Original Article

A Novel Investigation on Tensile Strength, Compressive Strength, Hardness and Corrosion Resistance of Al6061 Hybrid Composite Reinforced with 15% Weight Fraction of B_4C+Fly Ash and Comparing the Outputs with As-Cast Al6061

G.Vinoth[1], G.Bharathiraja[2]

[1]Research Scholar, Department of Mechanical Engineering, Saveetha School of Engineering, Saveetha Institute of Medical and Technical Sciences, Saveetha University, Chennai, Tamil Nadu. India. Pincode: 602105.
[2]Project Guide, Corresponding Author, Department of Mechanical Engineering, Saveetha School of Engineering, Saveetha Institute of Medical and Technical Sciences, Saveetha University, Chennai, Tamil Nadu. India. Pincode: 602105.

Abstract

Aim: The primary purpose of the search is comparison of tensile strength, compressive strength, hardness and corrosion resistance of Al6061 hybrid composite reinforced with 15% weight fraction of B_4C,Fly ash. **Materials and Methods:** Al6061 aluminum casting plate of thickness 10 mm was used in this research work Al6061 aluminum was normalized at 750 degree Celsius with the help of muffle furnace.Tensile, compressive, hardness and corrosion resistance tests were carried out as per the ASTM standards.Test samples (N = 20) were taken from each plate of experimental group (B4C,Fly ash) and control group (Al6061) G-Power: 80%. **Results:** One way ANOVA using SPSS software revealed that B_4C+Fly ash has significantly higher tensile (410.15 MPa), compressive (255.45 MPa), hardness (118.7 HV) and corrosion resistance (0.9256 mm/year) than that ofAl6061 with significance value of 0.045 ($p<0.05$). **Conclusion:** Within the limitations of this study, by doing the comparison of control and experimental groups the composite materials have better properties i.e. by doing the tensile,compressive,hardness and corrosion resistance testings.

Keywords: Novel tensile strength, Compressive strength, Hardness, Corrosion resistance, Aluminum, Fly ash, Mechanical behavior

DOI: 10.47750/pnr.2022.13.S03.088

INTRODUCTION

Our main aim of the research is to compare the Al6061 with reinforced metal matrix composite material B_4C+Fly Ash based on the weight fraction. (Evans, Marchi, and Mortensen 2013). A material has a property which is different from its constituents (Paulo Davim 2014). Because of their improved mechanical qualities, demand for aluminum hybrid metal matrix composites has risen in recent years to meet the needs of advanced technical applications like more strength, weight minimization and stiffness when compared to the past monolithic materials. High strength in shear and compression, capabilities to work in higher temperature are the result of combination of MMCs with ceramic materials (Paulo Davim 2011). The demand for MMCs in structural, defense, automotive and aerospace applications and availability of alternate cheaper reinforcements and various processing techniques are increasing year after year. In this research the composite material used in aerospace industries has been manufactured because of less weight and more stiffness.and nowadays the composite materials were used moreover in the automobile based industries (Parswajinan et al. 2018).

Around 612 research articles were reported on experimental Investigation on tensile strength, compressive strength, hardness and corrosion resistance of Al6061 (Coyal et al. 2020) hybrid composite reinforced with 15% weight fraction of B_4C+Fly ash and comparing the outputs with as-cast Al6061(Sendhil Kumar et al. 2020)the aluminum 6061 as a metal matrix composite material adding with B_4c and flyash based on

the weight fraction of 15% and(Bauri and Yadav 2017) comparing the outputs.(Palanichamy et al. 2019). Investigation of mechanical properties adding fly ash reinforced aluminum metal matrix composite and review (Coyal et al. 2020). Along this research the best study based on the survey.and knowing the properties of the composite materials.

