FABRICATION OF THE SPECIAL ALLOYS USING STIRCASTNG PROCESS WITH RADIOGRAPHY AND NDT APPORACH

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Abstract:
Nondestructive testing is relevant in terms of degradation of the material during the operation with long service life without the possibility of replacement or major repairs of the product. Issues concerning defectoscopy occupy an important place in modern applied phisics and industry. Additive manufacturing is a technique which builds structures by depositing material in a layer-by-layer manner. Wire plus arc additive manufacturing technology also belongs into this group of manufacturing processes. In this paper, we explain some basic process planning and implementation techniques, as well as the main advantages and disadvantages of the process. In addition, we discuss the potential of in-process non-destructive ultrasonic testing application to this process, in order to inspect the quality of the part while it is being produced, and to enable eventual repairs in-situ. Some authors have already presented the idea of non-destructive testing for AM products, and stated that ultrasonic testing could provide the most reliable results for detecting the lack of fusion, porosity, and other possible flaws. While researches so far were limited to post-process testing, this paper proposes the idea of in-process testing, which could provide a chance to find the flaws and the defects earlier in order to change the parameters in-situ, and avoid production of the whole part if it is already recognized as unacceptable. Despite some constraints, we believe the proposed method has great potential and represents a challenge worth investigating in more detail in the future.

I. INTRODUCTION:

Stir casting: This involves incorporation of ceramic particulate into liquid aluminium melt and allowing the mixture to solidify. Here, the crucial thing is to create good wetting between the particulate reinforcement and the liquid aluminium alloy melt. The simplest and most commercially used technique is known as vortex technique or stir-casting technique. The vortex technique involves the introduction of pre-treated ceramic particles into the vortex of molten alloy created by the rotating impeller. Vortex-mixing technique for the preparation of ceramic particle dispersed aluminium matrix composites was originally developed at the Indian Institute of Science. Subsequently several aluminum companies further refined and modified the process which are currently employed to manufacture a variety of AMCs on commercial scale.

Microstructural in homogeneties can cause notably particle agglomeration and sedimentation in the melt and subsequently during solidification. Inhomogeneity in reinforcement distribution in these cast composites could also be a problem as a result of interaction between suspended ceramic particles and moving solid-liquid interface during solidification. Generally it is possible to incorporate upto 30% ceramic particles in the size range 5 to 100 μm in a variety of molten aluminum alloys. The melt–ceramic particle slurry 11 may be transferred directly to a shaped mould prior to complete solidification or it may be allowed to solidify in billet or rod shape so that it can be reheated to the slurry form for further processing by technique such as die casting, and investment casting. The process is not suitable for the incorporation of sub-micron size ceramic particles or whiskers. Another variant of stir casting process is compo-casting. Here, ceramic particles are incorporated into the alloy in the semi solid state.

Stir Casting is characterized by the following features:

• Content of dispersed phase is limited (usually not more than 30 vol. %).
• Distribution of dispersed phase throughout the matrix is not perfectly homogeneous:
  1. There are local clouds (clusters) of the dispersed particles (fibers);
  2. There may be gravity segregation of the dispersed phase due to a difference in the densities of the dispersed and matrix phase.

• The technology is relatively simple and low cost.

Distribution of dispersed phase may be improved if the matrix is in semi-solid condition. The method using stirring metal composite materials in semi-solid state is called Rheocasting. High viscosity of the semi-solid matrix material enables better mixing of the dispersed phase.

II. Literature review:

Rama Rao et al (2012) studied the fabrication and mechanical properties of aluminium-boron carbide composites. The aluminum alloy-boron carbide composites were fabricated by liquid metallurgy techniques with different particulate weight fractions (2.5, 5 and 7.5%).The authors observed that Uniform distribution of the boron carbide particles in the matrix phase, hardness of the composites increased and density was decreased with increasing the amount of the boron carbide in the matrix phase

Parker WJ et al (2012) have explained the flash method of determining thermal diffusivity, heat capacity and thermal conductivity. A high-intensity short-duration light pulse is absorbed in the front surface of a thermally insulated specimen a few millimeters thick coated with camphor black, and the resulting temperature history of the rear surface has been measured by a thermocouple and recorded with an oscilloscope and camera.

