iJRASET
International Journal For Research in
Applied Science and Engineering Technology

INTERNATIONAL JOURNAL FOR RESEARCH
IN APPLIED SCIENCE & ENGINEERING TECHNOLOGY

Volume: 8 Issue: V Month of publication: May 2020

DOI: http://doi.org/10.22214/ijraset.2020.5074

International Journal for Research in Applied Science & Engineering Technology (IJRASET)
ISSN: 2321-9653; IC Value: 45.98; SJ Impact Factor: 7.429
Volume 8 Issue V May 2020- Available at www.ijraset.com

An Investigation and Effect of Coconut Shell Ash and Egg Shell Particles of Aluminium based Composites

Prabhakaran. S[1], Felix Raj. P P[2], Mothiswaran. A[3], Barath. B[4], Mr. Dhayanithi. J[5], Mr. Mohanram. M[6]
[1, 2, 3, 4, 5, 6]*Department of Mechanical Engineering, M.A.M. College of Engineering and Technology, Trichy, Tamil Nadu, India*

Abstract: Chicken eggshell (ES) is an aviculture result that has been utilized as the fortification in the current examination which is recorded worldwide as one of the most disgusting ecological issues. The current work manages advancement of ES-fortified Al1100 lattice composites by cauldron throwing process with 0 to 10 wt% of fortification at an interim of 2 wt%. Al 1100 compound is chosen as the lattice material while carbonized coconut shell particles (CCNSp) and SiCp as support. Composites were readied utilizing fluid throwing strategy with Carbonized coconut shell 0% 2.5% 5% and Egg shell 0%, 5%, 10% wt % with consistent load of Silicon carbide 2% support. It has been seen that the rigidity and compressive quality of composites increments with the expansion of ES particles and the most extreme qualities were accomplished at 5wt% with consistent 2% of SiC. And afterward saw that hardness of composites increments with the expansion of ES particles and the greatest qualities were accomplished at 10 wt%. With the expansion in ES strengthening particles in lattice, molecule pulled out and molecule network debonding have been seen which lead to fragile crack. Because of this explanation unadulterated Al1100 has most extreme effect quality.

Keywords: Aluminum metal lattice composites, Crucible throwing, Reinforcement, Egg Shell, Coconut Shell

I. INTRODUCTION

Srisaran Venkatachalam [1] et.al were investigated the mechanical properties of aluminium reinforced with titanium dioxide particles which is fabricated through casting process. A comparative study has been conducted by varying the percentage of the reinforcement in the base metal matrix. The composite was casted and the samples were prepared, by simple turning and milling processes, for performing various mechanical tests. The reinforcement i.e. titanium dioxide weight percent of 5 %, 10 % and 15 % resulted in increasing ultimate tensile strength, impact strength, average hardness and density with increasing concentration of titanium dioxide particles, while the compressive strength decreases with increase in the concentration of titanium dioxide reinforcement. Hence, it can be concluded that as the percentage of titanium dioxide increases the properties show enhancement due to the development of strong bonding between the particles of reinforcement and the base matrix and also due to the wet ability property of the reinforcement in the base metal matrix. M. M. Siva [2] et. all were studied hybrid Aluminium matrix composite was fabricated through stir casting route. Coconut ash (CCNSp) and graphite (Gr) particles were used as reinforcement phases for the present study. The hybrid MMC was prepared with varying the Tio_2 particles volume fraction ranging from 5% to 10%.and fixed quantity 3% of graphite. The average on reinforced particles size of Tio_2 and graphite are 25 microns and 45 microns respectively. The stirring process was carried out at 200rev/min for 15 min. The microstructure and mechanical properties are investigated on prepared MMCs.

