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Deuterium permeation and retention behavior in a martensitic/ferritic steel

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Reduced activation martensitic/ferritic steel has been selected as the first wall material of ITER testing blanket modules (TBM). The first wall is subjected to hydrogen isotope permeation by the two mechanisms: one is plasma-driven and the other is gas-driven, which may result in tritium safety and extraction issues. Meanwhile, to evaluate hydrogen isotope permeation and inventory in the first wall material, accurate measurements of hydrogen isotope transport parameters are essential. In present work, deuterium (D) transport parameters including permeability, solubility, diffusivity and recombination coefficient of a martensitic/ferritic steel have been investigated. D retention behavior of the steel exposed to D2 gas and D plasma has also been compared.
D gas-driven permeation (GDP) through the steel has been performed in a temperature range of 650-800 K to obtain the D transport parameters such as diffusion coefficient, Sieverts'constant and permeability. To evaluate the D recombination coefficient, low energy (several eV) plasma-driven permeation (PDP) has been done in a steady-state laboratory-scale linear plasma device PREFACE at ASIPP. The surface morphology was examined by scanning electron microscopy (SEM) before and after D plasma irradiation. D retention properties of the steel were checked by thermal desorption spectroscopy (TDS) after GDP and PDP experiments.

Eligible for student paper award?

Yes

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