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PII: S0257-8972(18)31029-6  
DOI: doi:[10.1016/j.surfcoat.2018.09.046](https://doi.org/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-CeO<sub>2</sub> composite coating for enhanced wear and corrosion resistance of Aluminium alloy. *Sct* (2018), doi:[10.1016/j.surfcoat.2018.09.046](https://doi.org/10.1016/j.surfcoat.2018.09.046)

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# Nanoceria induced grain refinement in electroless Ni-B-CeO<sub>2</sub> composite coating for enhanced wear and corrosion resistance of Aluminium alloy

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## 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<sub>2</sub> 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<sub>2</sub> nanocomposite shows remarkable improvement in microhardness of  $\square$  684 VHN compared to pure Ni-B coating with  $\square$  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 ( $2.48 \times 10^{-6} \text{ A cm}^{-2}$ ) than that of the particle-free counterpart ( $11.18 \times 10^{-6} \text{ A cm}^{-2}$ ). Uniform Ni-B-CeO<sub>2</sub> 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

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