Our team has extensive knowledge and research experience that has translate into high quality publications(Bhansali et al. 2021; Jayanth et al. 2021; Sudhakar, Ravel, and Perumal 2021; Sathiyamoorthi et al. 2021; Deepanraj et al. 2021; Raju et al. 2021; Arun Prakash et al. 2020; Kamath et al. 2020; Shanmugam et al. 2021; Rajasekaran et al. 2020; Adhinarayanan et al. 2020; Rajesh et al. 2020; Aurtherson et al. 2021). The importance of this research is comparing the mechanical behavior of both Al6061 and hybrid metal matrix composite knowing the properties of novel tensile strength, compressive strength, hardness and corrosion resistance and using the spss software displaying the output through the points and graph. (Altshuler and ADVANCED MATERIALS LAB CONCORD MA. 1988). It used to change physical properties such as wear resistance, friction coefficient, or thermal conductivity. Our ultimate aim is to compare the performance of investigation on tensile strength, compressive strength, hardness and corrosion resistance of Al6061 hybrid composite reinforced with 15% weight fraction of B_4C+Fly Ash with the help of stir casting process it is mixed the material are melted with the help of the muffle furnace at 730c and poured in the molten cavity as the desired shape it is required.(Bauri and Yadav 2017)The applications of the metal matrix composite are automotive industries like disc brakes,driveshafts,engine etc. aircraft components like structural components of the jets landing gear.Space systems, attach plates for high-speed robots, parts in particle accelerators.

Materials And Methods

The complete fabrication process was done at Saveetha School of Engineering, Saveetha Institute of Medical and Technical Sciences,Chennai. The raw material used for this research is aluminum 6061,boron carbide,fly ash was collected from the Omkar Steel Corporation chennai,india.c in the rod shape material for our research it is required the flat material. In this research the parent material aluminum 6061 was melted with the muffle furnace at 750c and poured in the mold cavity to get into desired shape. The furnace operated at 230v AC with 50hz frequency. And make is hotking instruments.co. It has seven segment display to shows the output value and temperature indications.and for the reinforced metal matrix composite material to mix the aluminum 6061,boron carbide,fly ash by the stir casting method.by the weight fraction of material used is aluminum 6061 is 85% and boron carbide is 7.5% and fly ash is 7.5%. No.of groups 2, sample size 80 and the total sample size is 160. The g power is 80%, std devations is 2.76 and mean value is 7.60 (Coyal et al. 2020). This research contains two groups namely group1 and group2,parent group and experimental group were taken for study to identify the properties of the material.

The AL6061 was obtained from Omkar Steel Corporation for use in this research. It is to purchase the raw material in rod shape but for this research required flat plate material.so adopted the casting process with the help of muffle furnace. The furnace operated at 230v AC with 50hz frequency. And make is hotking instruments.co.it has a seven segment display to show the output value and temperature indications. For manufacturing hybrid metal matrix composite material combining the boron carbide and fly ash with the AL6061, the weight fraction of pure aluminum is 85 percent, B_4c is 7.5%, and fly ash is 7.5%. All of these materials were mixed using the stir casting process. It rotates at 800rpm and fixes the material, after which the liquid state metal will be put into the cavity and left for a period of time to solidify, and the material size is 150*150mm with a thickness of 10mm. As per astm standard, cut the material in the darkbone shape and do the tensile test,compressive strength,hardness test and corrosion resistance.

Only pure aluminum 6061 is used in the control group, So the material was collected from Omkar Steel Corporation and needed to be melted into a liquid state with the help of a muffle furnace at 730°C. The furnace operated at 230v AC with 50hz frequency. And make is hotking instruments.co. It has a seven segment display to show the output value and temperature indications. And poured the molten metal into the cavity to get the required dimensions and waited for it to solidify. And do the testing process as per the astm standard.and testing process tensile, compressive hardness and corrosion resistance.

Tensile strength for both pure aluminum and metal matrix composite were obtained using a Universal testing machine (UTN 1/2011-4540). Experiment was performed at room temperature 28 ℃ approximately. Tests were conducted on 20 specimens for Group 1 and Group 2 as per ASTM D638 standard. The cut samples of Group 1 and Group2. The input parameters of universal testing were 0.1 mm/min displacement resolution, 480 kN maximum test load, 5N load resolution and cross head speed of 0.1 mm/min to 500 mm/min are considered for

obtaining the tensile strength of the fabricated Group 1 and Group 2 composites. Tensile strength of the test 4 of 14 groups were obtained using the load v/s displacement values. The formula is compressive strength at point of failure = Force/Initial cross sectional area. The vital properties of concrete and motor is the compressive strength. The finish of the product and its performance characteristics is greatly dependent on its binder strength. This is required to substantiate the quality of the finished product.