SateeshItkale et al (2016) Manufacturing of any object in the aerospace components that to particularly through forming process is to achieve the product superiority characteristics and mechanical properties with process cost and time, Aluminium alloys with light weight and high performance characteristics are important materials for aerospace applications. The mechanical properties of different Aluminium alloys such as AA6061, AA7075 were evaluated and tensile test was performed under annealed condition and these alloys have excellent corrosion resistance and machining properties. In this project we have done that the hardness test, Microstructure study and mechanical properties such as Ultimate tensile strength, Yield strength, and % of elongation as well as % of reduction at fracture are performed by experimentally and then these results were compared with theoretical as well as COSMOS works analysis tool.

Ganeshkumar, A.G et al (2014) Electronics waste is contains heavy metals and other toxic substances such as polychlorinated Bi-phenyls, Etched chemicals, etc. E-waste pose risk to health hazards such as inflammation and oxidative stress precursor to cardiovascular diseases, skin diseases, DNA damage and cancer, etc, and the dumping of E-waste spoils the fertility of the soil and causes lot of hazards to ecosystem. E-waste can be considered as a resource that contains use the full materials of economics benefit from recovery of plastics, Iron, Glass, Aluminium, Copper and precious metal such as Silver, Gold, Platinum, Palladium, etc.

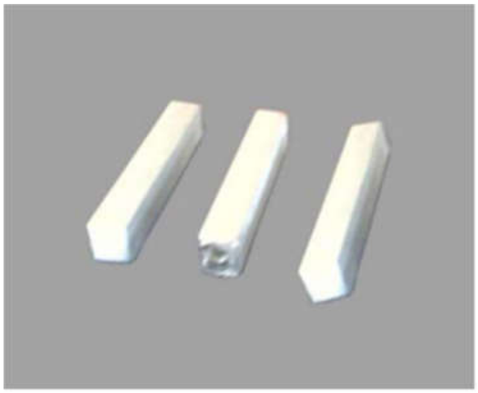
III. Methodology:

Stir casting

The simplest and most commercially viable technique is the vortex technique or stir casting technique. The stir casting setup consists of a furnace, an electric motor with a stirrer arrangement and temperature sensors.

In this method, ceramic particulates are incorporated into liquid metal melt and the mixture is allowed to solidify. It is important to create a good wetting between the particulate reinforcement and the liquid metal. The vortex technique requires the introduction of pre-treated ceramic particles into the vortex of the molten matrix created by a rotating impeller. Generally, it is possible to incorporate up to 30% ceramic particles in the size range 5 to 100 m in a variety of molten aluminium alloys.

Pictorial view of sample containing 5% offlyashby weight for hardness test

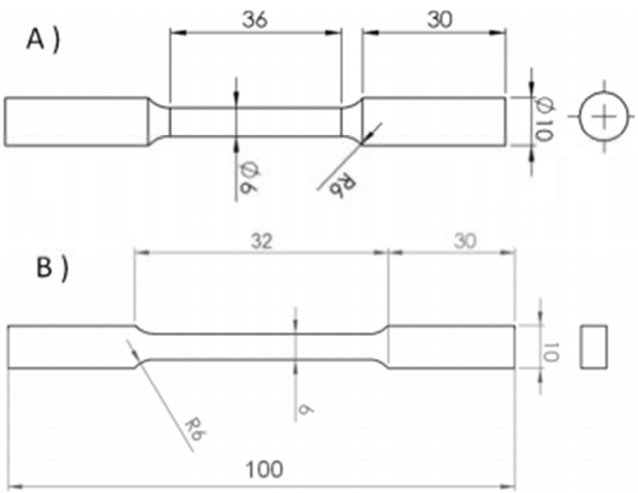


Pictorial view of samples for impact test

Pictorial view of sample for comparing indentation load with normalized displacement

Chemical composition ofAA 6061-T6 alloy

Element	Mg	Si	Fe	Mn	Cu	Cr	Ti	Al
Wt%	0.825	0.711	0.342	0.023	0.152	0.017	0.083	Balance



Geometry and dimensions of the standard A) Round and B) Flat tensile specimens used in this study. All values presented in mm

Tensile samples with tubes machining
Sample 1: Al SIC +Fly ash + Husk
Sample 2: Al Sic + Fly ash + *TiB2*
Sample 3: Al 6061 + Fly ash+ Husk

The above figure demonstrates the specimen 1 of carbon NANO - polymer made of elastic testing which is gotten in strong express the malleable load is connected on the material.

