Abstract ID 529

EXPLORING THE IMPACT OF DEFORMATION-INDUCED MARTENSITIC TRANSFORMATION IN THE MONOTONIC AND FATIGUE BEHAVIOUR OF THE 301L STAINLESS STEEL WITH APPLICATION IN PASSENGER TRAIN STRUCTURES

Vítor M. G. Gomes[(1)], Aida B. Moreira[(1)], C. Diogo Mota[(1)], Francisca M. de Sousa Baptista[(1)], Miguel A. V. de Figueiredo[(1)], João Cruz[(2)], João D. S. Silva[(3)], Manuel A. S. Pereira[(3)], Manuel F. Vieira[(1)], Abílio M. P. de Jesus[(1)]

[(1)]Faculty of Engineering of the University of Porto
[(2)]Sermec Group
[(3)]CP - Comboios de Portugal

vtgomes@fe.up.pt, aidamoreira@fe.up.pt, up201704847@edu.fe.up.pt, up201906425@edu.fe.up.pt, mfiguei@fe.up.pt, joaocruz@sermecgroup.pt, jdssilva@cp.pt, maspereira@cp.pt, mvieira@fe.up.pt, ajesus@fe.up.pt

Keywords: Railway carriages; Austenitic Stainless Steel; Monotonic Behaviour; Fatigue Behaviour

Summary: Type 301L austenitic stainless steel is widely used in various industries due to its excellent corrosion resistance, mechanical strength, weldability, and significant work hardening capacity. These characteristics are crucial for the railway industry, which values the comfort, safety, and durability of its trains, thus ensuring that 301L steel is a common choice for the structure of railway carriages. These materials are commonly applied in components such as structural elements of railway carriages, where resistance to cyclic loads is critical. The fatigue behaviour of these steels is strongly influenced by deformation-induced martensitic transformation, which can increase strength but can also contribute to crack initiation and propagation under cyclic loading. Given the demanding operating conditions of railway components, namely exposure to dynamic stresses, impact loads, and environmental factors, understanding the fatigue performance of these materials is crucial to ensuring durability and safety. In this paper, the strength of 301L stainless steel under two conditions (MT and HT) is evaluated for monotonic and fatigue loading conditions. Under monotonic tests, the effect of finishing (MT and HT) is observed in the mechanical strength properties, namely in the significant increase in yield strength to the detriment of the material's ductility, in the HT state. This increase in strength is also observed under fatigue loading conditions. When the fatigue strength data are compared with the fatigue design curves for structural steels given, for example, by Eurocode 3, it is observed that fatigue design curve is still conservative for both materials.

Acknowledgments: This work is a result of Agenda “PRODUCING RAILWAY ROLLING STOCK IN PORTUGAL”, nr. C645644454-00000065, investment project nr. 55, financed by the Recovery and Resilience Plan (PRR) and by European Union - NextGeneration EU.