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A critical review of the tribocorrosion of cemented and thermal sprayed tungsten carbide

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Abstract

Cemented and thermal sprayed tungsten carbide are extensively used in a wide range of applications, ranging from downhole drilling tools and oil and gas valves to gas turbine engines. These WC based systems offer improved wear resistance as a result of hard ceramic phases surrounded by a metallic binder matrix. However, the presence of hard and soft phases within these materials also leads to differing wear mechanisms and the formation of micro-galvanic couplings in aqueous environments often result in a reduction in combined wear-corrosion resistance. This paper examines the wear-corrosion performance of these WC based systems in a range of wear, electrochemical and wear-corrosion tests to develop models and establish relationships between wear mechanisms and environmental factors such as pH.

Keywords (Max 4): Ceramic; Thermally-sprayed coating; Synergism; Numerical analysis

Highlights

- Significant difference in composition and structure between cemented WC and WC coating
- Tribocorrosion is an area of significant interest and needs further understanding
- Understanding of individual degradation mechanisms is required
- Numerical modelling provides a method for understanding and prediction of degradation

1 NOMENCLATURE

a1	Fitting parameter
a2	Fitting parameter
a3	Fitting parameter
a4	Fitting parameter
a5	Fitting parameter
A_a	Apparent area of contact
d_{WC}	WC grain size
D	Average wear debris particles diameter during low-cycle micro-fatigue wear
D_m	Average particle diameter in the influence of multi-degradation
f	Contact frequency between sliding surfaces or cyclic loading frequency
F	Faraday's constant
F_n	Normal wear load