2.6 SEQUESTRATION OF CAVITIES AT NANOPARTICLE-MATRIX INTERFACES IN HELIUM PLUS HEAVY ION IRRADIATED NANOSTRUCTURED FERRITIC ALLOYS — C. M. Parish[1*], K. A. Unocic[1], L. Tan[1], S. J. Zinkle[1,2], S. Kondo[3], L. L. Snead[4], D. T. Hoelzer[1], and Y. Katoh[1] - [1] Oak Ridge National Laboratory, [2] University of Tennessee, Knoxville, [3]Institute of Advanced Energy, Kyoto University, [4] Massachusetts Institute of Technology

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Four ferritic alloys: one cast-nanostructured alloy containing Ti-W-Ta carbides, one 9Cr alloy containing Y-Ti-O nanoclusters, and two Fe-12Cr-5Al alloys containing Y-Zr-O or Y-Hf-O clusters, were subjected to simultaneous dual-beam Fe+He ion implantation at 650°C to ~50 dpa at ~15 appm He/dpa ratio, to simulate fusion-reactor irradiation conditions. Post-irradiation examination using scanning/transmission electron microscopy revealed small, high-number-density helium bubbles of ~8 nm, ~10^{21} m^{-3} in the cast nanostructured alloys (CNA) and ~3 nm, 10^{23} m^{-3} in the three nanocluster-strengthened alloys. Advanced X-ray mapping methods combined with data mining of the X-ray maps using multivariate statistical analysis (MVSA) showed that the precipitates in all alloys serve as effective helium trapping sites while precipitates survived the ~50 dpa irradiation at 650°C. All four alloys appear to be viable candidates for future fusion energy systems, although the nanocluster-strengthened alloys appear to sequester the helium into smaller bubbles and away from the grain boundaries more effectively than the cast nanostructured alloys.