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Experimental analysis of Al-Cu-Si metal matrix composite by powder-metallurgy process

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ABSTRACT

In various automotive and aerospace applications, aluminum alloy is prefre for its high strength and low weight. It is generally recognized that when strengthened by ceramic material, aluminum generates better mechanical properties. In various engineering applications, Al-Cu-Mg alloy is used. It can not be used in construction applications because of such limitations of decreased strength and compressibility. Silicon and 1% alumina have been used in this analysis to enhance this alloy framework. In order to study the alloy 's impact, the composition of copper and silicon was different. It was made of powder metallurgy—this composite. Copper was applied to silicon at 3.5% and 5.5% to silicon at 0.5, 1.5, and 3%. By applying 90 kN of load on the universal measuring tool, the metal powder was uniformly blended and compacted. Each of these preforms was sintered under the nitrogen atmosphere at 530 °C for 50 min, and no oxidation occurred. The desity calculation done by the sintered and green performs. The composite preforms were measured in their hardness and compressive strength.
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1. Introduction

Aluminum powder metallurgy is the most widely used metal forming process in the aerospace application on its excellent hardness and wears resistance contribution to high damage tolerance [1]. Normay the turing and milling process the standard dimensional like rod, rectangular bar materials used, but for complex materials, industries are preferred the strir casting process [2–3]. Thanks to its lightweight and outstanding mechanical properties, composite aluminum has increased significantly since the 1980 s. The composite-forming aluminum alloys are high strength, wear resistance, fracture strength, and stiffness. The bonding of the aluminum matrix with reinforcement, distribution, and particle size defines the essential properties. AC-2014, which contains the Al, 4.4%Cu, 0.8%Si, 0.6%Mg alloy based on many commercial wrought alloy suppliers AA2014, powder metallurgy processing used here shows a strong response and provides better properties after sintering. There are some significant changes in the new alloys, but porosity remains a challenge for many applications [4] Table 1.

Adding Mg can lead to precipitation of Magnesium-rich silicon particle layer in the Mg_2Si eutectic process in the molten alloy. The copper addition produces Al_2Cu and is not dissolve during heat treatment. As ceramic material, aluminum fiber is widely used as an ideal aluminum alloy reinforcement material and increases mechanical durability and wear resistance at high temperatures. When the temperature increases, the strength of the matrix decreases, the aggregate strength decreases as in the mixing law. The composites developed by reinforcing the ceramic aluminum matrix are responsible for improving mechanical properties such as low density, thermal conductivity, high defined strength, and low melting point. SiC, Al2O3, B4C, TiC & TiB2 are various refurbishing particles. [5]. Silicon is strong casting material used as deoxidant. The current research was to analyze the impact of SILICON on the densification, strength, and hardness of composite Al-Cu-Si-Mg-Al2O3. Using a computer-assisted Universal Testing Machine and a Charpy Impact Testing Machine, manufactured composite plates subject to mechanical properties such as flexural strength, impact strength testing of various specimens. Results show that in both flexural and tensile tests, the pure basalt fiber combination maintains higher values. The basalt fiber impact test, however, is slightly lower than reinforced jute fiber [6].

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