EFFECTS OF BONDING BAKEOUT THERMAL CYCLES ON PRE- AND POST IRRADIATION MICROSTRUCTURES, PHYSICAL, AND MECHANICAL PROPERTIES OF COPPER ALLOYS -
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Extended Abstract

At present, dispersion strengthened (DS) copper is being considered as the primary candidate material for the ITER first wall and divertor components. Recently, it was agreed among the ITER parties that a backup alloy should be selected from the two well known precipitation hardened copper alloys, CuCrZr and CuNiBe. It was therefore decided to carry out screening experiments to simulate the effect of bonding and bakeout thermal cycles on microstructure, mechanical properties, and electrical resistivity of CuCrZr and CuNiBe alloys. On the basis of the results of these experiments, one of the two alloys will be selected as a backup material.

Tensile specimens of CuCrZr and CuNiBe alloys were given various heat treatments corresponding to solution anneal, prime ageing, and bonding thermal cycle followed by reageing and the reactor bakeout treatment at 623K for 100 hours. Tensile specimens of the DS copper were also given the heat treatment corresponding to the bonding thermal cycle. A number of these heat treated specimens of CuCrZr, CuNiBe, and DS copper were neutron irradiated at 523K to a dose level of ~0.3 dpa (NRT) in the DR-3 reactor at Risø. Both unirradiated and irradiated specimens with the various heat treatments were tensile tested at 532K. The dislocation, precipitate and void microstructures and electrical resistivity of these specimens were also determined. Results of these investigations will be reported and discussed in terms of thermal and irradiation stability of precipitates and irradiation-induced precipitation and recovery of dislocation microstructure. Results show that the bonding and bakeout thermal cycles are not likely to have any serious deleterious effects on the performance of these alloys. The CuNiBe alloys were found to be susceptible to radiation-induced embrittlement, however, the exact mechanism is not yet known. It is thought that radiation-induced precipitation and segregation of the beryllium may be responsible. The CuCrZr specimens were much more resistant to these effects, presumably due the sluggish precipitation kinetics of the slowly diffusing chromium.