

Aluminium Reinforced Metal Matrix Composites

T. Subash
Assistant Professor
Dept of AERO-
J.J.College of Engineering.

P. Rajarajagopalan
Assistant Professor
Dept of AERO
J.J.College of Engineering.

G. Harshavardhini
Dept.of AERO-
J.J.College of Engineering.

P. Keerthana
Dept.of AERO-
J.J.College of Engineering.

V. Kishore Kumar
Dept.of AERO-
J.J.College of Engineering.

Abstract:- This paper reviews about the manufacturing of metal matrix composite by using aluminium e- glass fiber and epoxy resin. The composite material playing significant role in design and development of commercial aircraft and composite has proved that it can effectively reduce weight about 20%. The metal matrix composite (mmc) is composite material with at least two constituent parts, one being a metal necessarily, the other material may be a different metal or another material, such as a ceramic or organic compound. When at least three materials are present it is called a hybrid composite. Metal matrix composite represent an attractive material to be used in air frame and engine application because of their high elastic modulus and strength and low density. These requirements improve performance particularly higher thrust to weight ratio in aerospace application has resulted in the introduction and high strength and density material. Current trend using from automobile industry for piston, cylinder, brake and aerospace application for fuselage, wing, rudder.

This paper describe about the manufacture of aluminium metal matrix composite in different ratio under the different manufacture technology.

Key Words: Composites, Aluminium, Mechanical Property, E-Glass Fiber.

INTRODUCTION

Aluminium metal matrix composites are attractive for a wide variety of aerospace and defense application but it has lower resistance to strength and hardness. One of the main problems in the design of aerospace structures in the choice of material that satisfies requirements of the exploitation of the future product. The degree improvement of the mechanical property of MMC is strongly dependent on the kind of reinforcement on improved mechanical properties occurs on reinforced compared to uninforced MMC alloy to overcome the problem E- glass fiber is added as a reinforcement particle to enhance the mechanical behavior of Al MMC. In recent years, aluminium based composite material have gained significance in aerospace, automotive and structural application due to

their enhance mechanical property and good stability at high temperature. Metal matrix composite are increasing by becoming material for advanced aerospace application because their properties can be tailored through the addition of selected reinforcement. The composite was prepared both powder metallurgy method and stir casting method. Specimen was examined using standardizing tests which are microstructure analysis compression test and Rockwell hardness test.

2. MANUFACTURING TECHNOLOGY

Manufacturing process is that part of the production process which is directly concerned with the change of form or dimensions of the part being produced. It does not include the transportation handling or storage of parts as they are not directly concerned with the change in to the form is dimension of the produced.

Hand- Lay- Up

Hand-lay-up is a hand open molding method suitable for making a wide variety of composites products. This is used for very small to very large production. However, it is feasible to produce substantial production quantities using multiple molds. Hand-lay-up is the simplest composites molding method. This is offering low cost tooling simple processing and a wide range of part size.

Stir Casting

Conventional stir casting process has been employed for producing discontinuous particle reinforced metal matrix composites. Stir casting is a liquid state method for composite materials fabrications, in which dispersed phase is mixed with a molten matrix metal by means of mechanical stirring the liquid composite material is then cast by conventional die casting method.

Fabrication of aluminium matrix composites

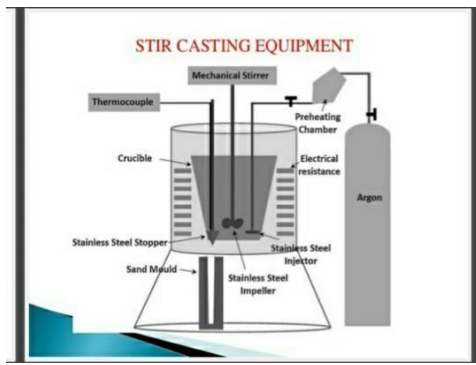


Figure 1: Stir Casting Equipment



Figure 2: Stir Casting Procedure

Stir casting process which is one of the liquid metallurgy techniques is used to AMC. The advantages of using this technique are:

- Flexibility
- Simple and less expensive
- Wide selection material
- Better matrix –particle bonding

However some problem with stir casting includes

- Porosity
- Poor wettability
- Heterogeneous distribution

3. LITERATURE REVIEW

Aluminium silicon carbon composites

The evaluation of mechanical behavior to Al-Sic metal matrix composite has been studied in this paper. The selection of material from this paper are aluminium & Sic. [1]The ratio of material has been chosen are Al & sic 12%, 10%&20%. The manufacturing process of stir casting method used in this paper. The conduction of test from this method are tensile stress, bending stress, hardness test & microanalysis test. The Al-sic metal matrix composite were cast in the cast iron metal mold by casting process. The result shows that the matrix alloy 7072 exhibits lower ductility than the matrix alloy 6063.