N. B. Dhokey [3] et.al were analyzed Metal matrix composites (MMCs) possess significantly improved properties including high specific strength; specific modulus, damping capacity and good wear resistance compared to unreinforced alloys. These composites initially replaced Cast Iron and Bronze alloys but owing to their poor wear and seizure resistance, they were subjected to many experiments and the wear behaviour of these composites were explored to a maximum extent and were reported by number of research scholars for the past 25 years. In the present investigation, they have chosen aluminium as a matrix phase and titanium oxide as a reinforcement phase. The aim of our project is investigate the wear behaviour of aluminium metal matrix on different amount of reinforcement. The titanium oxide, 5%, 10%, and 15% weight of aluminium was used to make three different specimen. Among all the fabrication process we choose stir casting because stir casting process are simplest and cheapest. Magnesium (4% by weight) was added in molten aluminium to improve the wet ability. After fabrication; the composites have been characterized for their wear behaviour to see the suitability as a wear resistant material. Wear test was performed as a function of sliding distance, applied load, sliding velocity with the help of Pin-On-Disc wear test machine.

C.S. Ramesh [4] et.al were verified aluminium based metal matrix composites are being used for a variety of applications such as military, aerospace, electrical industries and automotive purposes owing to their improved properties such as high strength to weight ratio, good ductility, high strength and high modulus, excellent wear and corrosion resistance. AMC attracts much attention due to their lightness, high thermal conductivity, and moderate casting temperature, corrosion resistance. Engine pistons, engine blocks and other automotive and aircraft parts operating under severe friction conditions are fabricated from reinforced aluminum matrix composites. The pure Aluminium was reinforced with TiO_2 particles 5% by wt., 10% by wt. 15% by wt. The composites were characterized by XRD, TGA, Wear, Compressive, Tensile, Hardness and Impact tests were carried out in order to identify mechanical properties. T.V. Christy [5] et.al were demonstrated the effect of passes on particle distribution, microstructure, microhardness and wear properties was systematically investigated. Micro structural studies revealed a fine equiaxed grain structure in the stir zone due to the dynamic recrystallization. The first pass surface composite sample results in agglomeration of particles toward the advancing side due to insufficient materials flow and strain. The second pass was carried out by changing advancing and retreating side of composite plate processed by the first pass. The results showed that marginal change in grain size was observed with homogeneous microstructure when compared to first-pass surface composite. Microhardness was carried out across the cross sections of the surface composites to obtain hardness profile. The tribological performance was assessed using a pin-on-disk tribometer. The result reveals that surface composites processed by the second pass show better hardness and wear resistance when compared to as-received aluminum. The wear mechanism shows a transition from adhesive wear in surface composites to the combination of abrasive and delamination wear in as-received aluminum.

C. Rajaravi [6] et.al were experimentally analyzed the casting process will start by mixing Aluminium matrix with Titanium Oxide and titanium Carbide reinforced with different percentage composition and the results will be compared with the values of pure Aluminium. The phase composition and morphology of material will be evaluated from hardness test. The microstructure of specimens will be revealed to investigate on continuous distribution of TiO2 and TiC in the metal matrix, which will be responsible for enhancement of tensile strength of the material. This feature is very likely and due to addition of Titanium Carbide (TiC) and Coconut ash (CCNSp) in Aluminium (Al) matrix, there will be a good interface bonding of uniformly dispersed submicron size of reinforced materials. Good stiffness, high strength to weight ratio, good thermal properties which are very beneficial for aerospace applications are emphasized in the current paper.

S.Suresh [7] et.al were studied A comparative study of the scope and surface properties of alumina (Al_2O_3) and Coconut ash (CCNSp) nano particles, synthesized using different methods, was carried out using Fourier-transform infrared spectroscopy (FTIR), ultraviolet-Vis diffuse reflection spectroscopy (UV-Vis DRS), and Raman spectroscopy, as well as X-ray diffraction methods. It is shown that the differences in the synthesis methods can change the surface properties of the nanoparticles, while maintaining the phase composition of the material. The nanoparticles of each material are shown to exhibit unexpected properties. In particular, the special luminescence characteristics of TiO2, a photon-energy shift from the rutile region into that region typical for the anatase, and a significant difference in the Lewis center concentration values for the alumina γ-phase were observed. This variation in the properties indicates the necessity to involve a wider range of analysis techniques and the importance of precisely characterizing the surface properties. To identify those nanoparticle functional properties that determine their interactions with other materials, a comprehensive study of their phase compositions and surface properties must be completed.

