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Evaluation of Microstructure, Mechanical and Wear Properties of Aluminium Reinforced with Boron Carbide Nano Composite

A. Devaraju[1]* and K. Pazhanivel[2]

[1]Department of Mechanical Engineering, Adhi College of Engineering and Technology, Affiliated to Anna University, Chennai, Kanchipuram - 631 605, Tamil Nadu, India; adevaa2011@gmail.com
[2]Department of Mechanical Engineering, Thiruvalluvar College of Engineering and Technology, Affiliated to Anna University, Chennai, Vandavasi - 604 505, Tamil Nadu, India

Abstract

Background/Objectives: In recent days, the demand of light-weight materials is being increased in industrial applications. Especially, nanocomposites are used in aerospace, automobile sector and bio-medical applications. **Methods/Statistical Analysis**: In this context, in the current study, aluminium alloy - boron carbide composites were fabricated and its microstructure analysis was evaluated with the help of Optical Microscope (OP). Further, a detailed study was done to evaluate the mechanical and wear resistance of the fabricated composites. **Findings**: The OP pictures reveal that boron carbide particles were uniformly distributed in aluminium matrix. When the amount of boron carbide is increased, the density of the composites is decreased which resulted 1. The micro hardness is increased. 2. The ultimate compressive strength is also increased and 3. Wear resistance is also increased.

Application/Improvements: This study proves that the aluminium reinforced with Boron Carbide composite exhibits better performance than aluminium AL1100 in all aspects. Hence, aluminium reinforced with Boron Carbide composite can be used in aerospace applications.

Keywords: Mechanical Properties, Microstructure, Micro Hardness, Nanocomposite, Wear Resistance

1. Introduction

Synthetic fiber reinforced composites are widely used in aerospace industries as they are having greater toughness and rigidity[1]. A detailed review on Polymer nano-composites suggests that replacing composites by nano-composites in sandwich structures could produce improved properties than the simple sandwich structures[2]. [3]An innovative attempt was done on Polypropylene/Montmorillonite (PP/MMT) nano-composites and proves that PP/MMT nano-composites maintain its mechanical properties at cryogenic temperature. These studies were useful to select the current study on nanocomposite material.

Studied about the wear behavior of Nanostructured Aluminium (Al) and boron carbide (B_4C) composites and conclude that Nano crystallization of Al matrix and incorporation of B_4C Nano particles into the A1 matrix improve the wear performance and also increase their hardness[4]. Studied on self-mating of A1-B_4C Nano composites and found that tribo film was formed which reduce friction and wear[5]. Analyzed the influence of particle properties on erosive wear of sintered boron carbide[6]. Studied the effect of small amounts of boron (less than 195 ppm) added to 16% Cr white iron[7]. It was found that boron addition increases wear resistance of white irons by 40% on average. Conducted aware study of boron carbide

*Author for correspondence