Accepted Manuscript

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PII: S0925-8388(18)33432-7

DOI: 10.1016/j.jallcom.2018.09.191

Reference: JALCOM 47610

To appear in: *Journal of Alloys and Compounds*

Received Date: 31 August 2018

Revised Date: 12 September 2018

Accepted Date: 16 September 2018

Please cite this article as: O.S.I. Fayomi, A.A. Atayero, P. Mubiaye, I.G. Akande, P.A. Adewuyi, M.A. Fajobi, W.A. Ayara, A.P.I. Popoola, Mechanical and opto-electrical response of embedded smart composite coating produced via electrodeposition technique for embedded system in defence application, *Journal of Alloys and Compounds* (2018), doi: https://doi.org/10.1016/j.jallcom.2018.09.191.

Mechanical and Opto-electrical Response of Embedded Smart Composite Coating produced via Electrodeposition Technique for Embedded System in Defence Application

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Abstract

The emergence of nanocomposite particulate with the increasing demand for opto-electrical properties for defence application has necessitated this study. In this work, an attempt was made to develop Zn-CeO_2/Zn-CeO_2-Al_2SiO_5 thin film composite on A356 mild steel using electrodeposition technique. The developed coating was attained in 2V for 10 minutes at a constant current density of 1.5A/cm^2 and pH of 4.5. The mass concentration of Al_2SiO_5 was varied, ranging from 0-15g. The composite coatings were characterized using Scanning electron microscope equipped with energy dispersive spectrometer (SEM/EDS). The corroding properties of the coated and uncoated sample were examined through potentiodynamic polarization technique via Autolab PGSTAT 101 Metrohm potentiostat/galvanostat with NOVA software of version 2.1.2 in 3.65% NaCl. The electrical characterization was carried out using voltage-ammeter meter and Keithley 2400 series source meter application tester. The opto-electrical investigation was done using a solar simulator with maximum intensity of 1000W/m^2 under an air mass of 1.5 at a working intensity of 750W/m^2. The outcome of various test and characterizations revealed that the electrodeposited Zn-CeO_2/Zn-CeO_2-Al_2SiO_5 possessed good stability, improved microstructural qualities, better electrical conductivity and outstanding corrosion resistance.

Keywords: Microhardness, Coating, Mild steel, Semiconductor, Agglomeration, optoelectronics.