A. R. Kennedy [8] et.al were studied and compared regarding possible adverse health effects, ionic and particulate NM effects have to be taken into account. As NMs behave quite differently in physiological media, special attention was paid to techniques which are able to determine the biosolubility and complexation behavior of NMs. Representative NMs of similar size were selected: aluminum (Al0) and aluminum oxide (Al_2O_3), to compare the behavior of metal and metal oxides. In addition, Coconut ash (CCNSp) was investigated. Characterization techniques such as dynamic light scattering (DLS) and nanoparticle tracking analysis (NTA) were evaluated with respect to their suitability for fast characterization of nanoparticle dispersions regarding a particle's hydrodynamic diameter and size distribution. By application of inductively coupled plasma mass spectrometry in the single particle mode (SP-ICP-MS), individual nanoparticles were quantified and characterized regarding their size. SP-ICP-MS measurements were correlated with the information gained using other characterization techniques, i.e. transmission electron microscopy (TEM) and small angle X-ray scattering (SAXS). The particle surface as an important descriptor of NMs was analyzed by X-ray diffraction (XRD). NM impurities and their co localization with biomolecules were determined by ion beam microscopy (IBM) and confocal Raman microscopy (CRM). We conclude advantages and disadvantages of the different techniques applied and suggest options for their complementation. Thus, this paper may serve as a practical guide to particle characterization techniques.

ISSN: 2321-9653; IC Value: 45.98; SJ Impact Factor: 7.429
Volume 8 Issue V May 2020- Available at www.ijraset.com

II. CHOICE OF MATERIAL

A. Aluminium 1100

Aluminium 1100 is one of the more unmistakable aluminum composites. Due to the combinations great exhaustion opposition, particularly in thick plate structure, the material is determined for use in the aviation and military segment in fuselage applications in such regions as structures and wing pressure individuals. With improved break sturdiness and exhaustion split development, Alloy 1100 keeps on keeping up quality attributes.

B. Silicon Carbide

Silicon Carbide is the main synthetic compound of carbon and silicon. It was initially created by a high temperature electro-substance response of sand and carbon. Silicon carbide is a phenomenal grating and has been created and made into crushing haggles rough items for more than one hundred years. Today the material has been formed into a top notch specialized evaluation artistic with generally excellent mechanical properties.

C. Egg Shell

Eggshells were washed in water to expel the layer and afterward stuffed in a round tempered steel plate. The washed egg shells contained in the plate were dried in the sun for 6 hours. The dried eggshells were squashed physically with the guides of hand pressure and afterward at long last pummeled in a planetary ball factory. This processing was accomplished for 3hours after which the factory was offloaded. Uncovers the eggshells in two distinct structures.

Fig.1 Unpulverized and Pulverized of Egg Shell Samples

D. Coconut Shell

In this investigation, coconut shell debris (CSA) is utilized as a support material, which is an agro squander and liberally accessible. The amazing property of coconut shell contains high lignin, which supports wear opposition with improved erosion obstruction that builds the quality of the material. Because of its outstanding direction of structure and low debris content, coconut shell is best for making the enacted carbon.

Fig.2 Coconut Shell powder

Ratio	AL 1100 grams	CCNSp weight percentage	EGG SHELL	SILICON CARBIDE
I	800	0	0	0
II	800	2.5%-20g	5%-40g	2%-16g
III	800	5%-40g	10%-80g	2%-16g

Table-1. Percentages of Specimen

III. PREPERATION OF CASTING

In this undertaking we have utilized sand form throwing for produce the necessity size. Sand throwing, otherwise called sand shaped throwing, is a metal throwing process described by utilizing sand as the form material. It is generally modest and adequately hard-headed in any event, for steel foundry use. An appropriate holding specialist (normally dirt) is blended or happens with the sand. The blend is saturated with water to create quality and versatility of the mud and to make the total appropriate for trim. The expression "sand throwing" can likewise allude to a throwing created by means of the sand throwing process. Sand castings are delivered in specific production lines called foundries. Over 70% of every single metal throwing are delivered by means of a sand throwing process.

