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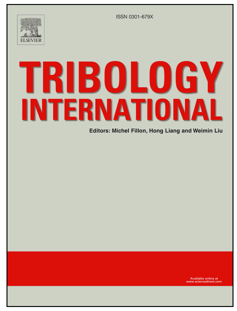

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Effect of microstructures with the same chemical composition and similar hardness levels on tribological behavior of a low alloy steel

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Abstract

The tribological behaviors of various microstructures are investigated, but it is mainly focused on wear without fixing hardness and/or chemical composition. Therefore, friction tests between steel pins with different microstructures for similar hardnesses ($310H_V$-$500H_V$) and abrasive papers with different sizes (15µm-200µm) under different loads (50N-110N) are performed.

For each hardness, compared to single-phase and multi-phase microstructures, dual-phase microstructures improve the tribological behavior. Among these microstructures, as martensite colonies become coarser and equiaxe, the tribological behavior is enhanced. Moreover, as hardness increases, friction coefficient and wear rate decrease for each microstructure whereas the microstructure effect on the tribological behavior is less pronounced. A transition in friction behavior and wear mechanisms is observed for an optimal particle size (CPS) around 35 µm.

Keys words: Microstructure, Hardness, Abrasive Wear, Friction.

1. Introduction

In various fields such as transportations and industrial applications, considerable amount of energy is consumed to overcome friction. In addition, mechanical components can undergo severe wear leading to reduce their lifetimes. Finally, associated to a consequent financial cost, the replacements of these components are required to ensure the efficiency of the associated mechanical systems. Therefore, an improved understanding of the tribological behavior of contacting materials aims to reduce the severe wear of mechanical components and energy and economic losses [1].

Several works pay considerable attention to determine the effect of roughness on the tribological behavior of two materials rubbing against each other. For instance, abrasive papers with different embedded abrasive particles sizes are used to determine the optimal abrasive particle size and therefore the optimal roughness minimizing the friction coefficient and the wear rate [2-5]. Indeed, this effect of particle size on friction and wear behaviors represents a growing interest in the literature [2-14]. Based on scanning electron micrographs and surface topography observations, as the size and