ELEVATED TEMPERATURE WEAR BEHAVIOR OF WC-Co/NANODIAMOND COMPOSITE COATINGS
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The elevated temperature (300 °C) and room temperature wear behavior of WC-Co/Nanodiamond (ND) coatings deposited using high velocity oxyacetylene flame (HVOF) and air plasma spray (APS) is evaluated. Composite feedstock powders are prepared by ball milling thermal spray grade WC-Co powder with ND (~ 5-10 nm) powder. ND powder appears uniformly distributed on the surface of the 30-40 µm WC-Co particles. Reciprocating ball on flat wear tests are conducted using a 5 mm Si\textsubscript{3}N\textsubscript{4} counter-surface with an applied normal load of 100 N for 7200 cycles. The incorporation of ND leads to modest wear volume reductions of ~8% and ~13% in HVOF and APS coatings, respectively, at room temperature. The enhanced wear resistance in the composite coatings is attributed to the enhanced formation of a protective silica tribofilm. However, at elevated temperatures (300 °C), the wear volume of WC-Co-ND coatings is 35% and 88% higher than WC-Co coatings in HVOF and APS coatings, respectively. The wear behavior is characterized in terms of coating microstructure, wear track morphology, wear mechanisms, and tribofilm evolution using scanning electron microscopy (SEM), x-ray diffraction (XRD), x-ray photoelectron spectroscopy (XPS), energy dispersive spectroscopy (EDS), and microindentation.

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