International Journal of Research
Available at https://edupediapublications.org/journals
e-ISSN: 2348-6848
p-ISSN: 2348-795X
Volume 04 Issue 09
August 2017

Characterization of Mechanical Properties of Al alloy MMC

K. John babu & J.P.Karthik
[1]pg Student, Department Of Mechanical Engineering, Rvr&Jc College Engineering, Guntur-19
[2]assistant Professor, Department of Mechanical Engineering, Rvr&Jc College Engineering, Guntur-19
kandrujohn@gmail.com & chandrakalachari@gmail.com

Abstract: *Aluminum is a silvery-white metal, the 13 element in the periodic table. One surprising fact about aluminum is that it's the most widespread metal on Earth, making up more than 8% of the Earth's core mass. It's also the third most common chemical element on our planet after oxygen and silicon. At the same time, because it easily binds with other elements, pure aluminum does not occur in nature. It is one of the lightest metals in the world: it's almost three times lighter than iron but it's also very strong, extremely flexible and corrosion resistant because its surface is always covered in an extremely thin and yet very strong layer of oxide film. The use of aluminum and its alloys in automotive components was limited in the early sixties and seventies but today the awareness on weightlessness made this material appreciable in terms of all automobile and industrial applications. Experiments have been conducted by reinforcing AL Alloy by varying weight fraction of almandine keeping all other parameters constant. Tensile and Hardness tests are conducted on the prepared components and the results were quite satisfactory.*

Introduction:

Composites were the combination of materials that have distinct physical and chemical properties. It combines both the properties of matrix and reinforcement and this characteristic feature of composites made it a preferable material among manufacturers and researchers. Metal matrix composites (MMCs) were widely accepted in automotive industry for the properties of wear resistance, expansion coefficient, fatigue strength and damping property Aluminum metal matrix composite (AMMCs) led to the development of advanced materials with the improved properties of lightweight, stiffness and temperature resistant . Light MMCs with ceramic reinforcement have gained attention for its improved mechanical properties as well as it was cost effective and has benefit towards the environment. The possible ways to develop AMMCs and the difficulties involved in the process were investigated for automotive applications. Researchers contributed several techniques for the manufacture of composites such as stir casting, plasma spraying, powder metallurgy and squeeze casting. Composites fabricated using powder metallurgy process was found to exhibit weak interface bond between matrix and reinforcement and in order to obtain composites with denser structure, powder metallurgy technique followed by an extrusion process were employed. Stir casting technique was the cost effective method among all other techniques for fabrication of MMCs .Stir casting technique was preferred over other techniques for its ability to achieve uniform distribution of reinforcement particles.

M. G. Anantha Prasad et al. 2015 [1], investigated the mechanical behavior of Aluminum (LM13)-Garnet Metal Matrix Composites using chill casting technique. In this paper, he found that UTS and hardness increased from 3%, 6% and 9% by wt. percentage of garnet and then decreased for 12% by wt. percentage of garnet. Dr. Ali HubiHaleem et al. [2], investigated the silicon carbide particle reinforced aluminum matrix composite prepared using stir casting technique. In this paper, he found that Vickers Micro Hardness value is gradually increasing with increase of %wt. of Sic

Materials and Methods:

Cu	Mg	Si	Fe	Mn	Ni	Zn	Pb	Ti	Tin	Others each	Other total	Al
2.0-4.0	0.5-1.5	8.5-10.5	1.2	0.5	1.0	1.0	0.2	0.1	0.2	0.05	0.15	remainder

Stir Casting: Manufacturing of aluminum alloy based casting composite materials via stir casting is one of the prominent and economical route for development and processing of metal matrix composites materials. Properties of these materials depend upon many processing parameters and selection of matrix and reinforcements. Stir casting is also known as vortex technique. In this process reinforcing phases (ceramic particles, short fibres) are introduced by the means of mechanical stirring into molten metal. Many authors suggested that reinforcement in particulate form up to 30% by wt. can be added in molten alloy, to achieve better distribution of the reinforcement. Reinforcement is added forcefully in to the molten stage of aluminium and obtaining homogeneity during solidification of fabricated composite depends on following factors. AL Alloy was heated up to 6500C and the preheated almandine garnet powder is added to the molten metal based on % by wt. calculations. The stirred is driven by ½ HP AC motor at 400 rpm. After this, the

International Journal of Research
Available at https://edupediapublications.org/journals
e-ISSN: 2348-6848
p-ISSN: 2348-795X
Volume 04 Issue 09
August 2017

mixture is poured into the mould containing 5 slots of 150mm length and 20mm diameter.

