A New Asperity-Scale Mechanistic Model of Tribocorrosive Wear: Synergistic Effects of Mechanical and Corrosive Wear

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Abstract

An electrochemical wear model is considered at the asperity-scale of a tribocorrosive wear system as well as the traditional Archard-type mechanical wear model. The geometry of the surface asperities are modified in a contact mechanics model with respect to both electrochemical and mechanical wear calculations. The model is then used to predict the chemical and mechanical components of the total wear of the system. Synergistic effect of corrosion on mechanical wear and mechanical wear on corrosion are modelled numerically in this work. The values are then used to explain different components of mechanistic tribocorrosive wear models present in the literature and wear maps are developed for different loads and sliding speeds. This deterministic model, for the first time, calculates the corrosion enhanced wear in a tribocorrosive wear environment and proposes that changes in the topography are responsible for this synergistic effect. The wear enhanced corrosion can be modelled using the electrochemical wear model due to the dynamic de-passivation and consequent re-passivation of the surface oxide layers.

Key words: *Tribocorrosion, Wear modelling, Electrochemistry, Wear map*