IV. CALCULATION OF SPECIMEN

A. Volume = $\pi/4\ d^2 * L$ = $\pi/4*2.5^2*30$---vol 147.26
B. Plate: L*B*H (cm)
1) =10* 1.5*1.5=22.5
2) 147.26 +22.5=169.76
C. Al=169.76 *2.7=458g+20% Extra-131.6 (Density-2.7 g/cm^3)
D. Total Al 1100-800 gram

V. EXPLORATORY WORK

A. Rockwell Hardness

1) Rockwell Hardness frameworks utilize an immediate readout machine deciding the hardness number dependent on the profundity of infiltration of either a precious stone point or a steel ball. Profound entrance showed a material having a low Rockwell Hardness number.
2) Be that as it may, a low entrance shows a material having a high Rockwell Hardness number. The Rockwell Hardness number depends on the distinction in the profundity to which a penetrator is driven by a clear light or "minor" load and a positive overwhelming or "Major" load.
3) The ball penetrators are hurls that are made to hold 1/16" or 1/8" measurement solidified steel balls. Additionally accessible are ¼" and ½" ball penetrators for the testing of milder materials.
4) There are two kinds of iron blocks that are utilized on the Rockwell hardness analyzers. The level faceplate models are utilized for level examples. The "V" type iron blocks hold round examples solidly.
5) Test squares or alignment squares are level steel or metal squares, which have been tried and set apart with the scale and Rockwell number. They ought to be utilized to check the precision and adjustment of the analyzer as often as possible.

B. Impact Test

Izod sway quality testing is an ASTM standard strategy for deciding effect quality. A scored test is commonly used to decide sway quality. Effect is a significant marvel in overseeing the life of a structure. On account of airplane, effect can happen by the winged creature hitting the plane while it is cruising, during take - off and arriving there is sway by the flotsam and jetsam present on the runway an arm held at a particular stature (steady potential vitality) is discharged. The arm hits the example and breaks it. From the vitality consumed by the example, its effect quality is resolved. The North American standard for Izod Impact testing is ASTM D256. The outcomes are communicated in vitality lost per unit of thickness, (for example, ft-lb/in or J/cm) at the score. On the other hand, the outcomes might be accounted for as vitality lost per unit cross-sectional zone at the score (J/m² or ft-lb/in²). In Europe, ISO 180 strategies are utilized and results depend just on the cross-sectional region at the score (J/m²). The components of a standard example for ASTM D256 are 4 x 12.7 x 3.2 mm (2.5" x 0.5" x 1/8"). The most widely recognized example thickness is 3.2 mm (0.125"), yet the width can fluctuate somewhere in the range of 3.0 and 12.7 mm (0.118" and 0.500").The Izod sway test varies from the Charpy sway test in that the example is held in a cantilevered bar setup rather than a three point twisting arrangement.

C. Tensile Test

Rubbing prepared joints are assessed for their mechanical attributes through tractable testing. A ductile test helps deciding pliable properties, for example, rigidity, yield quality, level of stretching, and level of decrease in region and modulus of flexibility. The welding parameters were arbitrarily picked inside the range accessible in the machine. The joints were made with arbitrary parameters and assess rigidity and consume off. At that point the joints were made and assess the mechanical and metallurgical attributes. The erosion welded examples were set up according to the ASTM norms. The test was done in a widespread testing machine (UTM) 40 tones FIE make.

ISSN: 2321-9653; IC Value: 45.98; SJ Impact Factor: 7.429
Volume 8 Issue V May 2020- Available at www.ijraset.com

D. Compressive Test

A compression test is any test wherein a material encounters restricting powers that push internal upon the example from inverse sides or is in any case packed, "crushed", squashed, or leveled. Motivation behind Compression Tests: The objective of a pressure test is to decide the conduct or reaction of a material while it encounters a compressive burden by estimating key factors, for example, strain, stress, and distortion.

