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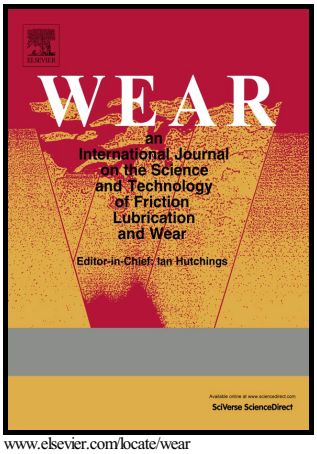

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Wear performance of TiC/Fe cermet electrical discharge coatings

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Abstract

The tribological behaviours of TiC-based cermet coatings, prepared by electrical discharge coating (EDC) using a semi-sintered TiC tool electrode, have been investigated. The as-deposited coatings exhibited complex microstructures, comprising TiC grains within an Fe matrix, on both high speed steel (HSS) and 304 stainless steel (304-SS) substrates. The wear resistance of TiC/Fe cermet coatings, on both substrate types, increased dramatically (one and two orders of magnitude improvement in specific wear rate), compared to as-polished substrates. Further, EDC cermet coatings on HSS were typically 2-4 times more wear resistant, depending on loading, than those deposited on 304-SS, with wear performance reflecting the composite nature of the coating coupled with the mechanical properties of the substrate. Laser surface treatments used to improve surface integrity of the as-deposited coatings, through elimination of cracks and porosity characteristic of ED coating, acted to increase wear rates for all samples, with the exception of coatings on HSS under conditions of high loading. The general increase of wear rate was attributed to a significant reduction in the proportion of TiC within the ED coatings, after laser treatment, combined with an increase in grain size; whilst improvements to the wear performance of laser treated, cermet coated HSS, under high loading, was attributed to the avoidance of an abrasive wear mechanism.

Keywords

electrical discharge coating; EDC; EDM; TiC/Fe cermet; tribology; wear

1 Introduction

The electrical discharge coating (EDC) method, being an adaptation of electrical discharge machining (EDM), may be used to produce hard cermet coatings, using a sacrificial semi-sintered tool electrode [1]. The advantages of ED processing, over competing surface modification techniques, include the ability to machine material and apply a coating using the same machine tool, without need for post-processing, combined with the ability of EDM to