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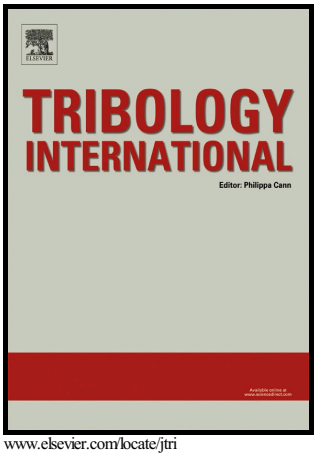

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Development of a novel *in-situ* technique for hydrogen uptake evaluation from a lubricated tribocontact

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Abstract

Hydrogen in mechanical elements can be generated as a result of tribochemical reactions during surface-rubbing causing steel embrittlement. In this study, a new modified Devanathan-Stachurski setup in which a tribological charging cell is incorporated was developed in order to provide an online measurement of hydrogen permeation through steel from a lubricated metal-metal contact. This new technique enables the study of the hydrogen source and the rate of its permeation in a tribocontact. The effect of water contamination and the presence of conventional anti-wear and friction modifier additives in polyalphaolefin base oil on tribologically-induced hydrogen uptake were investigated. The results indicate significant influence of water on hydrogen uptake. The ZDDP anti-wear has promoted hydrogen uptake from the tribocontact. Whilst MoDTC friction modifier reduced the hydrogen permeation.

Keywords: Tribological hydrogen uptake; *In-situ* measurement; Electrochemical method; Oil decomposition

1. Introduction

Steels are widely utilised in many industrial applications due to their suitable mechanical properties, good performance, and reasonable cost [1]. However, hydrogen has been shown to have many deleterious effects on the mechanical properties of the steel. Steel alloys are susceptible to a loss in steel ductility and premature failure at lower stress concentrations in the presence of hydrogen. It has been demonstrated by several investigators that the steel fatigue life significantly shortens due to the presence of hydrogen [2-6]. Hydrogen atoms can easily penetrate into the steel due to their extremely small size. Therefore, damage of