HEAT TREATMENT EFFECTS ON PRECIPITATION IN IRRADIATED HT9 STEEL

T.M.K. Green, Todd Allen
Nuclear Engineering and Radiological Sciences, University of Michigan, 2355 Bonisteel Boulevard, Ann Arbor, MI , 48109, United States of America, tmkgreen@umich.edu, traumich@umich.edu

Li He
Engineering Physics, University of Wisconsin-Madison, 1415 Engineering Drive Madison, WI, 53706, United States of America, lhe32@wisc.edu

HT9 is a 12%-chromium and 1%-molybdenum high-strength ferritic/martensitic steel. HT9 has been studied extensively as a candidate for in-core advanced reactor applications due to its high-dose resistance to void swelling and adequate mechanical properties. Currently, there is insufficient understanding regarding how the processing of HT9 prior to irradiation affects HT9's microstructural evolution under neutron irradiation. An NSUF Rapid Turnaround Experiment was awarded to study the heat-to-heat variability of the radiation response of HT9 using the Irradiated Materials Characterization Laboratory at Idaho National Laboratory. Three sets of HT9 samples were investigated. Each set has a different heat processing history but was irradiated at the Advanced Test Reactor at 430°C to 8 dpa. This low dose regime is of interest as it might display information about the microstructure during the trajectory of HT9's operational lifetime. The size, density, and composition of precipitates were evaluated from the data obtained using TEM. $M_{23}C_6$ carbides composed of Cr, C, Mo, V, and Mn were found in all unirradiated samples. VN precipitation was also found in all conditions. The $M_{23}C_6$ carbides ranged from ~60-75 nm and the VN particles ranged from ~30-60 nm. The different heat treatments and starting compositions had significant effects on the VN and $M_{23}C_6$ precipitation. Radiation caused coarsening of both types of precipitates. Preliminary results suggest that heat treatment had an effect on the radiation responses of the different HT9 samples.