Contribution ID: **696** Type: **Poster**

DEUTERIUM PERMEATION THOUGH CANDIDATES STRUCTURAL MATERIALS FOR A FUSION REACTOR

Thursday, 20 October 2016 08:30 (4 hours)

In the next step fusion devices, such as DEMO or fusion neutron sources high neutron fluxes and fluences are expected. In this case reduce activated (RA) and heat-resistant structural materials should be used.
In Russia V-(4÷10) Ti-(4÷10) Cr alloys, austenitic and RA ferritic-martensitic steels for fission applications are developed and manufactured in A.A. Bochvar High-technology Research Institute of Inorganic Materials. For using materials in next step fusion devices additional studies should be done. Interaction of hydrogen isotopes with structural material is one of the important factors, determining the possibility of using this material in fusion reactors. Permeation of hydrogen isotopes through structural material is one of the key characteristic as tritium is the component of fusion fuel available only in small quantities, expensive and radioactive.
In the present work gas-driven permeation (GDP) and plasma-driven permeation (PDP) through ferritic-martensitic steel RUSFER-EK-181 (Fe-12Cr-2W-V-Ta-BC), austenitic steel ChS-68 (used in fast breeder reactor BN-600 as cladding) and V-4Ti-4Cr were investigated with using PIM facility (NRC “Kurchatov Institute”). In the experiments RUSFER-EK-181 and ChS-68 tubes of 250 mm length with diameter of 6.85 mm and wall thickness of 0.4 mm (effective area 50 cm2) and flat V-4Cr-4Ti membrane with diameter of 50 mm and thickness of 0.1 mm (effective area 20 cm2) were used. PIM facility is equipped with distributed ECRH plasma source, which was used for cleaning the inlet surface of samples by argon ions with ion energy 300 eV and for deuterium plasma irradiation in PDP measurements (typical ions flux density is 10 A/m2 at accelerating potential of –300 V). Deuterium GDP measurements was performed in the pressure range of 5·10-2÷100 Pa and in the temperature range of 600÷900 K.
At GDP permeability coefficient of V-4Cr-4Ti membrane is about 4 orders of magnitude higher than that of RUSFER-EK-181 while permeability coefficient of ChS-68 is higher than permeability coefficient of RUSFER-EK-181 at all pressures and temperatures. However V-Cr-Ti alloys are promising materials for a membrane pump as a superpermeable metal membranes that can be used for provide a significant compression for hydrogen and a 100% separation of fuel from He and other impurities.

Paper Number

MPT/P5-38

Country or International Organization

Russian Federation

Primary author: Dr SPITSYN, Alexander (NRC ”Kurchatov institute”)

Co-authors: Dr GOLUBEVA, Anna (NRC ”Kurchatov institute”); Mr CHERKEZ, Dmitry (Ilyich); Mr BOBYR, Nikolay (NRC ”Kurchatov institute”)

Presenters: Dr SPITSYN, Alexander (NRC ”Kurchatov institute”); Mr CHERKEZ, Dmitry (Ilyich); Mr BOBYR, Nikolay (NRC ”Kurchatov institute”)

Session Classification: Poster 5

Track Classification: MPT - Materials Physics and Technology