IV. RESULTS

A. Rockwell Hardness

S.No	Material	HRB
R_1	Al-1100+100%	37
R_2	Al-1100+Es 5%+CCNSp 2.5%+SiC 2%	41
R_3	Al-1100+Es 10%+CCNSp 5%+SiC 2%	51

Table-2 Hardness Test Result

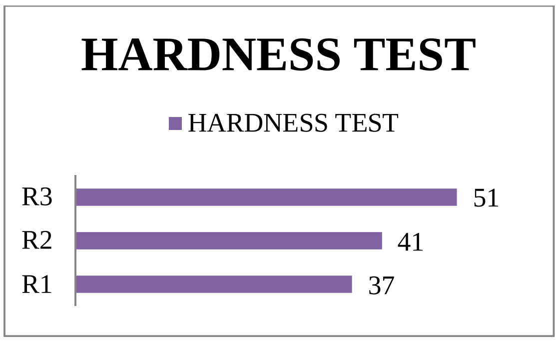


Chart-1. Hardness Test

B. Impact Test

S.No	COMPOSITION	Impact Strength (Joules)
R_1	Al-1100+100%	11
R_2	Al-1100+Es 5%+CCNSp 2.5%+SiC 2%	9
R_3	Al-1100+Es 10%+CCNSp 5%+SiC 2%	7

Table-3 Impact Test Result

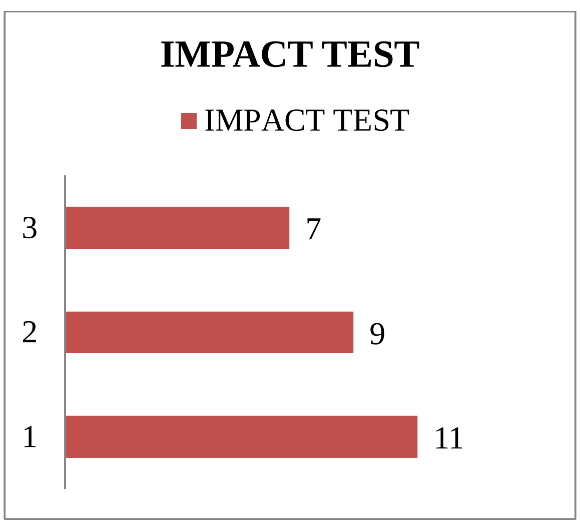


Chart-2. Impact Test

International Journal for Research in Applied Science & Engineering Technology (IJRASET)
ISSN: 2321-9653; IC Value: 45.98; SJ Impact Factor: 7.429
Volume 8 Issue V May 2020- Available at www.ijraset.com

C. Tensile Test

Ratio	Dia mm	CSA mm^2	YL kN	YS N/mm^2	TL kN	TS N/mm^2	IGL mm	FGL mm	%E	FD	%RA
A_1	16.12	204.17	3.24	15.87	5.96	29.19	50.00	51.47	2.94	15.79	4.05
A_2	15.97	200.39	11.49	57.34	16.72	83.44	50.00	51.39	2.78	15.37	7.37
A_3	16.04	202.15	8.67	42.89	13.57	67.13	50.00	51.24	2.48	15.46	7.10

Table-4 Tensile Test Result

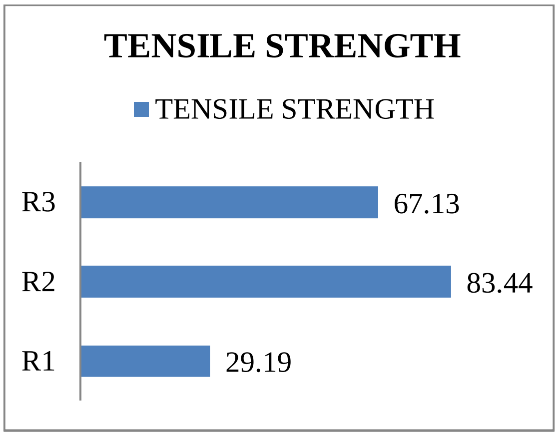


Chart-3. Tensile Test

D. Compressive Test

Identification	Dia mm	CSA mm^2	Compression Load KN	Compression Strength N/mm^2
R_1	17.68	245.60	34.59	140.84
R_2	17.59	243.11	42.16	173.42
R_3	17.95	253.16	43.08	170.17

