STATISTICS TOOLS FOR TRIBOLOGICAL STUDIES: TEST PARAMETERS EFFECT AND TRIBOLOGICAL MAPS

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1. Introduction

DLC (Diamond-Like Carbon) films exhibit unique mechanical and tribological properties and have applications on terrestrial and spatial environments. Depending on the hydrogen concentration on the DLC films and on the test environment they can present high or low friction coefficient and wear.

The usual experimental approach for finding the optimal material for each application is to vary one parameter at time while keeping the others constant, thus measuring the influence of each one. This approach ignores the interactions between the parameters and can lead to incomplete or wrong conclusions. The use of factorial design to describe the overall effect when you vary all parameters at the same time allows representing the parameters influence in a simple way.

Response surface methodology was used to develop a mathematical modeling of friction and wear of these films, by using the experimental results, in order to identify the parameters that control friction and wear and to obtain the equation that describes these parameters to construct the maps.

2. Experimental

The tests were carried out on reciprocating system on ball on plate configuration and for Ti6Al4V/DLC20% pair on environmental conditions (~25°C and ~40% RH). Friction and wear maps are constructed with measured and with calculated values by using response surface methodology.

3. Results and Discussions

Figure 1 shows one totally measured friction map and figure 2 shows the calculated map for the DLC films with 20% hydrogen concentration. The results show that the maps help to predict the material behavior in a wide range.

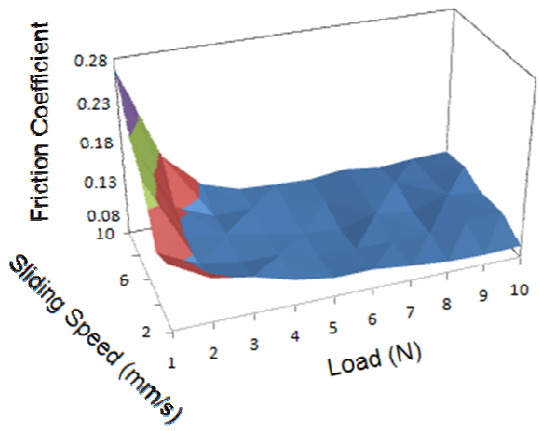

Fig. 1. *Measured friction map for DLCH20% on ten loads from 1.0 to 10.0N and five sliding speeds from 2.0 to 10.0N.*

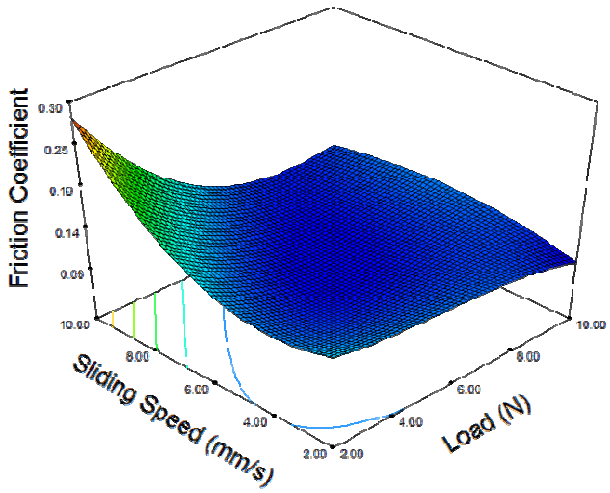

Fig. 2. *Calculated friction map for DLCH20% on four loads from 2.0 to 10.0N and four sliding speeds from 2.0 to 10.0N.*

4. References

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