The influence of structure, sensitization and corrosion on the fatigue properties of AISI 304 austenitic steel

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Austenitic stainless steels are widely used biomaterials owing to their high biocompatibility and corrosion resistance. Their current study mostly aims to further improve their mechanical properties, wear and local corrosion resistance [1]. The protective passive film on the stainless steel surface ensures high resistance to the uniform corrosion in common oxidation environments, but under special conditions local corrosion forms can be initiated [2].

The article will be focused on examining and comparing the influence of structure, sensitization and corrosion on the fatigue properties of austenitic stainless steel. The methodology of the experiment includes fatigue tests of samples attacked by intercrystalline corrosion. Therefore, the test samples were subjected to heat treatment for sensitization. Then these samples were subjected to long-term exposure in an aggressive corrosion solution.

Experiments deal with microstructural material analysis, fractographic analysis, mechanical and fatigue tests. The microstructure of the testing sample was examined using a light microscope (LM) ZEISS Neophot 32. A Vickers hardness test was performed on a Zwick/Roell ZHV μ-A test apparatus. Fatigue properties of austenitic steel were tested by three-point bending cyclic loading. Fatigue tests have been carried out on testing machine ZWICK/ROELL Amsler 150 HFP 5100. The fracture surface of the testing sample was examined using a scanning electron microscope (SEM) TESCAN Vega II LMU, where samples were observed on various stages of the fatigue process, their characteristics and differences of fracture surfaces.

The aim of this work is to analyze stainless austenitic steel after heat treatment (sensitization) and exposure in a corrosive environment, by comparing and evaluating the results of fatigue tests and fracture surface fractography.

The research was supported by the Scientific Grant Agency of the Ministry of Education of Slovak Republic and Slovak Academy of Sciences, VEGA 01/0134/20, KEGA 004ŽU-4/2023, KEGA 016ŽU-4/2023, project APVV-20-0427 and project to support young researchers at UNIZA, the ID of project 12715.

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