ABSTRACTS

The quality standards improvement in the aerospace field have revealed a real industrial need for precise and systematic control of the produced and manufactured steels. Different techniques for the control of the manufactured products quality already exist, the so-called “non-destructive testing and evaluation (NDT&E) techniques”. The objective is to evaluate both internal and external states of the tested samples without affecting their integrities.

The need for NDT is becoming more prominent. Its evolution is linked to the increasing complexity of the new industrial products geometries and to the instrumentation and computer science improvements. This evolution is also related to the evolution of society preoccupation. In the aerospace bearing industry, the nondestructive testing techniques based on the “local magnetic signature” constitutes a real alternative to the classic NDT methods like the traditional chemical baths which reveal defects in the form of nuances of gray spots (precipitated carbon) and which are generally quite difficult to interpret. The micro-magnetic methods are nonpolluting methods, they consist in controlling the structural modifications of a test sample under high magnetic field excitation [1]-[4]. Using local dedicated magnetic sensors, we can establish a precise cartography of the controlled structure and the treated parts. In SKF Company, France, Barkhausen noise is by instance used since many years now. It is particularly efficient for the control of contact zones between the rolling and the set elements of the bearings.

The current industrial uses of the Barkhausen’s noise in particular and of the micro-magnetic NDT&E methods in a general way are very empirical; operators set thresholds of rejection using experimental results but no accurate models are available to refine these thresholds and to improve the phenomena understanding. The purpose of our work is to develop local accurate models of the coupled mechanical/magnetic and of the microstructure to improve the understanding of the material behavior [5]. This will help to refine and generalize the use of the micromagnetic signature control as a method for nondestructive testing.


KEYWORDS

Micromagnetism | Hysteresis model | Non-destructive testing |