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Robert J.K. Wood, Stephen Herd, Mandar R. Thakare



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

Professor Robert J.K. Wood <sup>a</sup>

Stephen Herd <sup>a</sup>

Dr Mandar R. Thakare <sup>b</sup>

a: National Centre for Advance Tribology, Engineering and the Environment, University of Southampton, Highfield Campus, Southampton SO17 1BJ

b: Element Six Global Innovation Centre, Fermi Avenue, Harwell Campus, Didcot, OX11 0QR

## 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

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a1	Fitting parameter
a2	Fitting parameter
a3	Fitting parameter
a4	Fitting parameter
a5	Fitting parameter
A <sub>a</sub>	Apparent area of contact
d <sub>wc</sub>	WC grain size
D	Average wear debris particles diameter during low-cycle micro-fatigue wear
D <sub>m</sub>	Average particle diameter in the influence of multi-degradation
f	Contact frequency between sliding surfaces or cyclic loading frequency
F	Faraday's constant
F <sub>n</sub>	Normal wear load

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