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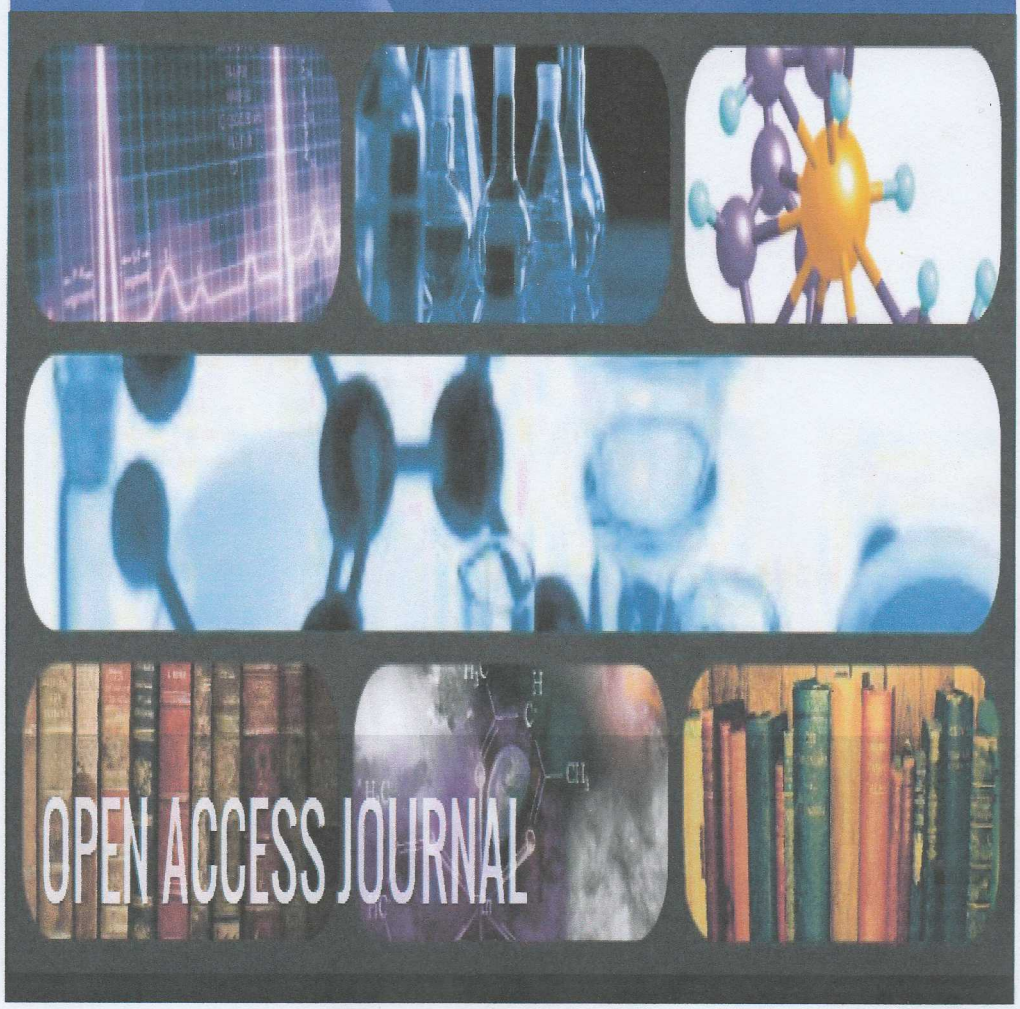

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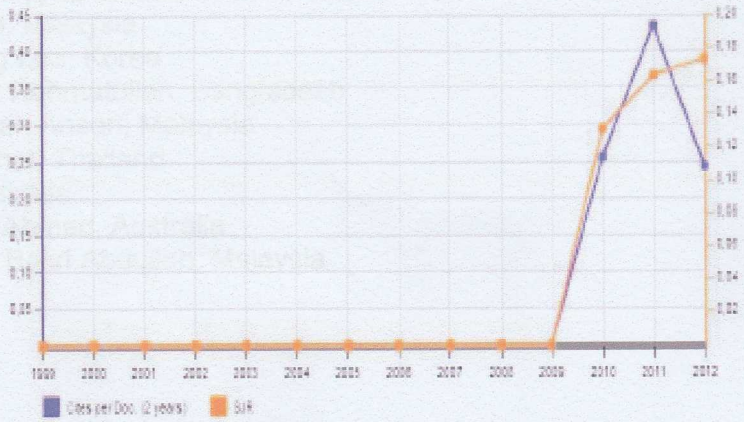