Hardness for both pure aluminum and metal matrix composite were obtained using a brinell hardness tester-3000**(**10/01/038**)** Tests were conducted on 20 specimens for Group 1 and Group 2 as per ASTM D638 standard. The application of hardness testing enables you to evaluate a material's properties, such as strength, ductility and wear resistance, and help to determine whether a material or material treatment is suitable for the purpose you require. Salt spray test for both pure aluminum and metal matrix composite were obtained using as per AstmB117-19 and test condition the requirements and actual values are chamber temperature at 34.8c and ph of solution is 6.9 and air pressure at 15psi concentration of sodium chloride is 5.4% and collection of solution per hour is 1.5ml and the test was conducted for 24 hours and in the result no red rust and no white rust observed at the end of 24hours of testing.

Statistical Analysis

The SPSS Software package was used in this research for statistical analysis SPSS(v.26). The independent variables are adding B_4C and flyash.To the material and dependent variables knowing the properties. Group statistics and independent sample t-tests were performed on the experimental tensile strength results and the graph was built for two groups under study.analysis done with the descriptive and anova tables,post hoc bonferroni test,bar chart etc.(Coyal et al. 2020).

Results

Figure 6 shows the bar graph for the mean value of tensile strength of Group1 and Group 2. Table 1 shows the mean tensile strength of Group 1 composite and it was found to be 25.89 MPa. The mean tensile strength of Group 2 composite was found to be 43.69 MPa. Table 1 shows the mean compressive strength of Group 1 composite and it was found to be 54.75 MPa. The mean compressive strength of Group 2 composite was found to be 53.28 MPa. Table 1 shows the mean hardness of Group 1 composite and it was found to be (63,66,65). The mean hardness of Group 2 composite was found to be(73,76,75).

In this research, comparison was made on the tensile strength, compressive strength, hardness and corrosion resistance.aluminium 6061 (group1) and hybrid composite reinforced with 15% weight fraction of B_4C+Fly ash (group2) Table 1 shows the mean corrosion resistance of Group 1 composite and it was found no white rust and no red rust observed at the end of 24hours of testing. The mean corrosion resistance of Group 2 composite was found no white rust and no red rust observed at the end of 24hours of testing. Table 1 finding the mean values for tensile strength,compressive strength,hardness,corrosive resistance for Al6061 hybrid composite reinforced with 15% weight fraction of B4C,Fly ash.Table 2. Finding the anova values by using the spss software. (Murugan, Velmurugan, and Jegan 2016)(Kumar et al. 2012) (Murugan, Velmurugan, and Jegan 2016).The aluminum 6061 is the parent material for this study shown in the Fig1. so investigation of mechanical and wear behavior of aluminum 6061 metal matrix composite as shown in the Fig.2. By this research comparison of both aluminum 6061 and metal matrix composite material reinforced with15% of the weight fraction by using the stir casting process shown in Fig.3.and hybrid metal matrix composite material has no red rust and white rust under the observation of 24 hours Fig.4. and for compressive strength Fig.5. and for a hardness test Fig. 6. Bar graph showing the comparison of mean tensile strength,compressive strength,hardness,corrosive resistance of al6061 hybrid composite reinforced with 15% weight fraction of B_4C+Fly.

Discussion

Knowing the properties of the material, tensile strength for the aluminum 6061 is 25.4MPa and for metal matrix composite material is 43.5MPa shown in Fig.4. and for compressive strength for the aluminum 6061 is 54.75 MPa and for the metal matrix composite material is 53.28MPa shown in Fig.5. and for hardness test the mean value of pure aluminum is (63,66,65).and for metal matrix composite material is (73,76,75).the corrosion resistance for aluminum is 6061(0.03917).

