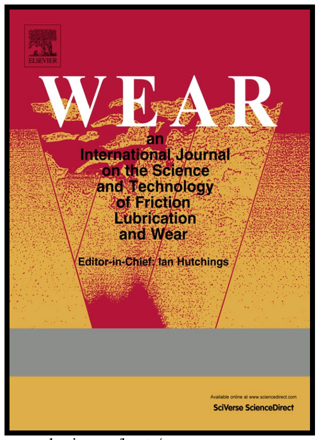
Author’s Accepted Manuscript



www.elsevier.com/locate/wear

Case Study: formation of white etching layers in a failed rolling element bearing race

Li-Biao Wan, Shu-Xin Li, Si-Yuan Lu, Yun-Shuai Su, Xue-Dao Shu, Hai-Bo Huang

PII: S0043-1648(17)30640-3
DOI: http://dx.doi.org/10.1016/j.wear.2017.07.014
Reference: WEA102211

To appear in: *Wear*

Received date: 16 April 2017
Revised date: 12 July 2017
Accepted date: 21 July 2017

Cite this article as: Li-Biao Wan, Shu-Xin Li, Si-Yuan Lu, Yun-Shuai Su, Xue-Dao Shu and Hai-Bo Huang, Case Study: formation of white etching layers in failed rolling element bearing race, *Wear* http://dx.doi.org/10.1016/j.wear.2017.07.014

Case Study: formation of white etching layers in a failed rolling element bearing race

Li-Biao Wan, Shu-Xin Li *, Si-Yuan Lu, Yun-Shuai Su, Xue-Dao Shu, Hai-Bo Huang

School of Mechanical Engineerying and Mechanics, Ningbo University, Ningbo 315211, PR China

*Corresponding author. Tel.: +86 574 87600134; fax: +86 574 87608358. li_shuxin@163.com

Abstracts

The aim of this investigation was to study the formation of white etching layer (WEL) induced by rolling contact fatigue (RCF) in a bearing steel. Through sectioning a failed bearing, the microstructure of the WEL was investigated using optical microscopy, scanning electron microscopy (SEM), transmission electron microscopy (TEM) and micro indentation test. The result showed that the WEL is harder than the matrix. It consists of refined grains of martensite, austenite and carbides. In contrast to the thermally-induced WELs, where the austenite is the result of phase transformation due to austenitization, the austenite in the WELs of the current study comes from the original retained austenite. No phase transformation occurred, indicating that the WEL was formed under deformation induced the mechanism. WELs and white etching areas (WEAs) were compared in detail. The result suggested that WELs and WEAs are actually the similar responses to large shear deformation in RCF of martensitic bearing steels.

Keywords

Rolling contact fatigue (RCF); White etching layer (WEL); White etching area (WEA); Grain refinement.

1. Introduction

Materials subjected to RCF suffer from material alteration at both contact surface and subsurface. When inspecting cross-sections of failed bearings or samples after RCF, white etching matters such as white bands, white etching areas (WEA) and white etching layer (WELs) are observed under optical microscope. These white microstructures are different from base materials in terms of microstructural compositions and hardness.

White bands and WEAs are commonly observed in bearing steels and have been extensively studied, especially WEAs [1-8]. The results show that WEAs are composed of nanosized ferrites [1-3]. The hardness of WEAs varies with