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USING EXPERIMENTAL AND NUMERICAL CHARACTERIZATION IN COMPARING MARINE EXHAUST SYSTEM STAINLESS STEELS

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Material selection is one of the crucial points of mechanical design process. Selecting proper material is even more important when designing a component that is going to be exposed to harsh operating conditions like in the marine environment. This paper presents a comparison of three different austenitic stainless steels (1.4541, 1.4571, 1.4841) used in a production of marine exhaust systems. Selecting a suitable material can help in avoiding failure scenarios of such systems [1] that are exposed to elevated temperatures and marine environment.

Steels are compared based on experimentally and numerically determined properties and characteristics. Experimentally, ultimate tensile strength and yield strength are determined at room and elevated (300 °C, 600 °C) temperatures. Also, a short-term creep test is performed in order to compare material creep responses for selected temperatures. Further, Charpy impact energy is experimentally measured and value of fracture toughness calculated.

As for the numerical research, finite element (FE) simulation of Charpy test is performed. Also, in order to predict fracture behaviour of considered steels, single specimen test method used in fracture mechanics is numerically simulated. Using FE stress analysis results of such test, *J*-integral is calculated to quantify crack driving force. This numerical research was performed in order to establish reliable models that can be used in industry to characterize materials, opposite to traditional experiments, and has proven to be reasonably accurate and efficient [2].

Comparing the results obtained by experimental and numerical assessment of the three considered stainless steels, it can be noted that 1.4841 has the highest yield and ultimate tensile strength along with Charpy impact energy and fracture toughness. Also, steel 1.4841 has higher values of *J*-integral, making it more adequate to structures that need less susceptibility to fracture. Numerically predicted values comply with those experimentally determined ensuring further use of the FE models. Results can be useful in a design process when selection of proper material is of a great importance.

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