All of these values were obtained by doing the different mechanical tests for AHMMC.This is also evident in the study conducted by (Coyal et al. 2020).where the values are increasing with weight fraction and stirring time likewise exhibited in (Palanichamy et al. 2019). ($p < 0.001$ one-way ANOVA) and this statement is

in agreement with the findings of (Kumar et al. 2012).For B_4C fly ash reinforced AA6061, (Bauri and Yadav 2017). managed to show similar effects on the mechanical properties for 15% of the weight fraction. So for aluminum the corrosion resistance is less while compared to the other materials.all the following tests were one by the astm standard process. The table 1 has the Descriptives values and table 2 shows the anova values and obtained the output.

Research has been done with the aluminum composite material with 10% of reinforcement material and tested with the tensile,compressive,hardness,corrosion resistance(Gireesh et al. 2018).so our limitations of our research is to increase the percentage of reinforcement 10% to 15%. And comparing the output with the control group.(Venkatesan and Anthony 2020) in the previous research only property evaluation had been conducted with the hybrid metal matrix composites. (Altshuler and ADVANCED MATERIALS LAB CONCORD MA. 1988) in the future scope of our research is to increase the percentage of B_4c to make the metal matrix composites tensile test were cut into the dog bone and do the testing process using the universal testing machine. (Kreider 2016) composite metal matrix components provide in depth report and a reference on the technology of metal matrix composite and by discussing the principal metal laminate fabrication methods and the properties of meal laminated metal composite to the for the specific application .it also describes the technology in eutectic super alloys like nickel and cobalt. (Kreider 2016; Sendhil Kumar et al. 2020)**.**

Conclusion

By doing the comparison of (group1 and group 2) where the group1 is the parent and group2 experimental an Al6061 hybrid composite reinforced with 15% weight fraction of B_4C, Fly ash on tensile strength, compressive strength, hardness and corrosion resistance.the aluminum 6061 is 25.4MPa and for metal matrix composite material is 43.5MPa. Group 2 has the higher properties and it is used for aerospace applications. By doing the various test performance the results has been verified with the graph with the spss software and used anova for the output mean value and observed the variations in the result. So hybrid composite material has the higher properties.

DECLARATIONS:

Conflict of Interests
The authors of this paper declare no conflict of interest

Authors Contribution
Author GV was involved in the data collection,data analysis and manuscript writing. Author GB was involved in conceptualization,data validation and critical review of the manuscript.

Acknowledgment
The authors would like to express their gratitude towards Saveetha School of Engineering, Saveetha Institute of Medical and Technical Sciences (Formerly known as Saveetha University) for providing the necessary infrastructure to carry out this research work successfully

Funding:
We thank our financial sponsors for financial support that enabled us to complete this study.
1. MRF Tyres and pre traders,vellore
2. Saveetha University
3. Saveetha Institute of Medical and Technical Sciences
4. Saveetha School of Engineering

References

1. Adhinarayanan, Rajesh, Aravindh Ramakrishnan, Gopal Kaliyaperumal, Melvinvíctor De Poures, Rajesh Kumar Babu, and Damodharan Dillikannan. 2020. "Comparative Analysis on the Effect of 1-Decanol and Di-N-Butyl Ether as Additive with diesel/LDPE Blends in Compression Ignition Engine." *Energy Sources, Part A: Recovery, Utilization, and Environmental Effects*, June, 1–18.
2. Altshuler, Thomas L., and ADVANCED MATERIALS LAB CONCORD MA. 1988. *Tensile Tests for Various Specimen Configurations for Metal Matrix Composite P55 GR/AL 6061-T6*.
3. Arun Prakash, V. R., J. Francis Xavier, G. Ramesh, T. Maridurai, K. Siva Kumar, and R. Blessing Sam Raj. 2020. "Mechanical, Thermal and Fatigue Behaviour of Surface-Treated Novel Caryota Urens Fibre–reinforced Epoxy Composite." *Biomass Conversion and Biorefinery*, August. https://doi.org/10.1007/s13399-020-00938-0.
4. Aurtherson, P. Babu, Bhanu Teja Nalla, Karthikeyan Srinivasan, Kulmani Mehar, and Yuvarajan Devarajan. 2021. "Biofuel Production from Novel Prunus Domestica Kernel Oil: Process Optimization Technique." *Biomass Conversion and Biorefinery*, May.