Table-5 Compressive Test Result

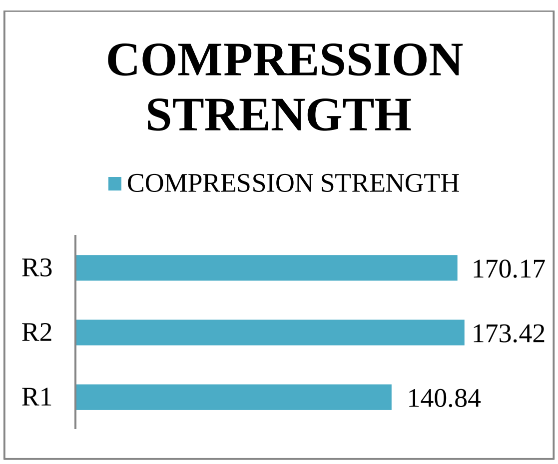


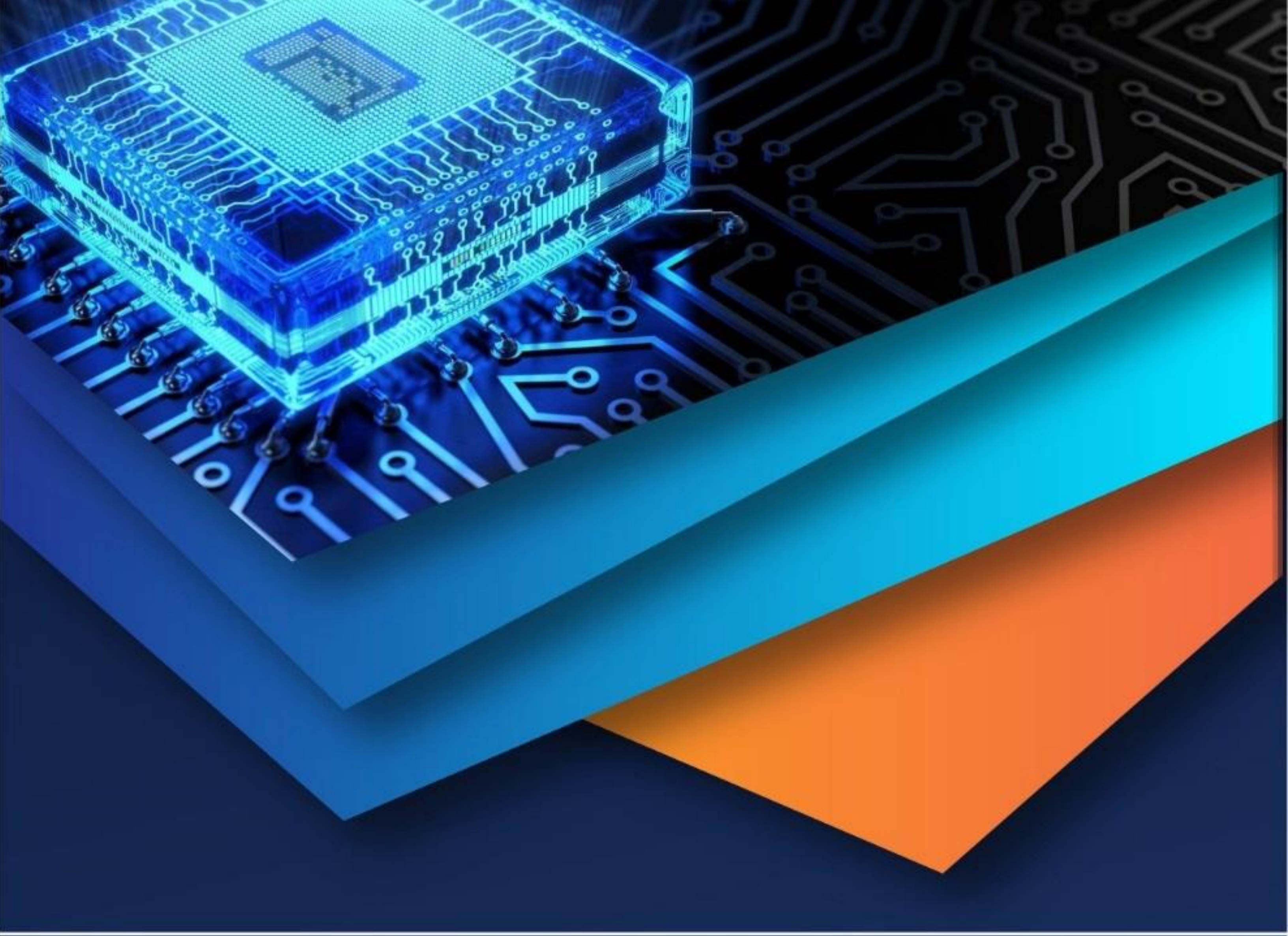
Chart-4. Compressive Test

V. CONCLUSION

It is discovered that the chicken eggshell (ES) particles have been effectively consolidated in Al1100 lattice composite through pot throwing strategy. It has been seen that the elasticity and compressive quality of composites increments with the expansion of ES particles and the most extreme qualities were accomplished at 5wt% with steady 2% of SiC. And afterward saw that hardness of composites increments with the expansion of ES particles and the most extreme qualities were accomplished at 10 wt%. The expansion in quality and hardness was come about because of the increment in the measure of the hard ES stage in the pliable Al1100 compound grid which prompted increment in separation thickness at the lattice molecule interphase. Further increment of ES particles in the grid prompts increment in hardness and quality which might be because of the expanded measure of caught air in this manner expanding the measure of pores. It has likewise been discovered that with the expansion in measure of ES fortification the thickness diminishes. With the expansion in ES strengthening particles in grid, molecule pulled out and molecule network debonding have been seen which lead to weak crack. Because of this explanation unadulterated Al1100 has most extreme effect quality.

REFERENCE

[1] Srisaran Venkatachalam Titanium Diboride Reinforced Aluminum Composite as a Robust Material for Automobile Applications International Conference on Materials, Manufacturing and Machining 2019 AIP Conf. Proc. 2128, 020010-1–020010-10; Published by AIP Publishing. 978-0-7354-1870-7.
