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FABRICATIONANDMECHANICALPROPERTIE SOFAL7075ANDSIC

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Abstract. The automobile industry needs metals or composites with properties such as light weight, and an un compromising strength & specific stiffness with higher wear-resistant and coefficient of thermal expansion. Various other areas like aerospace engineering need far more traditional material characteristics to maintain severe environmental conditions. The above-said qualities led to the use of Aluminum Matrix Composites (AMCs) which are a specific type of MMCs that are replacing conventional engineering materials in various engineering fields. In the present investigation, Aluminum based metal matrix composite is reinforced with 4%, 8%, 12%, 16%, and20% weight percentage of silicon carbide nano particles, powder metallurgy technique is used to fabricate to achieve the desired composites

Keywords: Fabrication, Al 7075, Sic, Powder Metallurgy.

1 Introduction

1.1 Composites

In general, the discontinuous phase is harder and stronger than the continuous phase and is called the „reinforcement"; whereas continuous phase is termed as the „matrix". The matrix holds reinforcement to form the desired shape and bears the major portion of an applied load, while the reinforcement improves overall mechanical properties of the matrix. Reinforcement increases the strength, stiffness, wear resistant and the temperature resistance capacity and lowers the density.

Ingen-
eral,compositesareclassifiedaccordingtothetypeofmatrixmaterialandthennatureofreinforcemen
tattwodistinctlevels.
Basedontypeofmatrixmaterial

- Metal-matrixcomposites(MMC)
- Polymer-matrixcomposites(PMC)
- Ceramic-matrixcomposites(CMC)
- Carbon–carboncomposites(CCC)

Basedonsize-andshapedispersedphaseasParticle–reinforcedcomposites

- Fiber-reinforcedcomposites
- Structuralcomposites

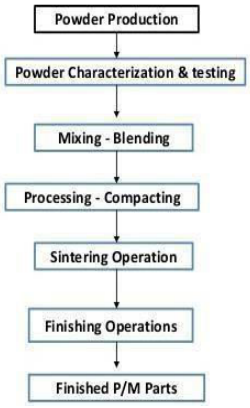
Literature Review

Aluminum Matrix Components (AMC) The need for engineering materials in the areas of aerospace and automotive industries had led to a rapid development of metal matrix composites (MMC). Researchers are turning to particulate-reinforced aluminum metal matrix components (AMC) because of the irrelatively low cost and isotropic properties. In AMC one constituent is aluminum/aluminum alloy termed as matrix phase. The other constituent is embedded in this aluminum/aluminum alloy matrix and serves as reinforcement. Mostly ceramic materials such as Sic, Al2O3, B4C, etc. are used reinforcement. The major advantages of AMCs compared to unreinforced materials are, it gives greater strength, improved stiffness, reduced density (weight), improved high temperature properties, improved abrasion and wear resistance and enhanced and tailored electrical performance, etc. Aluminum 7075 is an aluminum alloy, in which zinc as the primary alloying element. Al7075 alloy'scompositionroughlyincludes5.6–6.1%zinc,2.1–2.5%magnesium,1.2–1.6%copper,andlessthanhalfa percent of silicon, iron, manganese, titanium, chromium, and other metals. It is produced in many tempers, some of which are 7075-O, 7075- T6, 7075-T651. It has maximum tensile strength no more than40,000 psi (276 MPa), and maximum yield strength no more than 21,000 psi (145 MPa). The material has an elongation (stretch before ultimate failure) of 9–10%. 7000 series alloys such as 7075 are often used in transport applications, including marine, automotive and aviation, due to their high strength-to-density ratio. Their strength and light weight are also desirable in other fields. Rock climbing equipment, bicycle components, and hang liderair f rames are commonlymadefrom7075aluminumalloy.