https://doi.org/10.1007/s13399-021-01551-5.
5. Bauri, Ranjit, and Devinder Yadav. 2017. *Metal Matrix Composites by Friction Stir Processing*. Butterworth-Heinemann.
6. Bhansali, Karan J., Kamlesh R. Balinge, Subodh U. Raut, Shubham A. Deshmukh, M. Senthil Kumar, C. Ramesh Kumar, and Pundlik R. Bhagat. 2021. "Visible Light Assisted Sulfonic Acid-Functionalized Porphyrin Comprising Benzimidazolium Moiety for Photocatalytic Transesterification of Castor Oil." *Fuel* 304 (November): 121490.
7. Coyal, Anubhav, N. Yuvaraj, Ravi Butola, and Lakshay Tyagi. 2020. "An Experimental Analysis of Tensile, Hardness and Wear Properties of Aluminium Metal Matrix Composite through Stir Casting Process." *SN Applied Sciences*. https://doi.org/10.1007/s42452-020-2657-8.
8. Deepanraj, B., N. Senthilkumar, D. Mala, and A. Sathiamourthy. 2021. "Cashew Nut Shell Liquid as Alternate Fuel for CI Engine—optimization Approach for Performance Improvement." *Biomass Conversion and Biorefinery*, February. https://doi.org/10.1007/s13399-021-01312-4.
9. Evans, Alexander, Christopher San Marchi, and Andreas Mortensen. 2013. *Metal Matrix Composites in Industry: An Introduction and a Survey*. Springer Science & Business Media.
10. Jayanth, Bellappu Venkat, Melvin Victor Depoures, Gopal Kaliyaperumal, Damodharan Dillikannan, Dilipsingh Jawahar, Kumaran Palani, and Ganesha Prasad Meravanigee Shivappa. 2021. "A Comprehensive Study on the Effects of Multiple Injection Strategies and Exhaust Gas Recirculation on Diesel Engine Characteristics That Utilize Waste High Density Polyethylene Oil." *Energy Sources, Part A: Recovery, Utilization, and Environmental Effects*, June, 1–18.
11. Kamath, Manjunath, Subha Krishna Rao, Jaison, Sridhar, Kasthuri, Gopinath, Sivaperumal, and Shantanu Patil. 2020. "Melatonin Delivery from PCL Scaffold Enhances Glycosaminoglycans Deposition in Human Chondrocytes – Bioactive Scaffold Model for Cartilage Regeneration." *Process Biochemistry* 99 (December): 36–47.
12. Kreider, Kenneth G. 2016. *Metallic Matrix Composites: Composite Materials*. Elsevier.
13. Kumar, G. B. Veeresh, G. B. Veeresh Kumar, C. S. P. Rao, and N. Selvaraj. 2012. "Studies on Mechanical and Dry Sliding Wear of Al6061–SiC Composites." *Composites Part B: Engineering*. https://doi.org/10.1016/j.compositesb.2011.08.046.
14. Murugan, Senthil, M. Velmurugan, and V. Jegan. 2016. "Characterization and Optimisation of Al6061-Flyash-SiC Composite in Fabrication Process Using Taguchi Method." *Indian Foundry Journal* 62 (8): 34–38.
15. Palanichamy, Ragunath, Jayakumar Lakshmipathy, Balamurugan Kulendran, and Vairavel Madeshwaran. 2019. "MECHANICAL CHARACTERISTICS OF FLY ASH REINFORCED ALUMINIUM METAL MATRIX COMPOSITE-ART OF REVIEW." *INTERNATIONAL JOURNAL OF ADVANCED RESEARCH IN ENGINEERING & TECHNOLOGY*. https://doi.org/10.34218/ijaret.10.6.2019.015.
16. Parswajinan, C., B. Vijaya Ramnath, M. Vetrivel, M. Aswin, and B. Mohana Vignesh. 2018. "Mechanical Behavior of Aluminium Metal Matrix Composite." *Advanced Science, Engineering and Medicine*. https://doi.org/10.1166/asem.2018.2179.
17. Paulo Davim, J. 2011. *Machining of Metal Matrix Composites*. Springer Science & Business Media.
18. ———. 2014. *Metal Matrix Composites: Materials, Manufacturing and Engineering*. Walter de Gruyter GmbH & Co KG.
19. Rajasekaran, S., D. Damodharan, K. Gopal, B. Rajesh Kumar, and Melvin Victor De Poures. 2020. "Collective Influence of 1-Decanol Addition, Injection Pressure and EGR on Diesel Engine Characteristics Fueled with diesel/LDPE Oil Blends." *Fuel* 277 (October): 118166.
20. Rajesh, A., K. Gopal, De Poures Melvin Victor, B. Rajesh Kumar, A. P. Sathiyagnanam, and D. Damodharan. 2020. "Effect of Anisole Addition to Waste Cooking Oil Methyl Ester on Combustion, Emission and Performance Characteristics of a DI Diesel Engine without Any Modifications." *Fuel* 278 (October): 118315.
21. Raju, P., K. Raja, K. Lingadurai, T. Maridurai, and S. C. Prasanna. 2021. "Glass/Caryota Urens Hybridized Fibre-Reinforced nanoclay/SiC Toughened Epoxy Hybrid Composite: Mechanical, Drop Load Impact, Hydrophobicity and Fatigue Behaviour." *Biomass Conversion and Biorefinery*, March. https://doi.org/10.1007/s13399-021-01427-8.
22. Sathiyamoorthi, Ramalingam, Gomathinayakam Sankaranarayanan, Dinesh Babu Munuswamy, and Yuvarajan Devarajan. 2021. "Experimental Study of Spray Analysis for Palmarosa Biodiesel-diesel Blends in a Constant Volume Chamber." *Environmental Progress & Sustainable Energy* 40 (6). https://doi.org/10.1002/ep.13696.
23. Sendhil Kumar, S., S. Sendhil Kumar, S. Dharani Kumar, and U. Magarajan. 2020. "Investigation of Mechanical and Wear Behaviour of Graphene Reinforced Aluminium Alloy 6061 Metal Matrix Composite." *Metallic Materials*. https://doi.org/10.4149/km_2020_5_341.
24. Shanmugam, Rajasekaran, Damodharan Dillikannan, Gopal Kaliyaperumal, Melvin Victor De Poures, and Rajesh Kumar Babu. 2021. "A Comprehensive Study on the Effects of 1-Decanol, Compression Ratio and Exhaust Gas Recirculation on Diesel Engine Characteristics Powered with Low Density Polyethylene Oil." *Energy Sources, Part A: Recovery, Utilization, and Environmental Effects* 43 (23): 3064–81.
25. Sudhakar, M. P., Merlyn Ravel, and K. Perumal. 2021. "Pretreatment and Process Optimization of Bioethanol Production from Spent Biomass of Ganoderma Lucidum Using Saccharomyces Cerevisiae." *Fuel* 306 (December): 121680.

