SYNTHESIS AND CHARACTERIZATION OF METAL MATRIX COMPOSITE AND ANALYSIS SUPERPLASTIC FORMING PROPERTIES

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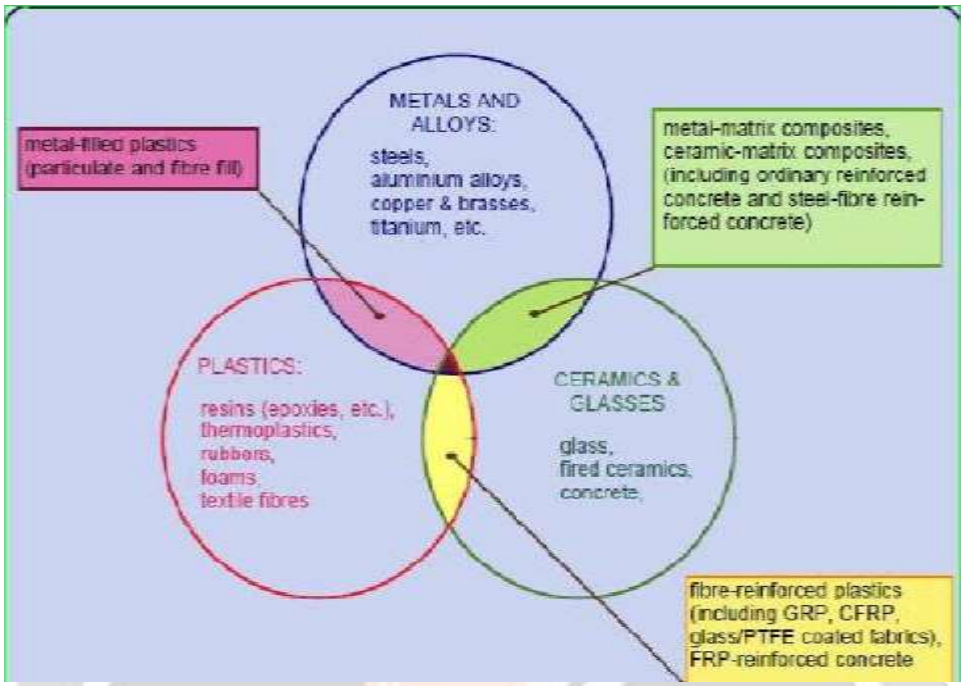
ABSTRACT

Superplastic forming (SPF) process is an important advanced manufacturing method that has the benefit of certain materials capability to undergo large strains to failure when deformed at prominent temperature and at lesser strain rates. The alloys of Aluminium can be formed into complex shapes by super plastic forming, a process that employs common metal working techniques. Present trend of the cost reduction, durability, reliability, and weight reduction with excellent toughness, resistance to corrosion in the field of automobile, aircraft structure and naval structure has created major impact on the engineering industries. Some alloys and compound metals can satisfy to some extent, but there are some constraints and limitations. Whereas, the ceramic reinforced composite materials have relevant properties to satisfy the above requirements. Composites are finding variety of application as structural material and for assembly of composite structure in which fastening is widely practiced.

1. COMPOSITE MATERIAS

Composite Materials are macroscopic combination of two or more distinct materials having a discrete and recognizable interface separating them. Thus composites are heterogeneous material, and many are naturally occurring the common is wood. Man has learned to fabricate composite materials relatively recently. Perhaps, one of the most evidence of a man made composite materials is the mud blocks reinforced with straws. The composite fabrication technology has since progressed from straw reinforced mud- blocks to man-made fiber reinforced composite material such as fiber reinforced polymers, ceramic matrix, metallic matrix and carbon- carbon composite materials.



1.1 METAL MATRIX COMPOSITES(MMC)

Metal composite materials have found the application in many areas of daily life for quite some times. MMCs have been used commercially in fiber reinforced piston and aluminium crank case with strengthened cylinder surface as well as particle-strengthened brake disks. The properties of these new materials are basically determined by the properties of their single components. The reinforcement of the metals can have many different objectives. The reinforcement of light metals opens up the possibility of application of these materials in areas where weight reduction has first priority.

1.2 STIR CASTING

In stir casting process, the reinforcing phases are distributed into molten matrix by mechanical stirring. Stir casting of metal matrix composites was initiated in 1968.when S. Ray introduced alumina particles into aluminium melt by stirring molten aluminium alloys containing the ceramic powders. Mechanical stirring in the furnace is a key element of this process. The resultant molten alloy, with ceramic particles, can then be used for die casting, permanent mould casting, or sand casting. Stir casting is suitable for manufacturing composites with up to 30% volume fractions of reinforcement. The cast composites are sometimes further extruded to reduce porosity, refine the microstructure, and homogenize the distribution of the reinforcement.

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compared to unreinforced material. Long or short fibers can be used for strengthening. Common fiber materials are carbon, silicon carbide, aluminium oxide and boron and refractory materials like tungsten. Usually, light metals (aluminium, titanium, magnesium) are used as matrix materials. Compared to polymer matrix composites, metal matrix composites have the advantages of larger service temperatur

2.1 OBJECTIVE OF THE PROJECT

- To attain the super plasticity state of Aluminium 7075 matrix composite.
- To predict a modified parameters for thermomechanical treatment to get a defect free sheet metal for super plastic forming.
- Analyzing and arriving a fine grain microstructure of Al-7075 matrix composites through various thermal cycling processes.
- Compare the Super plasticity formability of Aluminium 7075 matrix with reinforcement through addition of Micro grains through different weight ratio with constant thermomechanical treatment process.

3. SUPER PLASTIC FORMINGPROCESS

i. The sheet metal is the made to cut to desired dimension(70 mm) as of the designed super plastic die

ii. After Thermal cycling process the samples are subjected for Laser marking

process to analyze the strain rate over the formed sheet.

iii. The 70 mm diameter sheet metal is then placed in between the upper die and lower die and locked with bolts and nuts.

4. CONCLUSION

An analysis of thickness distribution and cavitation of aluminium 7075 composite with various weight ratio of the reinforcement (Boron Carbide) with a constant forming pressure, temperature and sheet thickness were undertaken in this study. Thus we conclude that for a 2 mm thickness composite sheet under the temperature of 540^{o}c and pressure of 1.5 bar, The Effective strain of 4% reinforcement is 0.664 and Effective strain of 2% reinforcement is 0.5734. The Effective strain rate of 4% reinforcement is 2.30×10^{-5} s^{-1} and Effective strain rate of 2% reinforcement is 1.99×10^{-5} s^{-1}. So we found that formability of 4% reinforcement was better than that of 2% and 6% reinforcement of BoronCarbide.

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