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A Review on Stir Casting Process and Parameters

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ABSTRACT

In Aluminium Metal Matrix Composite, aluminium forms matrix phase while other constitute plays a role of reinforcement which is generally ceramic or non metallic hard material. These reinforced materials play an important role in the characterization of mechanical properties of the composites. This paper reviews stir casting process and its parameters. These process parameters also affect the mechanical properties of the metal matrix composites.

Keywords-- Aluminum metal matrix composites, reinforcements, Stir casting process

I. INTRODUCTION

Stir casting Technique is a type of liquid state fabrication of Metal Matrix Composites (MMCs). In this process, short fibers, ceramic particles (which are known as dispersed phase) are mixed with a molten metal (matrix). During mixing, mechanical stirrer is used. Now this liquid composite material is casted by conventional casting methods. [1]. In the preparation of MMCs by stir casting method, there are three factors, uniform distribution of reinforced material, Wettability between substances and minimization of porosity should be deal with care so that good metallurgical properties can be obtained. Process parameters, stirrer design, rotational speed, stirring time, preheat temperature of reinforcement, temperature of mould (preheat), reinforcement feed rate, wettability-promoting agent, pouring of melt should be properly controlled [2-4].

II. LITERATURE REVIEW

Hossein Abdizadeh et.al [5] fabricated AMMC reinforced with nano Mgo (1.5, 2.5 and 5 vol%) by stir casting and powder metallurgy methods. During fabrication of AMMC Processing temperature of 800, 850 and 950^0c for stir casting and 575, 600 and 625^0c for powder metallurgy have been considered. and mechanical properties are investigated. Al- nano Mgo composite exhibited high hardness values for 5 vol % of Mgo and better mechanical properties were observed at 625 and 850^0c for powder metallurgy and stir casting respectively.

L. Rasidhar et.al [6] casted Aluminium ilmenite nano composite via stir casting technique having 1 to 5 weight percentage of ilmenite. During fabrication, molten metal (850^0C) is stirred for 10-15 min with rpm 650 to 700. To minimize the oxidation of molten aluminium, argon gas is supplied in the crucible. The increase in tensile and hardness values was observed with increase in reinforcement. Tensile and hardness values were maximum at 5% wt of ilmenite reinforcement.

Mahendraboopathi .M et.al. [7] fabricated Al-2024 reinforced with silicon carbide and fly ash hybrid metal matrix composites by two-step stir casting process. The optical micrographs revealed that distribution of SiC and fly ash particles were uniform in aluminium metal matrix composite. The author observed that increase in wt fraction of reinforcement, tensile strength, yield strength and hardness of the composite will also increase. It is also concluded by the author that if the percentage of SiC and fly ash is increased then the rate of elongation of the hybrid MMCs is decreased significantly.

Manoj Singla et.al [8] fabricated aluminium (98.41% C.P) based silicon carbide (320-grit) particulate metal matrix composite the two step stir casting technique. Reinforcement of SiC was 5, 10, 15, 20, 25, and 30% by weight. During fabrication, all other parameters were kept constant. Authors observed that at 25% wt fraction of SiC

reinforcement, maximum hardness and maximum impact strength was obtained.

Velmurugan et al [9] manufactured Al 6061-SiC/Graphite hybrid composite by stir casting technique with graphite stirrer. Fabrication of AMMC is carried out with10 wt% of SiC and 4wt% of graphite particles . Authors observed that wear resistance and brittleness are improved with the addition of SiC particles while addition of graphite particles improves the surface finish because they act as a solid lubricant. That is why heat generation during machining is reduced.

Sourav Kayal et.al [10] fabricated Aluminium alloy (LM-6)- SiCp composite by stir casting method. During fabrication of AMMCs, weight percentage of SiC was varied 2.5, 5, 7.5, 10, 12.5, and 15%. From SEM images uniform distribution of SiC particles in the composite samples were observed. Authors also observed that with increase in the fraction of SiCp, hardness was also increased.

V. Ramakoteswara Rao et.al. [11] produced Al 7075 and TiC metal matrix composite by stir casting route. In this fabrication reinforcement percentage of TiC was 2 to 10% by wt. Authors observed that if reinforcement particulates (TiC) percentage was increased, hardness was also increased.