Fig 1: Aluminium Stir Casting Furnace

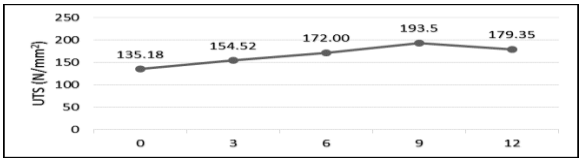
Mechanical Properties:

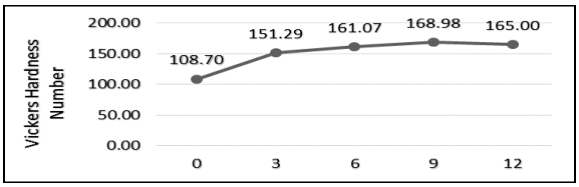
Tensile Test: Tensile is also known as tension testing, it is a fundamental material science test in which a sample is subjected to a controlled tension until failure. A tensile specimen is a standardized sample cross-section. It has two shoulders and a gage (section) in between. The shoulders are large so they can be readily gripped, whereas the gauge section has a smaller cross-section so that the deformation and failure can occur in this area. The test process involves placing the test specimen in the testing machine and slowly extending it until it fractures. During this process, the elongation of the gauge section is recorded against the applied force. The data is manipulated so that it is not specific to the geometry of the test sample.

Hardness Test: The Vickers hardness test was developed in 1921 by Robert L. Smith and George E. Sandland at Vickers ltd as an alternative to the Brinell method to measure the hardness of materials. The Vickers test is often easier to use than other hardness tests since the required calculations are independent of the size of the indenter, and the indenter can be used for all materials irrespective of hardness. For this test, 20mm diameter work pieces of length around 15mmwas considered. The work pieces were polished on both sides. Then the indent was positioned such that there was sufficient clearance from the specimen edge and between the individual indents. A force of 200kgfis applied on the work piece in the testing machine. The size of the indent left by the indenter at the defined test force in the surface of the specimen indicates the hardness of the test material. The force is applied for a dwell time of 15 seconds and the size of indentation (the distance between diagonals) is measured in the machine and hardness number is calculated.

Results and Discussion:

Tensile and Hardness Test Results:





In AL Alloy the uniform distribution of the reinforcement particle bearing the stress distribution homogeneously.If the weight percentage of reinforcement reaches certain level the reaction in aluminiumalloy with particle causes the density of garnet particles at a particular place to increase, hence causing an increase in brittleness value which in turn decreases the tensile strength.

1. Conclusions:

Aluminum matrix garnet-carbon reinforced composites were successfully cast by stir casting technique. Test result showed that these MMCs were greatly influenced by the dispersed garnet particles in AL alloy of aluminium. Hardness & UTS of the composite are found to increase on the wt. % of the dispersed garnet particles in AL alloy of aluminium. A dispersion content 9 wt. % Garnet was found to increase the mechanical properties, and therefore, it is considered as the optimum limit.

References

1. Abdul Saheb, Newal Muhammad Dawood Babylon University –Materials Dunia Engineering Collage. SIC particle reinforced Al matrix.
2. Lal Krishna S.K, Arun& Sandeep , Department of Mechanical Engineering, Sree Buddha College of Engineering, University of Kerala, India.
3. G.G.Hosmani, Mechanical engineering department, klecetchikodiKle'skle college of engineering and technology.
4. Prakash Gadade, Arun L.R, International Journal of Innovative Research in Science, Engineering and Technology, 2013.
5. A. Chennakesava Reddy and EssaZitoun, Indian Journal of Science and Technology, 2010. Sumod Daniel, Dr .G.Harish ,IOSR Journal of Engineering (IOSRJEN), aluminium MMC behaviour, 2014.