RECIPROCATING SLIDING WEAR BEHAVIOR ON ALUMINUM AND BRONZE ALLOYS UNDER DRY AND LUBRICATED CONDITIONS

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ABSTRACT

The reciprocating sliding wear behavior of 6026 aluminum and standard bronze was evaluated using a linearly reciprocating sliding tester. Coefficients of friction (COFs) were obtained using a load cell, a DAQ interface, and LabView software. Mechanical profilometry and SEM microscopy were used to evaluate the wear volume, additionally, XRD and EDS techniques were used to characterize the tribofilms generated. The bronze specimens in the dry condition showed high plastic deformation and material transferred to the steel ball by adhesion, while the aluminum specimens in the lubricated condition showed a greater wear volume.

Surface topography; experiments in tribology; wear; coefficient of friction

INTRODUCTION

The service life in machines and cutting tools is vital, because of the mechanical elements operating in critical conditions as heavy loads, high working speeds, and severe environmental conditions. Ball-on-flat linearly reciprocating sliding wear is one of the most common laboratory wear testing methods to determine the wear behavior of engineering materials. The volume of the material removed is one of the meaningful parameters for wear characterization materials.

Non-ferrous metals have found application in manufacturing various automotive engine components where adhesive wear or dry sliding wear is a predominant process. Moreover, materials with high wear resistance under dry conditions are associated with forming a tribolayer on the worn surface [1].

This study is aimed to evaluate the sliding wear behavior of 6026 aluminum and standard bronze against chromium alloy steel using a linearly reciprocating sliding tester with a ball-on-flat configuration either in dry or lubricated condition, using glycerol as lubricant.

METHODS

The sliding wear action was evaluated by monitoring the friction forces, their data were recorded by a DAQ interface. While, COFs were computed through the LabView software. The experimental tests were carried out using the parameters recommended in the ASTM G133 standard.

RESULTS

COFs did not show significant changes in the aluminum and bronze samples. In dry conditions, bronze showed high plastic deformation, and material transferred to the counterface by adhesion. The lubricated samples of 6026 aluminum showed a greater wear volume but exhibited seizure in the dry condition at the contact surface against the steel sphere at 15 N. Wear scars were analyzed using SEM, and some wear mechanisms were identified, such as plastic deformation, plowing, cracks, fractures, and pitting on aluminum specimens in dry condition. Moreover, in lubricated conditions, it was possible to find plastic deformation, fractures, and cracks. Tests on 6026 aluminum at lubricated conditions showed a high wear volume and deep wear scars, attributable to the tribochemical reactions at the contact surface and the glycerol used as a lubricant. Moreover, seizure on the contact surface of the steel sphere at 15 N was observed at dry conditions, mainly due to the low hardness of aluminum samples, which promotes that the real area of contact approaches to the apparent contact area.

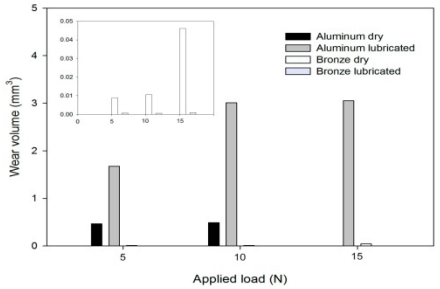

Fig.1 Wear volume vs applied load for aluminum and bronze.

REFERENCES

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