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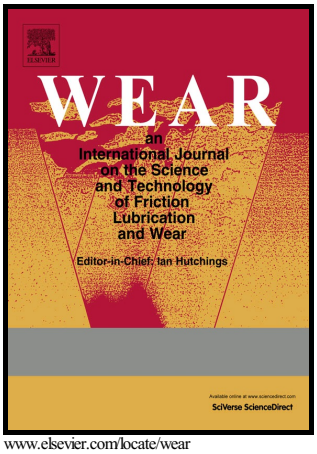

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Material wear map for ground engaging steels based on scratch tests

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Abstract

The present work examines the scratch resistances of a series of candidate ground engaging steels. A range of microstructures is considered: tempered martensite, nano-bainite, pearlite, and austenite. Scratch testing was performed using tungsten carbide and diamond spherical tip sliders with tip radii ranging between 25 μm and 1.3 mm. Wear grooves were analysed and material loss determined. A material property wear map based on hardness and 'scratch ductility' is introduced. The map is analogous to those frequently employed in the literature to compare the strength and ductilities of structural alloys. A simple analytical wear model is developed and this is employed to enable comparison between candidate materials for differing scratching conditions. It is seen that the role of hardness dominates over that of ductility for high loads and smaller abrasive tip radii. This leads to a number of striking changes in relative wear rates of the candidate materials examined and these are effectively captured in the proposed map. The groove geometry due to the plastic flow of the material was also found to be the key parameter of the wear model and prediction of the wear mechanism.

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1. Introduction

Ground engaging tools are an essential part of any mining operation. Their wear imposes considerable costs, particularly due to machine downtime [1-3]. Extending tool life is obviously an attractive endeavour. Current ground engaging steels are typically made from

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