Nanoceria induced grain refinement in electroless Ni-B-CeO2 composite coating for enhanced wear and corrosion resistance of Aluminium alloy

Jerin K. Pancrecious, J.P. Deepa, Varanya Jayan, Ulaeto Sarah Bill, T.P.D. Rajan, B.C. Pai

PII: S0257-8972(18)31029-6
DOI: doi:10.1016/j.surfcoat.2018.09.046
Reference: SCT 23819

To appear in: *Surface & Coatings Technology*

Received date: 13 June 2018
Revised date: 15 September 2018
Accepted date: 18 September 2018

Please cite this article as: Jerin K. Pancrecious, J.P. Deepa, Varanya Jayan, Ulaeto Sarah Bill, T.P.D. Rajan, B.C. Pai , Nanoceria induced grain refinement in electroless Ni-B-CeO2 composite coating for enhanced wear and corrosion resistance of Aluminium alloy. Sct (2018), doi:10.1016/j.surfcoat.2018.09.046

Nanoceria induced grain refinement in electroless Ni-B-CeO_2 composite coating for enhanced wear and corrosion resistance of Aluminium alloy

Jerin K. Pancrecious[1,2], J.P. Deepa[1], Varanya Jayan[1], Ulaeto Sarah Bill[1,2], T.P.D. Rajan[1,2,*], and B.C. Pai[1]

[1]CSIR - National Institute for Interdisciplinary Science and Technology, Trivandrum – 695019, Kerala, India

[2]Academy of Scientific and Innovative Research (AcSIR), New Delhi

E-mail: tpdrajan@gmail.com, jpancrecious@gmail.com

Abstract

Nickel-based coatings on aluminium with specific surface properties are of great interest for anti-corrosive, anti-wearing, and self-lubricating applications. In the present study electroless Ni-B alloy and Ni-B-CeO_2 nanocomposite coatings were formed on 356 aluminium alloy surfaces. Ceria incorporation to Ni-B coating reduces the average nodular grain size from 1150 nm to 650 nm and Ni crystallite size from 15 nm to 9.97 nm. Ni-B-CeO_2 nanocomposite shows remarkable improvement in microhardness of 684 VHN compared to pure Ni-B coating with 424 VHN. Enhanced wear resistance and reduction in friction coefficient are observed for the nanocomposite coatings compared to 356 Al alloy and Ni-B alloy coating. Potentiodynamic polarization measurements show a remarkable reduction in the corrosion current density for ceria added nanocomposite coating (2.48×10^{-6} A cm^{-2}) than that of the particle-free counterpart (11.18×10^{-6} A cm^{-2}). Uniform Ni-B-CeO_2 composite coating was obtained on centrifugally cast A356 aluminium alloy cylinder liners which have potential applications in automotive systems.

Keywords: Electroless process, nanocomposite, grain refinement, anti-corrosion, wear resistance