[2] M. M. Siva Analysis of Micro structural, Corrosion and Mechanical Properties of Aluminum Titanium Di boride Particles (Al-TiB2) Reinforced Metal Matrix Composites (MMCs) Indian Journal of Science and Technology, Vol 9(43), DOI: 10.17485/ijst/2016/v9i43/100410, November 2016.
[3] N. B. Dhokey Wear Behavior and Its Correlation with Mechanical Properties of TiB2 Reinforced Aluminum-Based Composites Hindawi Publishing Corporation Advances in Tribology Volume 2011, Article ID 837469, 8 pages doi:10.1155/2011/837469.
[4] C.S. Ramesh Development of Al 6063–TiB2 in situ composites Materials and Design 31 (2010) 2230–2236
[5] T.V. Christy A Comparative Study on the Microstructures and Mechanical Properties of Al 6061 Alloy and the MMC Al 6061/TiB2/12P Journal of Minerals & Materials Characterization & Engineering, Vol. 9, No.1, pp.57-65, 2010 jmmce.org printed in the USA.
[6] C. Rajaravi Analysis on Tensile Strength of Al/TiB2 MMCs in FEA for Different Mould Conditions IOSR Journal of Mechanical and Civil Engineering (IOSR-JMCE) e-ISSN: 2278-1684,p-ISSN: 2320-334X, Volume 13, Issue 3 Ver. IV (May- Jun. 2016), PP 103-108 www.iosrjournals.org.
[7] S.Suresh Aluminum-Titanium Di boride (Al-TiB2) MMC Procedia Engineering 38 (2012) 89 – 97.
[8] A. R. Kennedy The microstructure and mechanical properties of TiC and TiB2-reinforced cast metal matrix Composites Journal of Materials Science 34 (1999) 933– 940.



10.22214/IJRASET

INDEX COPERNICUS
45.98

IMPACT FACTOR:
7.129

IMPACT FACTOR:
7.429

INTERNATIONAL JOURNAL FOR RESEARCH

IN APPLIED SCIENCE & ENGINEERING TECHNOLOGY