EFFECT OF HELIUM PRODUCTION ON SWELLING OF F82H IRRADIATED IN HFIR – E. Wakai (Japan Atomic Energy Research Institute), N. Hashimoto (Oak Ridge National Laboratory), J. P. Robertson and R. L. Klueh (ORNL), and S. Jitsukawa (JAERI)

Extended Abstract (the full paper will be published in the Journal of Nuclear Materials as Proceedings of the Ninth International Conference on Fusion Reactor Materials, October 10-15, 1999, Colorado Springs, Colorado).

Swelling of tempered F82H-std, F82H steels doped with natural boron (309 appm), isotope ^{10}B (305 appm) and non-tempered F82H steels doped with 1.31 at% ^{58}Ni, and 1.27 at5% ^{60}Ni irradiated at 300 and 400°C to 51 dpa in the HFIR have been examined by TEM. The swelling of F82H-std irradiated at 400°C to 51 dpa was about 0.45% and the natural B and ^{10}B doped F82H steels was 0.9 and 1.1%, respectively. In the ^{58}Ni and ^{60}Ni doped F82H steels, the swelling was 0.02 and 0%, respectively, even though the ^{58}Ni-doped specimen had the highest helium production. Large cavities in the F82H-std were observed in the matrix but not observed near many lath boundaries, while in the ^{10}B doped specimens, cavities were formed even near lath boundaries. While the cavities formed at 300°C to 51 dpa were observed in only the F82H+ ^{10}B and F82H+ ^{58}Ni steels, the swelling value was insignificant. The number densities of dislocation loops formed in these steels at 300°C to 51 dpa were very high (i.e., on the order of 10^{22} m^{-3}), and at 400°C to 51 dpa the number densities were very low (i.e., on the order of 10^{22} m^{-3}). In the F82H+Ni, high-density carbides were formed in the matrix at these temperatures. The production of helium atoms enhanced the swelling of the F82H steel. However, the non-tempered treatment for the F82H+Ni suppressed remarkably the swelling. The cause of low swelling in the F82H+Ni may be due to the occurrence of high density carbides acting as sink or the decrease of mobility of vacancies interacted with carbon atoms in matrix.