STUDY OF CORROSION IN SUPERCRITICAL WATER

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In this work we summarize the results of high temperature corrosion studies of different type of alloys at relevant operating conditions for Supercritical Water cooled Reactor. The high temperature and pressure above the thermodynamic critical point of water result in higher oxidation rate which might be critical for thin-wall components like fuel cladding. The goal of this work was to collect data on the oxidation rate of candidate materials for future supercritical water devices. General corrosion rates were studied at 500 ^{o}C at 25 MPa for 1848 and 1632 hours in two series on a) Russian Cr-Mo-V steel (called 15H2MFA, 2%Cr), b) EUROFER97 (9%Cr), c) Titanium gr.2 alloy, d) AISI 316 steel (18%Cr). Four samples of each type were loaded into the autoclave and taken out regularly for further analysis. Oxide thicknesses were determined from cross-section samples by optical microscope. The compositions of the oxide layers were analyzed using scanning electron microscope (SEM).

As part of the project, miscibility of the corrosion product in supercritical water has been studied. The aim of this study was twofold. First, the miscibility and the transport of the corrosion product (oxide on the wall) can influence the rate of the chemical reaction itself. Second, the miscibility of several materials changes drastically in a narrow temperature range around the pseudo-critical temperature, which can cause deposits at the high-temperature region (i.e. in the core).