Rama Rao et.al. [12] fabricated aluminium-boron carbide composites by stir casting techniques with different particulate weight fractions (2.5, 5 and 7.5%).The authors observed that distribution of the boron carbide particles in the samples were uniform. Tensile strength and hardness of the composite increased while density was decreased with increasing the amount of the boron carbide in the AMMC.

Wahab M.N. et al. 2009, [13], Prepared aluminum metal matrix composites reinforced by Aluminium Nitride (2-10 wt%).The authors revealed that hardness of the composite was increased by the addition of Aluminium Nitride.

III. CONCLUSION

The above literature survey reveals that mostly authors fabricated the metal matrix composite with stir casting technique which is simplest and cheapest. Authors used silicon carbide, boron nitride, aluminium oxide, fly ash etc. as reinforcement in the composites and for homogeneous distribution of particles in the composites two step stir casting technique is useful.

REFERENCES

[1] B. Kandpal, J. Kumar and H. Singh, Production Technologies of Metal Matrix Composite: A Review, IJRMET Vol. 4, Issue 2, Spl - 2 May - October 2014.
[2] S. Kulkarni, J. Meghnani and A. Lal, Effect of Fly Ash Hybrid Reinforcement on Mechanical Property and Porosity of Aluminium 356 alloy, Elsevier, Procedia Materials Science 5 (2014) 746-754.
[3] S. Shinde, Manufacturing of Aluminum Matrix Composite Using Stir Casting Method, IJIERT, Vol. 2, Issue 5, May-2015.
[4] P. Sharma, Production of AMC by stir casting – An Overview, International Journal of Contemporary Practices, ISSN: 2231-5608, Vol.2, Issue 1.
[5] Hossein Abdizadeh, Reza Ebrahimifard, Mohammad Amin Baghchesara, Investigation of microstructure and mechanical properties of nano MgO reinforced Al composites manufactured by stir casting and powder metallurgy methods: A comparative study, Composites: Part B 56 (2014) 217–221.
[6] L. Rasidhar, Dr. A. Rama Krishna and Dr. Ch. Srinivas Rao, Fabrication and Investigation on Properties of Ilmenite (FeTiO3) based Al-Nanocomposite by Stir Casting Process, International Journal of Bio-Science and Bio-Technology Vol. 5, N o. 4, August, 2013.
[7] M.Mahendra boopathi, K.P. Arulshri N. Iyandurai, " Evaluation of mechanical properties of aluminum alloy 2024 reinforced with silicon carbide and fly ash metal matrix composites", American journal of applied sciences, 10, 2013, 219-229 .
[8] Manoj Singla, D. Deepak Dwivedi, Lakhvir Singh, Vikas Chawla, Development of Aluminium Based Silicon Carbide Particulate Metal Matrix Composite Journal of Minerals & Materials Characterization & Engineering, Vol. 8, No.6, pp 455-467, 2009.
[9] Velmurugan C, Subramanian R, Thirugnanam S & Ananadavel B. Experimental investigations on machining characteristics of Al 6061 hybrid metal matrix composites processed by electrical discharge machining. International Journal of Engineering, Science and Technology, 3(8) 87-101, 2011
[10] Sourav Kayal , Behera. R, Nandi. T, Sutradhar. G, Solidification behavior of stircast Al alloy metal matrix composites, International Journal of Applied Engineering Research, dindigul, Volume 2, No 2, 2011.
[11] Ramakoteswara Rao.V., Ramanaiah.N., and Sarcar.M.M.M., "Fabrication and investigation on Properties of TiC reinforced Al7075 metal matrix composites", Applied Mechanics and Materials, 592-594 ,2014, 349-353.
[12] S.Rama rao, G. Padmanabhan, "Fabrication and mechanical properties of aluminium-boron carbide composites", international journal of materials and biomaterials applications, 2, 2012, 15-18.
[13] M. Wahab, A. Daud and M. Ghazali, Preparation and characterization of stir cast-aluminum metal matrix composites, International Journal of Mechanical and Materials Engineering, Vol. 4, (2009), No. 2, 115-117.