Precipitation-hardened CuCrZr alloys are considered for use in the first wall and divertor components of the ITER. Unirradiated CuCrZr is ductile and has high fracture toughness. Neutron irradiation leads to significant hardening and ductility loss and the change in fracture toughness properties of the alloys. So far very few fracture toughness data are available on neutron-irradiated CuCrZr. The only fracture toughness experiment on neutron-irradiated CuCrZr was performed on specimens irradiated at a dose level of 0.3 dpa in the temperature range of 20 and 350°C. The fracture toughness data at high doses are needed to determine whether there is pronounced degradation for the ITER-relevant conditions.

In this paper, the fracture toughness properties of Elbrodur®G (KME-AG) CuCrZr were investigated in two heat treatment conditions, i.e. prime aged (solutionized, water quenched and aged), and HIPped, gas-cooled and aged. The second heat treatment is directly relevant for the ITER divertor components. Single edge-notched bend bar specimens and SS-3 sheet type tensile specimens were irradiated in the hydraulic tube facility at the High Flux Isotope Reactor at the Oak Ridge National Laboratory at an irradiation temperature of ~80°C and at two doses, ~0.1 and 1 dpa. Specimens were tested at room temperature to obtain the fracture toughness data and the baseline tensile property data. The microstructure in the primed aged and slow-cooled conditions was characterized by transmission electron microscopy. The effects of heat treatment and neutron irradiation on fracture toughness, tensile properties, and precipitation microstructure are described and discussed.

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