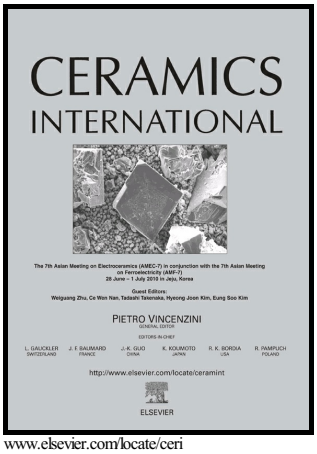

www.elsevier.com/locate/ceri

Copper-Alumina Nanocomposite Coating on Copper Substrate through Solution Combustion

E. Mohammadi, H. Nasiri, J. Vahdati Khaki, S.M. Zebarjad

PII: S0272-8842(17)32549-X
DOI: https://doi.org/10.1016/j.ceramint.2017.11.094
Reference: CERI16749

To appear in: *Ceramics International*

Received date: 23 October 2017
Revised date: 13 November 2017
Accepted date: 13 November 2017

Cite this article as: E. Mohammadi, H. Nasiri, J. Vahdati Khaki and S.M. Zebarjad, Copper-Alumina Nanocomposite Coating on Copper Substrate through Solution Combustion, *Ceramics International,* https://doi.org/10.1016/j.ceramint.2017.11.094

Copper-Alumina Nanocomposite Coating on Copper Substrate through Solution Combustion

E. Mohammadi[a], H. Nasiri[b]*, J. Vahdati Khaki[a], S.M. Zebarjad[c]

a: Department of Metallurgy and Materials Engineering, Faculty of Engineering, Ferdowsi University of Mashhad, Mashhad, Iran.

b: Department of Materials Engineering,, Birjand University of Technology. Birjand. Iran.

c: Department of Materials Science and Engineering, Shiraz University, Shiraz, Iran.

* Corresponding author. E-mail address: nasiri@birjandut.ac.ir, h.nasiri85@yahoo.com. Tel/Fax: +985632252181

Abstract

The main objective of the present research is to investigate the production of Cu-Al_2O_3 nanocomposite coating on a copper substrate using solution combustion synthesis. Solution combustion synthesis is mainly used to produce nanocomposite powders; however, in this study it is applied to produce nanocomposite coat. For this purpose, both copper and aluminum nitrates (Cu $(NO_3)_2.3H_2O$ and Al $(NO_3)_3.9H_2O$) are used as oxidizers. Also, urea and graphite are respectively used as fuel to synthesize the Cu-Al_2O_3 nanocomposite and as inhibitor to prevent the oxidation of the synthesized copper. The microstructure and morphology of the nanocomposite coating, which includes 25wt.% alumina as the reinforcing phase, was studied using X-ray diffraction, scanning electron microscopy, and transmission electron microscopy at different fuel/oxidizer ratios ranging from 0.9 to 2. The temperature variation during the process was measured as a function of time using a precise thermocouple. Finally, micro-hardness and wear tests were conducted on the nanocomposite coating. The results verified the formation of Cu-Al_2O_3 nanocomposite coating. Time-temperature curve illustrated that the highest temperature was achieved at the fuel/oxidizer ratio of 1.25. The results of the microhardness and wear resistance test showed that these properties depend heavily on the fuel/oxidizer ratio, with the best condition attained at the ratio of 1.25.

Keywords: B. Nanocomposites, C. Hardness, C. Wear resistance, D. Al_2O_3.

1. Introduction

Owing to its high electrical and thermal conductivity, copper is perhaps the most beneficial of all well-known metals. However, one of the most significant problems associated with copper is its low surface mechanical properties such as hardness, wear resistance, and yield strength. Many studies have investigated methods to improve