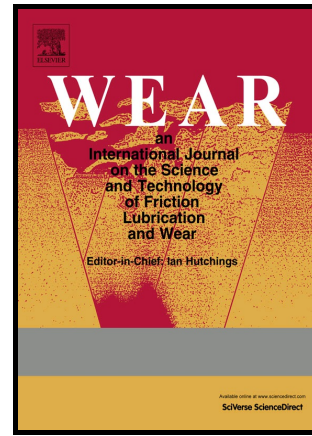


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The effect of contact stress on the sliding wear behaviour of Zn-Ni electrodeposited coatings

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Abstract

Electrodeposited zinc-nickel coatings, developed in the 1980's as a replacement for zinc coatings in the automotive industry, have recently gained interest in the aerospace industry to replace cadmium coatings. Due to different material properties of Zn-Ni and Cd, there is a need to characterize Zn-Ni for tribological applications. Sliding wear tests are performed on a reciprocating pin-on-flat tribometer using a steel counterface on two electrodeposited Zn-Ni coatings with different microstructure and surface topography. Tests were performed under 3, 7.5 and 12 N normal loads at a relative humidity of 60 % for 2000 cycles. Increasing the normal load increased the steady state friction coefficient and wear for both coatings. The smooth and dense coating was more sensitive to the change in normal load than the rough and porous coating, as the latter experienced less wear due to the columnar structure of the coating. In contrast, the smoother and dense coating, although has less wear at low loads, has more wear at high loads due to debonding of the coating. The coating morphology affected the extent of wear due to different wear and velocity accommodation mechanisms.

Keywords: Sliding wear; surface topography; intermetallic alloy; wear

1. Introduction

Electrodeposited zinc-Nickel alloy coatings were developed in the 1980's as a corrosion protective coating for the automotive industry [1]. Electrodeposition is the preferred method as the process is well developed, low cost, high productivity and easily controllable [2]. Recently, electrodeposited Zn-Ni have attracted attention from the aerospace industry as a replacement for cadmium, which is used as a corrosion protection coating for steel, but is toxic, carcinogenic and some cadmium plating baths contain cyanide [3-8]. Cadmium is used in the aerospace industry on landing gear components and fasteners, where both corrosion and tribological properties are important. Zn-Ni coatings, being a well-utilized corrosion resistant coating for more than

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