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原型炉ダイバータ模擬環境中におけるCuCrZr合金の腐食挙動に及ぼす伝導率と水圧の影響

Effects of water conductivity and water pressure on corrosion behavior of CuCrZr alloy in fusion relevant high temperature water environment

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(1) Introduction. In DEMO fusion reactor, plasma casts intensive thermal loading on heat-sinking system of which requires robust materials to withstand aggressive environments. CuCrZr alloy is regarded as one of the promising candidates for its excellent thermal conductivity and mechanical property. In order to evaluate whether water pressure and electrical conductivity affect the corrosion characteristics among water chemistry conditions, we conducted a corrosion test in which the electrical conductivity and water pressure were changed. We measured the weight before and after test; and observed the specimen surface. The degree of influence was evaluated from the results.

(2) Experimental. CuCrZr coupons received a two-step heat treatment to simulate the fabrication of W/Cu/CuCrZr component; and polished up to 0.05 μm prior test. Coupons were exposed to degassed, 230°C high temperature water up to 500 hours with three testing conditions: (1) low water pressure, low conductivity (5MPa, ~ 0.06 uS/cm), (2) high water pressure, low conductivity (15MPa, ~ 0.06 uS/cm) and (3) high water pressure, high conductivity (15MPa, ~ 0.3 uS/cm).

(3) Results and Discussion. Results show that the weight loss occurred on all three testing conditions. Regarding the influence of water pressure, before 250hr, the weight loss at low

pressure and at high pressure are roughly the same. Yet, at 500hr, the weight loss at low pressure is 41.5% smaller than the weight loss at high pressure condition. Regarding the influence of conductivity, before 250hr, the weight loss at high conductivity was higher than that at low conductivity. Nevertheless, at 500hr, the weight loss at high conductivity was 14% smaller than the weight loss at low conductivity condition. It is believed that these results might match parabolic law.

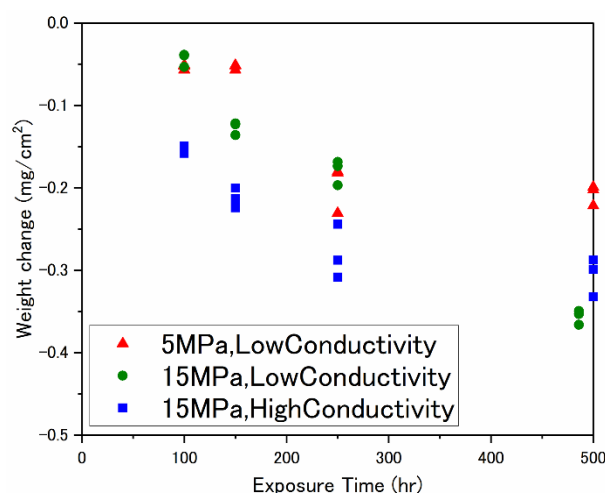


Figure 1 The weight change of specimens tested in (red) 5MPa, low conductivity, (green) 15MPa, low conductivity, and (blue) 15MPa, high conductivity water chemistry conditions