Accepted Manuscript

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PII: S0925-8388(18)31939-X

DOI: 10.1016/j.jallcom.2018.05.220

Reference: JALCOM 46196

To appear in: *Journal of Alloys and Compounds*

Received Date: 15 March 2018

Revised Date: 7 May 2018

Accepted Date: 19 May 2018

Please cite this article as: F.M. Kgoete, A.P.I. Popoola, O.S.I. Fayomi, I.D. Adebiyi, Influence of Si_3N_4 on Ti-6Al-4V via spark plasma sintering: Microstructure, corrosion and thermal stability, *Journal of Alloys and Compounds* (2018), doi: 10.1016/j.jallcom.2018.05.220.

INFLUENCE OF Si_3N_4 ON Ti-6Al-4V VIA SPARK PLASMA SINTERING: MICROSTRUCTURE, CORROSION AND THERMAL STABILITY.

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ABSTRACT

The objective of this research was to study the influence Si_3N_4 on Ti-6Al-4V via spark plasma sintering process. The experiments were performed at a temperature of 1000^{o}C with a holding time of 6 mins under a pressure of 50Mpa.Ti-6Al-4V powder was admixed with different weight proportions of Si_3N_4 powder. Sintered composite samples were produced from the mixture and the influence of Si_3N_4 on the microstructure; mechanical and thermal properties of the composites were investigated. Scanning electron microscope (SEM-EDS) was used to study the bulk morphology of the sintered composites. The phases present in the fabricated sintered composites were observed by energy dispersive X-ray diffraction spectrometer (XRD). Microhardness was investigated by the means of high impact diamond Durascan micros hardness tester. Electrochemical behavior of the sintered samples was measured by potentiodynamic polarization method. The thermal performances of the sintered composites were explored by a Thermal gravimetric analyzer (TGA). The experimental results revealed that the microstructure, corrosion resistance and thermal stability properties of the material were improved by the addition of Si_3N_4.The effect of Si_3N_4 on the performance characteristics of Ti6AI4V alloy was seen to be compactable and useful in aerospace application.

KEY WORDS: Spark Plasma Sintering; Advanced Composites; Silicon Nitride (Si_3N_4); Oxide Layer

1. INTRODUCTION

Excellent mechanical properties of Ti-6Al-4V alloy makes it remain the most widely used material in both biomedical and aerospace applications [1, 2]. The main interest for its use derives from its beneficial properties, such as low density, low modulus elasticity, excellent corrosion properties and biocompatibility [3]. However, poor tribological properties (such as high friction