Abstract Title: Improvement of Mechanical, Wear, and Fatigue Behaviour by Set of Nanostructured Bainitic Microstructure via Novel Heat Treatment of a Commercial 9254 Spring Steel

Mohammad Masoumi [1]

[1] *Universidade Federal do ABC, Centro de Engenharia, Modelagem e Ciências Sociais Aplicadas, Av. dos Estados, 5001 – Bangú, 09210-580 Santo André, SP, Brazil.*

Abstract

The study aims to introduce a series of novel heat-treatment on a well-defined material class to set a nanostructured bainitic to the improvement of classic mechanical properties and ensuring the fatigue reliability as a scientific issue. The development of nanobainitic steel obtained by low bainitic transformation temperature in high carbon and high silicon steel can provide a high strength and fatigue resistance with excellent formability, is an scope of suitable replacement of the existing martensitic steel for high hardness used in certain components to improve wear resistance and minimise the maintenance cost/time of common railways and bearing applications. The results exhibited that a nanostructured bainitic microstructure comprised of fine carbon-enriched film-like retained austenite dispersed in a carbide-free tempered lower bainite during bainitic transformation would be developed during the proposed bainitic transformation process. The effect of fraction of the phases, the holding time, and the stability of retained austenite, and also crystallographic orientation relationship between different phases were also comprehensively studied. In this case, relatively higher carbon content film-like austenite located between bainitic shaves. The bainitic sheaves have higher dislocation density induced during cooling, and bainitic transformation can retard the martensitic deformation of the remaining austenite. Additionally, predominant {110}//strain direction crystallographic texture was identified, which promotes slip deformation and enhances the mechanical properties. Moreover, remarkable amounts of fine film-like retained austenite oriented along compact crystallographic directions (i.e., <111> and <112>) were observed.

Keywords—*bainitic transformation, EBSD, crystallographic orientation, fatigue.*

Professional Biography (100-150 words)

Mohammad Masoumi has completed his PhD at the age of 31 years from Federal University of Ceará, Brazil and postdoctoral studies from University of São Paulo, Brazil. He is the associated professor of Federal University of ABC since 2018. He has published more than 30 papers in reputed journals and has been serving as an editorial board member of repute. His research interests are focused on the study the role of microstructural features such as microstructure, crystallographic texture, and grain boundary distributions on mechanical properties, corrosion resistance, and wear resistance in a wide range of materials (i.e., low, moderate, and high carbon content steels).

Email Id: mohammad.m@ufabc.edu.br

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