The above figure demonstrates the specimen 2 of carbon NANO - polymer made of elastic testing which is gotten in strong express the tractable load is connected on the material.

The above figure demonstrates the specimen 3 of carbon NANO - polymer made of pliable testing which is gotten in strong express the elastic load is connected on the material and the entire arrangement is finished.

NDT & Tensile samples

Following fig 's shows testing sample preparation

The above figure shows the sample-1 of carbon NANO -polymer made of non-destructive testing which is obtained in solid state.

The above figure demonstrates the specimen 2 of carbon NANO - polymer made of non-damaging testing which is gotten in strong state in isometric view.

The above figure demonstrates the specimen of carbon NANO - polymer made of non-dangerous testing which is gotten in strong state in the wake of applying loads.

Created polymer based items having no machining prerequisites with the exception of cleaning yet the metal network composites required machinability criteria on the grounds that the generation of single throwing is not doable financially as wells as periodical machining. This marvels of machining perception required to know the surface nature of the part.

By checking the machining tests it is watched that machining done easily and there is no blow gaps find in the throwing tests. By checking strung part we can discover the holding capacity of molecules while throwing is done on account of consistent stirrer speed.

The above figure demonstrates the specimen 1 of carbon NANO - polymer made of elastic testing which is gotten in strong express the malleable load is connected on the material.

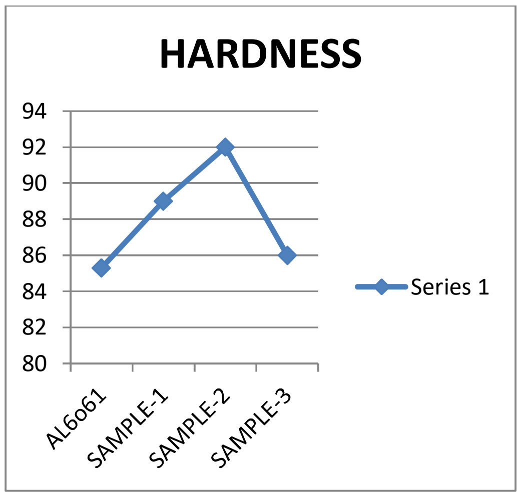
IV. RESULTS AND DISCUSSIONS:

HARDNESS TEST (BHN)

S.No	Sample Designations	HARDNESS BHN	U.T.S (Mpa)	% Elongation
1	ALSIC	85.3	162.2	5.42
2	Sample 1	89	170	5.92
3	Sample 2	92	164	5.57
4	Sample 3	86	158	6.87

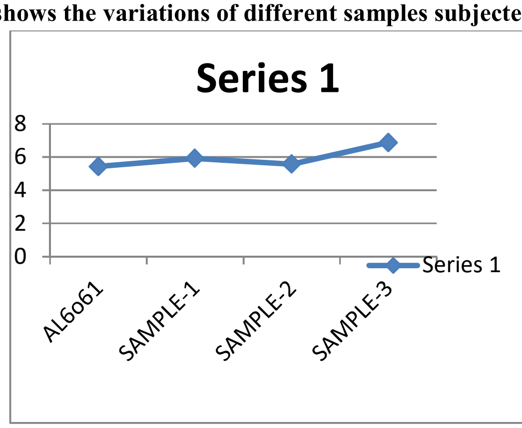
Above table is hardness test report be half of our testing examples where the estimations of Hardness, U.T.S and rate prolongation with a little contrast of fluctuation.

