

Study on the Behaviors of Tritium and Helium-3 in China Made Hydrogen Resistant Stainless Steels

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To efficiently confine the gaseous deuterium and tritium, which are the important fuels in the development of fusion energies, China has developed a series of hydrogen resistant stainless steels, named with HR series of stainless steels. The mechanisms of the interactions between tritium with the decayed helium-3 and these stainless steels were investigated by theoretical calculations or simulations and experimental observations or tests through gaseous tritium loading into the stainless steels and years of storage. Results showed that China made HR stainless steels had good performance to resist hydrogen damage or hydrogen brittlement. They are the ideal structure materials for tritium systems used in a fusion reactor like ITER. Nevertheless, tritium permeation at high temperatures are still high. Tritium permeation barriers with the aluminides on the surface of the components were successfully developed, which could greatly reduce tritium permeation flux down to 2~3 magnitudes.

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Supported by the development fund of science & technology of CAEP under the contract number of 2008A0301010.