

From the literature review paper related to the aluminium alloy(AL2024) metal matrix composite material indifferent reinforcement materials We have concluded that, the aluminium alloy mixed with Boron carbide(B_4C),alumina(Al_2o_3),high volume fraction of boron carbide, silicon carbide(SiC),Fe-Based metallic glass ,Hybrid composite(E-glass fiber plus Fly ash powder),Wrought aluminium alloy and malti walled carbon nanotubes of various particle sizes through the process like powder metallurgy techniques, Fabrication by stir casting route, friction stir processing and squeeze casting technique etc.

The use of hybrid composite materials is very much attractive because they have outstanding stiffness, strength and low weight. An additional benefits of using hybrid composites is that their stiffness and strength can be tailored to specific design loads.

It is clear that ultimate tensile strength increases with increase in percentage composition of constituent material with Aluminium2024.The increase in ultimate tensile strength is due to the addition of E-glass fiber which gives strength to the matrix alloy by enhancing resistance to tensile stresses. Distribution of the particle. It is seen that the increase of the c o m p r e s s i v e strength of the hybrid composites, and also increases monotonically as reinforcement contents are increased. And also present work is going on aluminium2024 matrix of boron reinforcement and it is very high tensile strength, low density and low thermal coefficient of the composite material.

REFERENCES

[1] Ruixiao Zheng [a,⇑], Xiaoning Hao [a], Yanbo Yuan [a], Zhiwei Wang [a], Kei Ameyama [b], Chaoli Ma [a,⇑] Effect of high volume fraction of B_4C particles on the microstructure and mechanical properties of aluminum alloy based composites. Journal of Alloys and Compounds 576 (2013) 291–298

[2] P. Rama Murty Raju[a], S. Rajesh[a]*, K. Sita Rama Raju[a], V. Ramachandra Raju[b] Effect of reinforcement of nano Al_2O_3 on mechanical properties of Al2024 NMMCs2214-7853 © 2015 Elsevier Ltd. All rights reserved. Selection and peer-review under responsibility of the conferencecommittee members of the 4th International conference on Materials Processingand Characterization. doi:10.1016/j.matpr.2015.07.15

[3] Ruixiao Zheng [a,n], Jing Chen [a], Yitan Zhang [a], Kei Ameyama [b], Chaoli Ma [a,] Fabrication and characterization of hybrid structured Al alloy matrix composites reinforced by high volume fraction of B_4C particles Materials Science & Engineering A 601 (2014) 20–28

[4] F. ERDEMIR, A. CANAKCI, T. VAROL Micro structural characterization and mechanical properties of Functionally graded Al2024/SiC composites prepared by powder metallurgy techniques Trans. Nonferrous Met. Soc. China 25(2015) 3569−3577

[5] Ruixiao Zheng [a], Han Yang [a], Tong Liu [a], Kei Ameyama [b], Chaoli Ma [a,⇑] Microstructure and mechanical properties of aluminum alloy matrix composites reinforced with Fe-based metallic glass particles

[6] Preetam Kulkarni , **Evaluation of Mechanical Properties of AL 2024 Based Hybrid Metal Composites** IOSR Journal of Mechanical and Civil Engineering (IOSR-JMCE)e-ISSN: 2278-1684,p-ISSN: 2320-334X, Volume 12, Issue 5 Ver. IV (Sep. - Oct. 2015), PP 108-122

[7] Christo Ananth,"A Novel NN Output Feedback Control Law For Quad Rotor UAV",International Journal of Advanced Research in Innovative Discoveries in Engineering and Applications[IJARIDEA],Volume 2,Issue 1,February 2017,pp:18-26.

[8] M. Kok* Production and mechanical properties of Al_2O_3 particle-reinforced 2024 aluminium alloy composite Journal of Materials Processing Technology 161 (2005) 381–387

[9] **S.E. Shin [a,b] and D.H. Bae [a,]** Please cite this article as: Shin SE, Bae DH, Fatigue behavior of Al2024 alloy-matrix nanocomposites reinforced with multi-walled carbon nano tubes, *Composites Part B* (2017), doi: 10.1016/ j.compositesb.2017.09.034.

[10] Dinesh Patidar, R.S.Rana Effect of B_4C particle reinforcement on the various properties of aluminium matrix composites. proceedings 4(2017)2981-2988