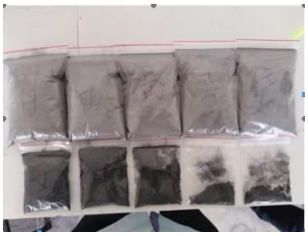
Powder Metallurgy

Powder metallurgy (PM) is a metal working process for forming precision metal components frommetal powders. The metal powder is first pressed into product shape at room temperature. This isfollowed by heating (sintering) that causes the powder particles to fuse together without melting. Theparts produced by PM have adequate physical and mechanical propertieswhile completely meetingthe functional performance characteristics. The cost of producing a component of given shape and therequired dimensional tolerances by PM is generally lower than the cost of casting or making it as awroughtproduct,becauseofextremelylowscrapandthefewerprocessingsteps.Thecostadvantageis the main reason for selecting PM as a process of production for high – volume component whichneeds to be produced exactly to, or close to, final dimensions.

Process of Powder Metallurgy:



Experimental Pictures



Results

Hardness Result

Compositions	Hardnessval-ue	RHN
Al7075+4%Sic	8 6 9	7.6
Al7075+8%Sic	8 8 11	9
Al 7075+12%Sic	12 15 16	14.33
Al 7075+16%Sic	18 20 23	20.33
Al 7075+20%Sic	23 23 20	22

Heat Treatment Results

Heat Treatment of Water

Compositions	Hardness-value	RHN
Al7075+4%Sic	12 14 17	14.33
Al7075+8%Sic	20 18 20	19.33
Al 7075+12%Sic	23 22 24	23
Al7075+16+%Sic	25 27 29	27
	30 32	

Al 7075+20%Sic	33	31.66

Heat Treatment of OIL

Compositions	Hardness-value	RHN
Al7075+4%Sic	16 18 22	18.6
Al7075+8%Sic	25 24 27	25.3
Al 7075+12%Sic	28 30 32	30
Al 7075+16%Sic	34 33 32	33
Al 7075+20%Sic	36 39 37	37.33

Table Heat Treatment of ICE

Wear Results

Table Wear at 1Kg Load 200mts

S.NO	Material	InitialWeight	FinalWeight	LossOfWeight
1	Al7075+4%Sic	10.949	10.9418	0.0072
2	Al7075+8%Sic	10.968	10.9609	0.0071
3	Al7075+12%Sic	10.468	10.4611	0.0069
4	Al7075+16%Sic	10.548	10.5412	0.0068
5	Al7075+20%Sic	10.585	10.58	0.0058

Table Wear at 1Kg Load 400mts

S.NO	Material	InitialWeight	FinalWeight	LossOfWeight
1	Al7075+4 %Sic	10.9418	10.9350	0.0068
2	Al7075+8% Sic	10.9609	10.9542	0.0067
3	Al7075+12% Sic	10.4611	10.4546	0.0065
4	Al7075+16% Sic	10.5412	10.5348	0.0064
5	Al7075+20% Sic	10.0453	10.0056	0.0057

Table Wear at 1Kg Load 600mts

S.NO	Material	InitialWeight	FinalWeight	LossOfWeight
1	Al7075+4% Sic	10.8243	10.8121	0.0122
2	Al7075+8% Sic	10.8440	10.8320	0.0119
3	Al7075+12%Sic	10.6348	10.6231	0.0117
4	Al7075+16%Sic	10.4238	01.4123	0.0115
5	Al7075+20% Sic	10.0581	10.0341	0.0112

Conclusion

- Byusingpowdermetallurgytechniquehybridcompositeswerefabricatedsuccessfully.
- Allthecompositeswereexhibitshigherhardnessthanbasematerial.
- Hybridcompositesthepreferenceofgraphiteinhybridcompo-siteswilllosethestrengthbecauseofsoftandhavingmuchinability.

- Micro structureofallcompositeswereshown.
- FESEMforthehybrid compositeswereshown.
- By using software based electro chemical weld tester system was used to carry outpotentialdynamicpolarizationtestsconducted.
- Allthecompositeswereshownbetter corrosiveresistivethanthebasematerial.
- Allthehybridcompositesweregoodcorrosiveresistivethannon-hybridcompositesbecauseofAL7075 andSICwereforumsalayerofprotectiontooxygen-reaction.

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