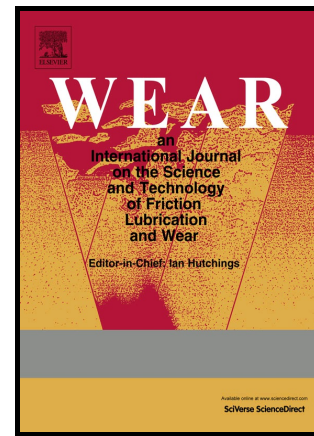


# Author's Accepted Manuscript

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PII: S0043-1648(18)30245-X  
DOI: <https://doi.org/10.1016/j.wear.2018.07.022>  
Reference: WEA102470

To appear in: *Wear*

Received date: 22 February 2018  
Revised date: 16 July 2018  
Accepted date: 25 July 2018

Cite this article as: M.V.N. Vamsi, Nitin P. Wasekar and G. Sundararajan, Sliding wear of as-deposited and heat-treated nanocrystalline nickel-tungsten alloy coatings, *Wear*, <https://doi.org/10.1016/j.wear.2018.07.022>

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# Sliding wear of as-deposited and heat-treated nanocrystalline nickel-tungsten alloy coatings

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## Abstract

The aim of the present study is to understand the sliding wear response of pulse electrodeposited nanocrystalline nickel (Ni) - tungsten (W) alloy coatings in both as-deposited and heat-treated conditions. Ni-W alloy coatings with a wide range of W content (0 % to 25 at%) were deposited using pulse electrodeposition and subsequently annealed at 700 °C up to 1 h. The tribological behaviour of Ni and Ni-W coatings (both as-deposited and heat-treated) was studied using a unidirectional pin-on-disc configuration at two different normal loads 3 kg and 5 kg respectively. All tests were performed in atmospheric air, at room temperature and at a constant sliding speed of 0.67 m.s<sup>-1</sup> using WC-Co disc as countersurface. Wear test results indicated that Ni-W alloy coatings exhibit greater wear resistance when compared to pure Ni coatings at both the loads. The wear mechanism in pure Ni coatings was attributed to severe abrasive wear along with brittle fracture whereas Ni-W alloy coatings exhibited mild ductile wear characterized by micro-plowing. In the case of as-deposited Ni-W alloy coatings, the addition of W up to 17 at% increased the wear resistance due to improvement in hardness, however, further increase in W content resulted in amorphization and reduced the hardness with corresponding decrement in wear resistance. Heat treatment of coatings resulted in grain growth, crystallization of amorphous phase and precipitation of nanoprecipitates (beyond 12 at% W). Presence of nanoprecipitates and crystallization of amorphous phase resulted in significant improvement in wear resistance of the heat-treated coatings compared to their as-deposited counterparts. Addition of W to Ni did not

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