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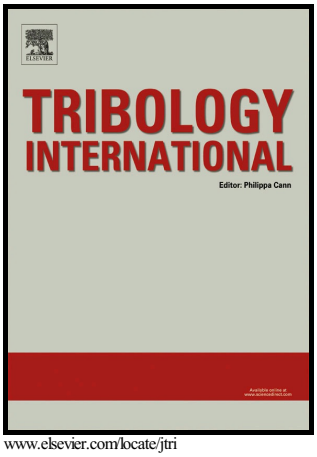

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Abstract

The tribological properties of martensite steel with different grain sizes in vacuum was studied. The surface nanocrystalline martensite steel exhibited lower wear rate but higher friction coefficient than corresponding coarse grained steel in vacuum. The results presented that the tribo-oxidation has been effectively restricted in vacuum. Therefore the mechanical behavior was the main factor of the wear rate variety of martensite steel with different grain sizes. The surface film of martensite steel formed easier as the hardness increased and ductility weakened. So the wear mechanisms of the martensite steel in vacuum changed from plastic deformation and adhesion to adhesion and fracture as the grain size decreased.

Keywords: Nanocrystalline; Friction; Wear; Vacuum

1. Introduction

The unique and demanding environments of aerospace, such as Hubble space telescope, have challenged liquid lubricant technology and led to a number of investigation friction and wear behavior of materials in unlubricated condition over the years as high-vacuum applications. These materials include carbon-based materials, ceramic composites, and even aerospace metals. That could be applied as ceramic gears, bushings, face seals, slide-ways, rolling element bearings, tooling and dies [1-3]. How to enhance the wear resistance of these materials is an important issue for vacuum application. There is in linear relationship between wear resistance and hardness according to the Archard equation [4]. Owing to the high hardness, it would show better