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Tema: Caracterización tribológica y desgaste de materiales para la industria siderúrgica"

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Resumen de Tesis:

The main aim of this PhD.Thesis is to contribute to the creation of a phenomenological model to predict high temperature wear of steel making industry components. This work is focused on wear of rotary piercing mandrels for seamless tube making industries. This tube making process is also known as Mannesmann rotary piercing.

State-of-the-Art of Mannesmann rotary piercing was determined by literature revision. Given that mandrels do not only wear by material removal but also by shape loss, creation of a tribological model which could consider this fact became necessary.

Laboratory scale process was analyzed for latter considering of application of its results at full scale.

A laboratory scale rotary piercing mill was designed and constructed at INTEMA for use as a mandrel wear testing machine. Despite that equivalence between full scale and laboratory scale equipment could not be fully established, wear study could be performed by comparison between materials and surface treatments at the same reduced scale. The wear testing machine was equipped with an electronic module for technological data acquisition during high temperature billet piercing sessions.

A mandrel profile acquisition technique, was created in order to evaluate shape loss during rotary piercing wear tests. This new technique was based on digital photography and feature recognition measuring software specially written for this purpose in Matlab/QtOctave environment.

Acquired data from piercing series was analyzed, at first using linear correlations and finally using Artificial Intelligence. This was performed by the implementation of Self Organizing Maps, a type of neural network, for finding

which variables, or relations among them, could be used for quantifying mandrels' wear and factors that influence the process.

A first approach of a wear predicting equation was introduced for the analysis of piercing mandrels behaviour.

This Self Organizing Maps analysis method, feeded with data supplied by technological, geometrical and microstructural analysis, could be easily implemented for other test conditions not taken in this work, for instance: different roll mill warping angles, gorge diameter, mandrel initial profiles and axial settings, etc. Moreover, using the adequate variables for each case, the presented method could be implemented to full scale process analysis, as well as to different steel making industries components.

Future activities and research lines starting from the present work are proposed.

Palabras clave: tribology, high temperature wear, direct piercing, self organizing maps, seamless tubes.