TABLES AND FIGURES

Table 1. Finding the mean values for tensile strength,compressive strength,hardness,corrosive resistance for Al6061 hybrid composite reinforced with 15% weight fraction of B4C,Fly ash

Descriptives									
		N	**Mean**	**Std. Deviation**	**Std. Error**	**95% Confidence Interval for Mean**		**Minimum**	**Maximum**

						Lower Bound	**Upper Bound**		
Tensile	1	39	14.4000	2.44318	0.39122	13.6080	15.1920	10.20	18.59
	2	1	12.9100					12.91	12.91
	Total	40	14.3628	2.42314	0.38313	13.5878	15.1377	10.20	18.59
Compressive	1	39	53.5538	1.80668	0.28930	52.9682	54.1395	50.09	56.96
	2	1	50.9900					50.99	50.99
	Total	40	53.4898	1.82886	0.28917	52.9049	54.0746	50.09	56.96
Hardness	1	39	71.0154	2.75689	0.44146	70.1217	71.9091	65.44	75.75
	2	1	68.9400					68.94	68.94
	Total	40	70.9635	2.74103	0.43340	70.0869	71.8401	65.44	75.75
corrosion	1	39	0.6233	0.24664	0.03949	0.5433	0.7032	0.23	0.97
	2	1	0.9120					0.91	0.91
	Total	40	0.6305	0.24770	0.03917	0.5513	0.7097	0.23	0.97

Table 2. Finding the anova values by using the spss software. It is observed that on performing One-Way ANOVA, there is a statistical significant difference for all the investigated properties ($p<0.05$).

