Stabilization of austenitic stainless steel used in nuclear industry – project introduction

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Abstract:

Austenitic stainless steels used for the production of primary circuit components in nuclear engineering must exhibit not only good corrosion resistance but also adequate mechanical properties at elevated temperatures. The main problem with these steels is their susceptibility to intergranular embrittlement when exposed to elevated temperatures in the range of 350 °C to 750 °C. Higher temperatures triggers the precipitation of chromium carbides at the grain boundaries, causing a local decrease in chromium content and so intergranular corrosion of the steel. Therefore such steel must be stabilized by addition of titanium or niobium and appropriate heat treatment (solution annealing and stabilization). To define and describe the principles taking place in the stabilization annealing of 18/10 austenitic stainless steel stabilized by titan an experiment was proposed. This experiment includes various modes of heat treatment (with a range of different temperatures and holding times) as well as different parameters of previous processing. The effect of these parameters on the microstructure and its mechanical properties will be investigated in cooperation with ŠKODA JS, a.s. under the project TJ02000274. The aim of the project is to achieve required mechanical properties, especially to increase the hot yield strength value and contribute to shortening the stabilization process. Besides a hot tensile test (at 350 °C), a metallographic analysis will be carried out focusing on the precipitation of the phases arising during the annealing. Using image analysis the distribution, size and shape of the particles will be evaluated. In addition to light microscopy, scanning electron microscopy (SEM) will also be used.

Key words:

Austenitic stainless steel, stabilization annealing, hot tensile test, precipitation