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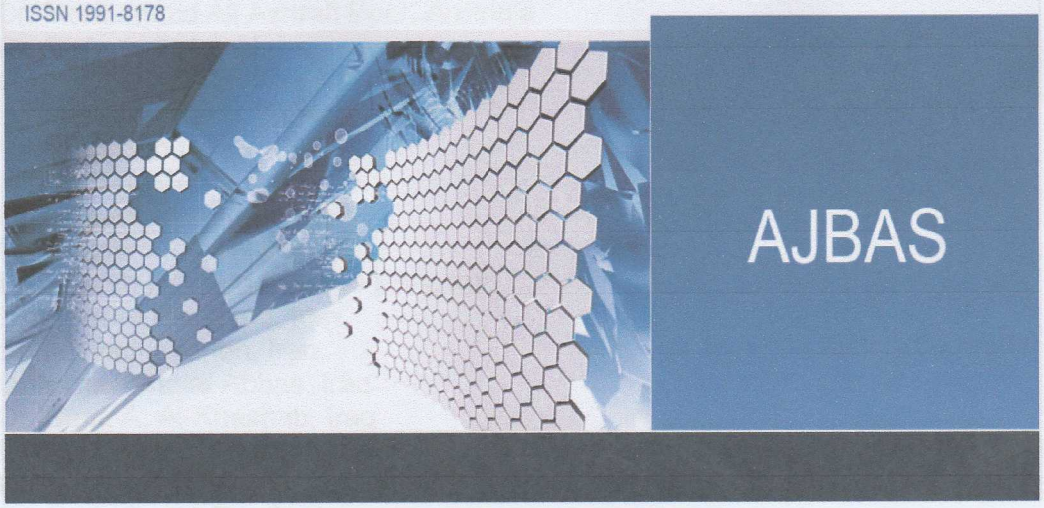

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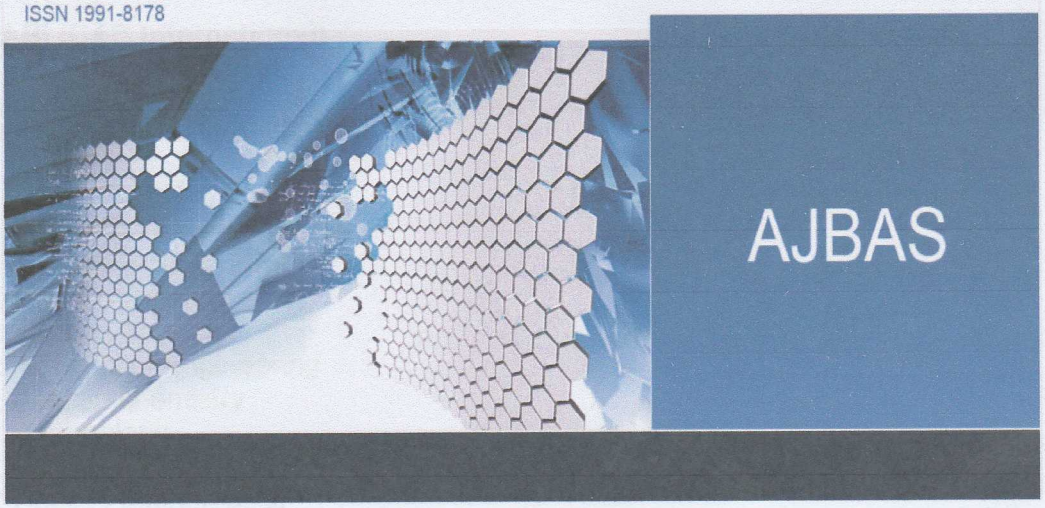

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The Effect Composition of Reinforcement SiC Whiskers and Al2O3 Particulates on Characteristics of Aluminum Matrix Composite