ANOVA						
		Sum of Squares	**df**	**Mean Square**	**F**	**Sig.**
Tensile	Between Groups	2.165	1	2.165	0.363	0.032

	Within Groups	226.827	38	5.969		
	Total	228.992	39			
Hardness	Between Groups	4.200	1	4.200	0.553	0.014
	Within Groups	288.818	38	7.600		
	Total	293.017	39			
Compressive	Between Groups	6.409	1	6.409	1.963	0.021
	Within Groups	124.035	38	3.264		
	Total	130.444	39			
corrosion	Between Groups	0.081	1	0.081	1.336	0.045
	Within Groups	2.312	38	0.061		
	Total	2.393	39			

Fig. 1. Parent Material Pure Aluminum

Fig. 2. Experimental Material Composite Material

Fig. 3. Stir Casting Process

Fig. 4. Tensile Strength

Fig. 5. Compressive Strength

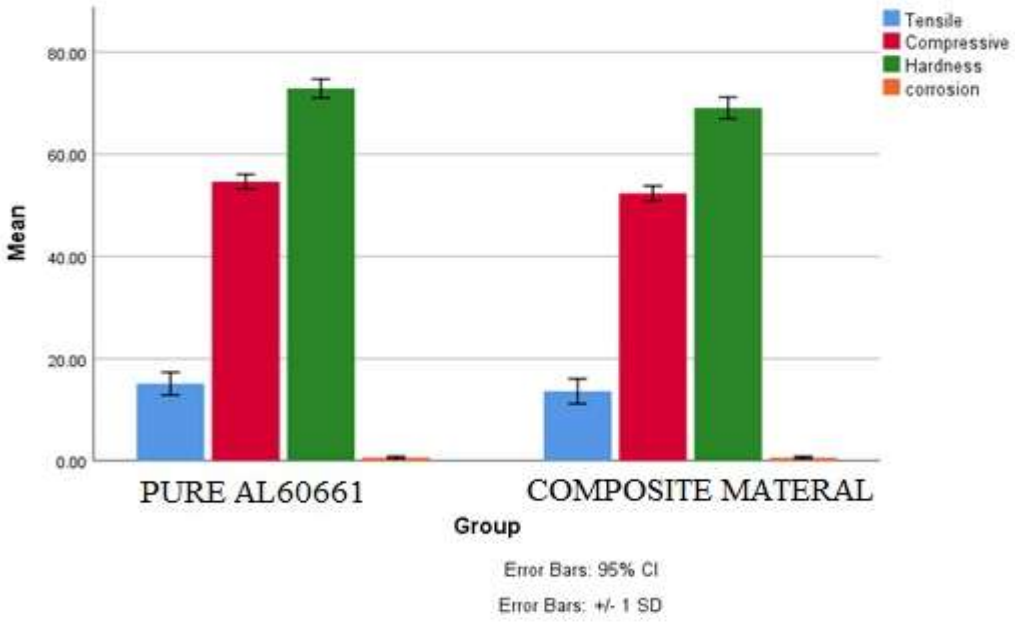

Fig. 6. Bar graph showing the comparison of mean tensile strength,compressive strength,hardness,corrosive resistance of al6061 hybrid composite reinforced with 15% weight fraction of B_4C+Fly ash and comparing the outputs with as-cast al6061.group 1 is parent material and group 2 is experiential material. Mean tensile strength value increases after adding boron carbide and fly ash material to the composite. The standard deviation of aluminum 6061 is better than metal matrix composite. Mean ± 1 SD.