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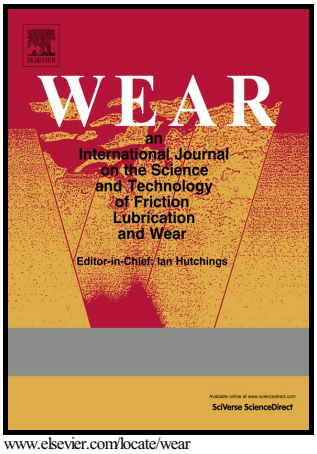

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Effects of grain size gradients on the fretting wear of a specially-processed low carbon steel against AISI E52100 bearing steel

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Abstract:

The purpose of this work was to study effects of different grain size distributions on fretting wear behavior of a low carbon steel flat specimen against a bearing steel ball. The grain structure of the low carbon steel was varied to produce a gradient microstructure consisting of fine grains at the surface and coarse grains in the interior. The novel method of surface treatment involved a multi-step technique of compressing a series of hardened steel rods on the surface and then recrystallizing those surfaces. Four similar kinds of microstructures as observed at different depths were reproduced on the surface of the steel samples by changing the heat treatment cycles after deformation. Worn specimens were characterized using scanning electron microscope (SEM), energy dispersive spectroscopy (EDS), Electron back scattered diffraction (EBSD) and optical profilometry. Wear resistance at all the loads was found to be highest for the fine-grained steel specimen compared to that of the coarser-grained specimens. The wear resistance of a bimodal microstructure was considerably higher due to the presence of fine as well as strained grains. Higher wear resistance for the finer grain microstructures was attributed to higher degree of interaction with the grain boundary regions. The wear behavior at the surfaces with different microstructures could well be correlated with similar types of microstructures developed at different depths.

Keywords*: Wear; Low carbon steel; Microstructure.*

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