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Investigation on Mechanical Properties of Al5052/BN Metal Matrix Composite

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Abstract

The paper aims to find the Mechanical properties of HNT and Boron Nitride, reinforced with Aluminium hybrid metal matrix composites. The aluminum matrix material are reinforced with different weight percentage of HNT(3%,5%,7%) and BN(2%,3%,4%).The hybrid matrix are fabricated through sir casting technique.The mechanical Properties of like hardness, tensile, impact and micro structure of the composites are examined. The hardness and tensile of the composite are increased with increase in weight percentage of boron nitride and HNT. Also the microstructure of the composites shows the clear distribution of the composites and XRD pattern shows the presence of reinforcement in the composites. The hardness and tensile strength increases when 7% of HNT and 4% of boron nitride are added towards the base materials.

Introduction

Metal matrix composites made of aluminium have become increasingly essential in today's industrial technologies. It has garnered a lot of fame and relevance due to their distinctive mechanical and physical properties. Composite materials have largely replaced traditional ferrous materials in the automotive industry because to their high strength and wear resistance. The use of ceramic particles to improve the mechanical strength, wear resistance, and corrosion resistance of aluminium alloys is prevalent [1], [2], [3]. With the exception of single-reinforced MMCs, many authors are interested in combination of hybrid aluminium metal matrix composites because they instigate and control tribological, mechanical, and oxidation properties by utilizing multiple reinforcements such as metal carbides, silicon carbide, borides, and sulphides [4].

Gopinath et al. Hybrid reinforcements are included into an aluminium 6061 matrix composite. Different proportions of boron nitride (BN), aluminium oxide (Al2O3), and carbon particles are stir casted into the aluminium 6061 alloy. Tensile testing demonstrates that the Al 6061–30 BN −10Al2O3- 5C has better tensile strength and ductility due to the presence of a greater BN content combined with 10% Al2O3. When compared to the bare Al 6061 alloy, the Al 6061–30 BN −10Al2O3- 5C has a much higher hardness value (63HV), compressive strength (187Pa), and impact strength (12J) [5].

P. Venkateshwar Reddy investigates the Al 5052 is a high-strength aluminium alloy with excellent corrosion resistance. The current project's goal is to improve Al 5052′s mechanical and wear qualities by adding reinforcements, silicon

carbide (SiC), and titanium carbide (TiC) by altering the percentage of reinforcements. The stir casting route was used to fabricate the aforesaid hybrid composites. The first specimen is made of 7.5% SiC and 2.5%TiC; the second specimen is made of 5% SiC and 5% TiC; and the third, SP3, is made of 2.5% SiC and 7.5%TiC. The following three specimens were tested for hardness, tensile strength, and wear characteristics in this the specimen with 7.5% of TiC and 2.5% of SiC exhibits superior mechanical properties [6]. To create a homogeneous dispersion of halloysite nanotubes (HNTs) in epoxy resin, researchers used an ultra-sonification dispersion approach. The nanomaterials are made using the liquid casting process, and the samples are prepared according to ASTM guidelines. The mechanical properties of nanomaterials containing different weight (wt) percent of HNTs changing in the range of 0–4 with the interval of 1. were evaluated using ASTM procedures to determine density, hardness, tensile, torsional, and impact resistance. Furthermore, when compared to other nanocomposite materials, the 3wt% HNT with ultrasonic homogenized nanocomposite demonstrates greater mechanical strength [7], [8].

Section snippets

Materials and methods

Aluminium alloy 5052 is chosen as a matrix material due to its high fatigue strength and corrosion resistance.The chemical composition of Al5052 is shown in Table 1. HNT was chosen as a primary reinforcement with weight percentage of 3, 6 & 9.The chemical compound or the molecular chemical formula of HNT is (H4AL2O9 Si2.2H2O).HNT is a low cost materials and it is widely used in many medical field especially for anti-cancer medical aid. The material mainly contains aluminium and silica which…

Hardness test

The Table 2 shows the hardness value of newly developed composites. The hardness of the composites was measured using Vickers Hardness test. The hardness value 39.7 HV is exhibits at 7% and 4% of Boron Nitride shows high hardness value. In increase in weight, percentage of reinforcement shows higher hardness value [10], [11] (see Fig. 1, Fig. 2, Fig. 3)….

Tensile test

The tensile strength of the developed composites are conducted using ASTM B209. The tensile strength increases with increasing weight…

Conclusion

HNT and Boron Nitride are reinforced with Al5052 through stir casting process to improve the mechanical properties like tensile, hardness and impact strength the hardness value 39.7 HV is exhibits at 7% and 4% of Boron Nitride shows high hardness value. When the HNT is 7% and Boron nitride is 2% the tensile value is 227.1Mpa due to increase in weight percentage of HNT. The impact strength are increased with the increasing weight percentages of the reinforcement added to the matrix. When the HNT …

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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