Mechanical behavior of Aluminum MMC

This paper reviews about the experimental investigation on mechanical behavior of aluminium metal matrix composite.[2] The selection of material from the paper Al₂O₃ fiber, Sic & Al 7073. The ratio chosen in this method by stir casting method are cu-1.6%, cr-0.15%, Mn -0.3%, mg - 2.5%, si- 0.4%, ti-0.2%, zn-5.5%,fe-0.5%, al-88.5%. The result from this paper are, the hardness test conducted through Vickers hardness test having microscope 10 xs and 40 xs. The result shows that the stir casting method is the best method to manufacture hybrid metal matrix composite.

Ultra-light space craft construction made of composite material

This paper reviews about the manufacture from the ultra-light spacecraft construction made of composite material.[3] The selection of material from this method Al, Ti, alloy steel, glass epoxy kelvar epoxy & graphite epoxy. The manufacturing process from this paper autoclave method & RTM process. The conducted test from the paper hardness test, tensile test, thermal test. This paper shows that there are some recommendations for choosing of material component and their manufacturing techniques depending on application of the structure, its operating conditions and low distribution.

Fabrication of Al MMC

This paper reviews about the fabrication of aluminium metal matrix composite.[4] The selection of material from these paper TIC, SIC, AL₂O₃. The ratio of material in this selection process are Aluminium 5%, Cu 10%, &aluminium 45% and cu alloy. The conduction process from the paper by using stir casting process and powder metallurgy. The various studies has enriched our knowledge about the processing of aluminium alloy composite, their physical properties, mechanical property.

Hybrid laminate composites

This paper reviews about the aluminium glass fiber and aluminium carbon fiber hybrid laminates [5]. The selection of material from this process are aluminium, glass fiber, carbon fiber. The conducted test from the paper are bending test and tensile test. This paper has been completed with mechanical test achieved at UPU to evaluate the composite material regarding their fatigue, impact and concentrate effort.

4. CONCLUSION

This review presents the views, theoretical and experimental results obtained and the conclusions made over the years by varies investigators in the field of aluminium MMCs. A considerable amount of

interest in Al-MMCs evinced by researchers from academics and industries has helped in conduction of various studies and has enriched our knowledge about the processing of Aluminium Alloy composites, their physical properties, mechanical properties. It has been observed that among all the

REFERENCES:

- [1] Chawla, K.K (1998). Composite materials: Science and Engineering, Springer-Verlog, N.Y.
- [2] Rajendra.S.K, Ramesha.C.M, "Survey of AL7075 Aluminium Metal Matrix Composites" International journal of science and research(2013).
- [3] V.I. Slinvinskij, G. V. Tkachenko, M. V. Slinvinskij, Jeftektivnost' primeneniya sotovyh konstrukcij v letatel'nyh apparatah, Vestnik SibGAU im. M. F. Reshetneva, Krasnojarsk, 2005, pp. 169-173.
- [4] Flemings M C, Behavior of metal alloys in the semisolid state, Metallurgical Transactions, 1991, 22A: 957-981
- [5] Rene Alderliesten, On the development of hybrid material concepts for aircraft structure, Recent Patents on Engineering 2009, 3, 25-38
- [6] Taguchi, G. (1986). Introduction to Quality Engineering, Asian Productivity Organization.
- [7] R. Keshavamurthy, Sadananda Mageri, "Microstructure and Mechanical Properties of Al7075-TiB₂ in Si-tu Composite". Research Journal of Material Sciences.
- [8] Eger S.M. Proekitirovanie samoletov: uchebink dlj vuzov, logos, Moscow, 2005.
- [9] P.P. Camanho, A. Fink et al, Hybrid-titanium- CFRP laminates for high performance bolted joints, Composites: Part A 40 (2009) 1826-1837
- [10] P. J. Ward, H. V. Atkinson, P. R. G. Anderson, L. G. Elias, B. Garcia, L. Kahlen and J-
- [11] M. Rodriguez-Ibabe, "Semi-solid processing of novel MMCs based on hypereutectic aluminum-silicon alloys" Acta Materialia, Vol. 44, No. 5, 1996, pp.1717-1727.
- [12] fabrication techniques considered, stir casting stands out as the most economical method.