

Microstructural Changes in ODS Steels During Long-Term Annealing

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Abstract. Oxide dispersion strengthened steels (ODS) are key alloys used in nuclear installations. Steels with chromium content of up to 10 wt. % are suitable for the construction of technological devices in the primary circuit of nuclear power plants. Chromium has anti-corrosive properties due to formation of a passivation layer, which results in lower activation of the material by neutrons. Macroscopic properties are determined by their microstructure, and therefore the description of the microstructure is important. For this purpose, transmission Mössbauer spectroscopy and atom probe tomography were applied. In this way, the physical and/or chemical environments of the resonant atoms can be described. The obtained spectral parameters reach saturation values from which the solubility limit of chromium in iron can be determined. In Cr-rich phase, the solubility limit can be estimated from the spectral parameters of a singlet located in the centre of a Mössbauer spectrum which corresponds to the alloy annealed for the longest time. The suggested procedures are subsequently applied to the case studies of stainless steels suitable for the construction of various components of the III+/IVth generation of nuclear reactors. Presence of trace elements in the investigated samples was determined by neutron activation analysis.

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