

Hydrogen Transport and Trapping in ODS-EUROFER (P4-I-480)

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Oxide Dispersion Strengthened (ODS) EUROFER is a candidate structural material to be used in the design of several blanket options [1]. This type of material allows higher temperature performance (650 °C) than standard RAFM steels and shows improved mechanical properties like superior tensile and creep properties in comparison to the base material EUROFER [2].

Together with mechanical and activation properties, the characterization of hydrogen isotope transport properties in any fusion technology material is compulsory because they affect important issues of the blanket concept using a specific collection of materials, such as the fuel economy, plasma stability and the radiological security of the fusion reactor.

The hydrogen interaction properties of permeability, diffusivity and Sieverts' constant in ODS-EUROFER are experimentally evaluated by using the gas evolution permeation technique. The results are analysed together with the properties of the base material in order to study the influence of the particular microstructure of ODS in the hydrogen transport.

Higher permeability of hydrogen in ODS-EUROFER has been obtained in comparison to the base material EUROFER. The effect of trapping showing a high time lag for non steady-state permeation has been noticed in the low temperature range. The trapping phenomena is identified to be the cause of such effect and the presence of nanoparticles of yttria the reason for the source of additional trapping sites. The concluding remark is a decrease in the diffusivity and an increase in the solubility of hydrogen in the material at low temperature. All the hydrogen transport parameters obtained for ODS-EUROFER are compared to the properties of base material and available data corresponding to other RAFM steels of the same kind.

[1] R. Lindau et al. Fusion Eng. Des. 75 – 79 (2005) 989.

[2] R. Lindau, A. Möslang, M. Schirra, P. Schlossmacher, M. Klimenkov, J. Nucl. Mater. 307-311 (2002) 769.