Microstructural evolution on CLAM martensitic steel irradiated by dual-beam to 28dpa with 10 appm He /dpa

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The Reduced Activation Ferritic/Martensitic steels (RAFMs) are presently considered as the primary candidate structural materials for fusion reactors. The structural materials for fusion reactors will indure high displacement damage and transmutation helium/hydrogen by intense fluence of high energy neutrons.

A series of R&D activities on China Low Activation Martensitic (CLAM) steel, the candidate structure material of the design of FDS series fusion reactors and ITER liquid LiPb Test Blanket Module of China, has been carried out at ASIPP (Institute of Plasma Physics, Chinese Academy of Sciences) under wide collaboration with other institutes and universities in domestic and overseas.

To investigate irradiation/helium effects on microstructure, dual-beam (e^-/He^+) irradiation to 28 dpa with 10 He appm/dpa at 450 °C and annealing experiments (650 °C/2 hours) after irradiation on CLAM steel was carried out with High Voltage Electron Microscope (JEM-ARM1300) and conventional Transition Electron Microscope (JEOL 2010). Evolution of microstructure was in-situ observed during irradiation and annealing procedure. Priliminary results show that size and density of dislocation loops and helium bubbles increased with irradiation dose. Change of size and density of irradiation induced dislocation loops saturated at ~4dpa and helium effects were analyzed. Effects of dislocation, grain boundary and annealing on dislocation loops and helium bubbles were also analyzed.

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