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PAPER

# An investigation on the tribological behaviour of biomimetic placoid and cycloid textures on AISI316L stainless steel

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## Abstract

Surface texturing is considered as one of the best techniques to improve material performance and characteristics related to its ability to govern exterior properties in specific applications. Contributing to the increase in demand for materials for a variety of use, surface texturing has garnered much attention in recent decades. The objective of this research was to investigate the friction and wear behavior of biomimetic shark-skin (placoid) $S_1P$, trout-skin (cycloid) $S_2C$ textures on AISI316L stainless steel surface and untextured surface $S_3S$ against commercial AISI52100 steel balls under dry sliding conditions. Nd:YAG laser texturing system was used to create micro-grooves similar to the biomic placoid and cycloid fish scales on AISI316L stainless steel surfaces. To determine their characteristics, the samples were examined using a 3D profilometer with AFM, FESEM, EDS, and XRD. Reciprocating ball on disc tribometer (Rtec-MFT-5000) was used to evaluate the sample's friction and wear performance. Tribo-tests were performed at two different loads and constant sliding speeds to observe the effect of texturing on the tribological properties of 316L stainless steel. Laser Surface Texturing (LST) was found to be effective in controlling the coefficient of friction and wear volume loss of materials. Sample $S_2C$ showed a relatively lower coefficient of friction and wear rate under dry sliding conditions. This paper used the analytical method to compare the tribological behavior of biomimetic placoid and cycloid textures on AISI316L Stainless Steel, and the results revealed that laser surface texturing can be an effective technique to enhance the tribological properties of friction material.

## 1. Introduction

Tribology encompasses the study of friction, wear and lubrication at both the macro and micro levels. One of the quintessential criteria in determining the tribological behavior of materials and components is to assess the surface finish of the material. This task can be carried out by quantifying some critical parameters, such as friction and wear. To achieve the optimal tribological performance of materials, the surfaces of the materials can be modified by using different methods and techniques, which transform the material's friction and wear behavior. A significant amount of research has been conducted to transform the material's surface. One of the most promising methods to achieve this purpose is to change the surface topography of the materials (Sahoo 2011). Since surface topography considerably impacts lubrication, friction, and wear rate, changing it is one of the most resorted to options for regulating the wear and failure processes of contacting surfaces. Therefore, altering the surface to regulate wear and friction may be helpful rather than having an entirely smooth surface. The topography of a surface can be changed in many ways, such as by developing coatings on the surfaces, fabricating textures, and by other physical and chemical etching and deposition methods.