BHN



% Elongation

The above graph shows the variations of different samples subjected to Hardness Test.



The above graph shows the variations of different samples subjected to elongation percentage.

THERMAL EXPANSION:

S.No	Sample Designations	Temperatures 30-100 $^{O}{}_{C}$	30-150 $^{O}{}_{C}$	30-200 $^{O}{}_{C}$
1	ALSIC			
2	Sample 1	8.00 σ=0.26/$^{O}{}_{C}$	8.37 σ=0.26/ $^{O}{}_{C}$	8.75 σ=0.27/ $^{O}{}_{C}$
3	Sample 2	9.77 σ=0.26/ $^{O}{}_{C}$	10.16 σ=0.26/ $^{O}{}_{C}$	10.56 σ=0.25/ $^{O}{}_{C}$
4	Sample 3	10.9 σ=0.25/ $^{O}{}_{C}$	11.20 σ=0.25/ $^{O}{}_{C}$	11.7σ=0.25/ $^{O}{}_{C}$

Above table is Thermal Expansion be half of our testing specimens which are showing variance of different temperatures for different samples

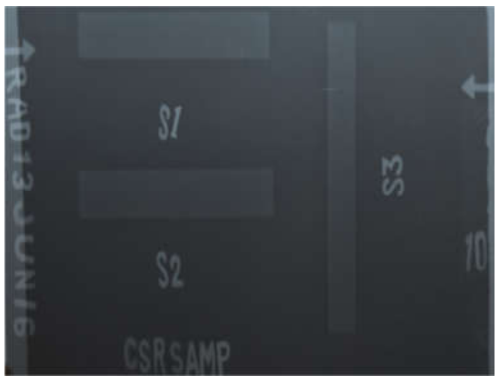
RADIOGRAPHY TEST RESULTS

X-radiography (sometimes abbreviated XR) is the most commonly used radiographic NDT method. In it, x-rays are used to take a shadowgraph image of the sample, and shades in the shadowgraph show the attenuation to the signal while it has passed through the corresponding spot in the sample. Traditionally films have been used to obtain the shadowgraphs in x-radiography, but use of films wouldn't allow on-line testing. Nowadays x-ray detectors that instantly output the image to computer, making even live viewing possible, are used.

The above figure demonstrates the specimen 1 of carbon NANO - polymer made of radiography test which is acquired in strong express the radiation is connected on the material and the entire arrangement is finished. By watching test 1 and the report the throwing procedure given a decent outcome with no imperfections acquired in it.

The above figure demonstrates the specimen 2 of carbon NANO - polymer made of radiography test which is acquired in strong express the radiation is connected on the material and the entire arrangement is finished. By watching test 2 and the report the throwing procedure given a decent outcome with no blemishes acquired in it and the holding is too great as saw in SEM pictures.

The above figure demonstrates the specimen 3 of carbon NANO - polymer made of radiography test which is acquired in strong express the radiation is connected on the material and the total arrangement is finished. By watching test 1 and the report the throwing procedure given a decent outcome with no blemishes got in it. The specimen watched a little aggravation in hardening yet not responsible in light of the fact that the twisting levels are low.



The above figure demonstrates the entire specimen of carbon NANO - polymer made of radiography test which is acquired in strong express the radiation is done on the material and the total development is finished.

V. CONCLUSION:

Conventional AM technologies use mostly polymers, and even if there have been more polymer parts in recent years, which are fully functional products, for some industries metal parts are still required. In addition, there is no need for some special equipment, as only some knowledge about how to connect computer software to existing welding systems is necessary. Disadvantages like porosity, cavities, residual stresses and deformations have already been avoided with some methods, or at least there is a way to reduce their influence.The experimental results show great potential for the detection of defects hidden in the depth of metals by means of eddy-current measuring systems. Whereas eddy-current monitoring could be previously used only to find surface defects (cracks, grooves, and discontinuities in the surface layer), the use of superminiature eddy-current transformers and specialized software permits the localization of the magnetic field within a small section of the sample and penetration of the field to considerable depth, with the appropriate choice of frequency for the field created by the exciting winding.

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