[1,2]Ketut Suarsana, [1]Rudy Soenoko, [1]Agus Suprapto, [1]Anindito Purnowidodo

[1]*Mechanical Engineering Department, Brawijaya University, East Java, Malang, Indonesia. Jl. Veteran Malang, Phone (0341) 895287*
[2]*Mechanical Engineering Department, Udayana University, Denpasar, Bali, Indonesia.*

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ABSTRACT

In the present investigation fine aluminum powder was selected as the matrix, and Carbon Silicon whiskers (SiCw) together with Alumina particles (Al2O3p) were used as reinforcement. The composite was formed under 25 kN pressure over 15 minutes holding time for each specimen. The characteristics tests included those for density, porosity, hardness and SEM. The results showed that the addition of the combined SiCw and Al2O3p reinforcements resulted in a decrease in density and an increase in porosity. However, it was the addition of the Al2O3p reinforcement itself which gave rise to the increase in hardness. The main cause of this was that the Al2O3 particles were smaller than those the aluminum matrix so could spread easily through it giving a good bond. While the SiCw in the form of fibres contributed to making it more porous. In this case the addition of Al2O3p itself had an effect on composite hardness. In the sintering process, extending holding time caused the highest increase in hardness at temperatures of 550oC with a holding time of 6 hours.

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INTRODUCTION

Components based on matrix Aluminum with Silicon Carbon whisker (SiCw) reinforcement, called Aluminum Matrix Composite (AMCw), have been developed widely due to its lightweight, strength, thermal and electrical conductivity as well as high corrosion resistance characteristics (Gibson, Ronald F., 1994). Essentially, the SiCw reinforcement prevents catastrophic brittle failure by dissipating energy. Toughening mechanisms, such as crack deflection, whisker pullout and whisker bridging, depend to a large extent on the nature of the whisker-matrix interface (Garnier, V., *et al.*, 2004). Also, strength deflection influenced by the percentage by weight of the reinforcement SiC with or without heat treatment or the effects of various silicon carbide and aging time on the alloy hardness value. However, the longer the aging time, the lower the hardness value (Kalkanli, A., & S. Yilmaz, 2007; Bolaji, S., & V. Sunday, 2006). The effects of carbide particles coated and non-coated silicon on the mechanical properties of aluminum-based metal-matrix composites with silicon on the mechanical properties of the aluminum-based metal-matrix composites show that it improves bonding between the matrix and reinforcement but that without the silicon coating there is deformation and a dimpled fracture surface (Lim, D., *et al.*, 2001; Davidson, A., 2000). The strength and wear resistance of alumina-silicate monolithic carbon increases with the addition of silicon metal or ferrosilicon and this additive is more effective than either carbon black or sulfur (Lim, D., *et al.*, 2001; Karamian, E., & A. Monshi, 2009). The highest density and lowest porosity of Al/SiC-Al/Al2O3 isotropic composite laminate is obtained at 40% volume fraction and the lowest shrinkage is achieved in 30% volume fraction (Widyastuti, Dedi Priadi., 2008). Hot deformation behavior of the composite shows that the addition of SiCw increases the flow stress a high temperature, yet, it decreases failure strain (Jean, J.-sic, & Leeb, H.-in. 1997). Hot deformation characteristics of the composite AA.2124 with silicon carbide whiskers and 15% SiCw+SiCp reinforcement show that composite flow stress increases with an increasing percentage of SiCw. In addition, SiCw is more effective in increasing strength than SiCp (Jean, J.-sic, & Leeb, H.-in. 1997; Ko, B.-chul, & Yoo, Y.-chul, 1996). The mechanical properties of Al-based powder metallurgy composite alloys 2014 and 6061 reinforced with SiC particles or fibers show a high elastic modulus, high tensile strength and low elongation percentages (Srinivasa, C., 1996; Khorramdel, Parshang., Behfuruz, Mohamad Reza, 2013).

Alumina (Al2O3) is a reinforcement which enhances hardness, wear resistance, thermal resistance and high stiffness. If Al2O3 reinforcement and the aluminum in the matrix are combined, they both impart high strength, light weight and good machinability to the composite (Froyen, L., B. Verlinden, 1994). The mechanical

Corresponding Author: Ketut Suarsana, Mechanical Engineering Department, Brawijaya University, East Java, Malang, Indonesia. Jl. Veteran Malang, Phone (0341) 895287