Institute of Materials Science, Joining and Forming
Kopernikusgasse 24/I, 8010 Graz

Announcement of a Master's Thesis, 23.08.2019

Weld characterisation of a new ferritic-martensitic steel with superior creep strength at high temperature

Description

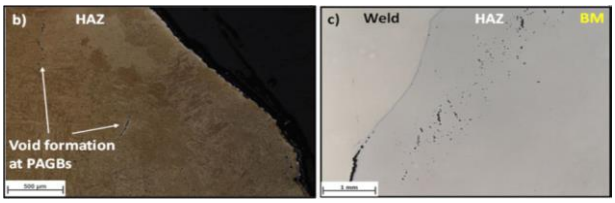

Figure 1: Formation of voids in HAZ of ferritic steel

The efficiency of the coal power plants (PP) increased a lot in the last 30 years from the efficiency range of 30% for the subcritical (SC) PP up to the most efficient ultra-supercritical (USC) PP operating with 46–47% efficiency. Further improvement of the efficiency will be obtained with the introduction of the next PP generation called Advanced-USC (A-USC), targeting efficiency in the range of 50%, where the steam service condition will be over 700°C and pressure over 300 MPa.

Through optimization of the chemical composition and heat treatment procedure, new materials for next generation power plants has been developed. However, the main limitation of the ferritic steels is related to the creep behavior of welded joints. It was shown that 9-12 %Cr-steel welded joints exhibit premature failure due to type IV cracking as demonstrated in the following figure. Light optical and EBSD investigations revealed an intense void formation in a restricted area along small grains at prior austenite grain boundaries (PAGB) in the heat affected zone as the main reason for creep failures. Consequently, advancing the microstructure stability of base material as well as weld metal will enhance creep life and hence product quality. Currently there is a strong need in Europe to develop and apply such steels in order to increase plant efficiency.

The main goal of the project is characterization of a new material in the various zones of the weld and simulation of the heat affected zone with regard to microstructure and mechanical properties after heat treatment and ageing (SEM, TEM, XRD).

Finally, the result of this project will be published in a scientific journal paper.

Organisation

Supervisor: Dr.techn. Mohammad Reza Ahmadi, mailto:mohammad.ahmadi@tugraz.at, Tel: +43 316 873 1678

Duration: from 01.01.2020 for min. 6 months

Location: IMAT institute, Materials group, Kopernikusgasse 24/I, 8010 Graz

Reward: € 2.000 + € 500 performance bonus for an excellent success

Further informationen

For further information please contact the secretariat of the institute or the supervisor.

Tel: +43 316 873 7181, office.imat@tugraz.at, http://imat.tugraz.at