



Mechanical properties of silicon nitride fortified aluminium based metal matrix composites – A review

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Abstract

Aluminum metal matrix composites (AMMCs) are in potential demand in numerous field such as automotive, defence and sports recreation sectors owe to important properties compared to traditional aluminium alloys. AA7055 is generally embraced and it is the ideal composite between Al7XXX series arrangement mainly used for different vehicle applications. AA7055 metal matrix composites properties can be improved by incorporating suitable reinforcement. The motivation behind this assessment is to give an outline of silicon nitride in the AA7055 MMC as a base material and to clarify changes in mechanical properties due to the inclusion of reinforcements that can be further improved in combination with the addition of appropriate reinforcement materials to the base matrix.

Introduction

Metal Matrix composites (MMC's) are developing consistently in the present era of technology. In this, metal is utilized as matrix while ceramic natural mixtures are taken as supporting material. Among different alloys, Aluminium, Titanium, and magnesium-based alloys are widely used as base material due to light weight material [1], [2], [3], [4], [5], [6], [7]. Aluminium-based metal matrix composites fortified with particulates and fibres are widely used in numerous fields like the defense sector, automobile and aerospace sector due to its inherent properties like high strength and excellent wear properties [8], [9], [10], [11], [12], [13], [14], [15], [16], [17]. Reinforcements such as silicon nitride, aluminium oxide, silicon carbide are commonly used in aluminium-based metal matrix composites. The hard ceramic reinforcement such as silicon nitride increases the hardness and wear resistance of Al-based metal matrix composites [18], [19], [20], [21], [22], [23], [24], [25], [26], [27]. Aluminium is the material mostly used as base matrix due to its lightweight, high strength and easy availability on the earth at lowest price [28], [29], [30], [31], [32], [33], [34], [35], [36]. Artistic reinforced metal matrix composites are viewed as extremely noticeable materials with the end goal of underlying applications because of its phenomenal property mixes like malleability, high strength, sturdiness, high modulus; which is the consequence of interaction of its comprising stages for example metal lattice and ceramic support [37], [38], [39], [40]. Ashish kumar et al [41] developed Aluminium based hybrid composites by using stir casting method and conducted wear test by adopting L27 taguchi technique and concluded that there is decrease in wear rate for 1.5% and 3wt% Gr in Al Si3N4 composite. D. Bhuvanesh used silicon carbide and aluminum oxide support and presumed that there is a huge improvement in wear resistance of the fabricated composites because of solid interfacial holding between the support aluminum lattice [42]. Stalin fabricated AA6063 invigorated with

silicon nitride composites and inferred that there is an improvement in wear rate by utilizing ANN-TLBO technique[21]. (See Fig. 1, Table 1, Table 2, Table 3).

Section snippets

Microstructural studies of Si₃N₄ as reinforcement

There are numerous researchers who have chosen silicon nitride as reinforcing material in various aluminium series alloys because of its high strength and excellent wear resistance.

T. Vijaya Kumar fabricated Al6061 –Silicon nitride reinforced composites by stir casting method by varying weight fractions like 5% and 15% and concluded that there is a uniform distribution for 5wt% due to vortex formation between the matrix and reinforcement [27].

G B Veeresh Kumar developed Aluminium 6063 with...

Conclusions

Following conclusions are made from the Si₃N₄ reinforced particles in aluminium matrix composites.

- 1) Si₃N₄ reinforced particles in aluminium metal matrix composites can be fabricated by employing liquid metallurgy route (Stir casting) very effectively and efficiently....
- 2) The maximum wt% of Si₃N₄ reinforcement is (12wt% of Si₃N₄). More than this wt % reinforcement leads to agglomeration and hence the porosity increases....
- 3) By incorporating Si₃N₄ particles mechanical properties (Ultimate tensile strength,...

...

CRedit authorship contribution statement

Vijayendra Kukanur: Data curation, Writing – original draft. **S. Ajith Arul Daniel:** Writing – review & editing. **S. Sivaganesan:** . **Veerabhadrapa Algur:** Conceptualization, Methodology....

Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper....

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