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P3.193 Study on the anisotropy in microstructure and tensile properties of the 12Cr ODS steel

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Oxide-dispersion-strengthened (ODS) steels have been developed as one of prospective candidate materials for fast reactor cladding as well as fusion reactor blanket applications. The anisotropy in microstructure and tensile properties in the range from room temperature (RT) to 973 K of the 12Cr ODS steel with the nominal composition of Fe-12Cr-2W-0.3Ti-0.25Y2O3 (in wt.%) was investigated by scanning electron microscopy, electron backscatter diffraction technique, transmission electron microscopy, Vickers hardness and tensile tests. The hardness was measured at RT with a load of 1 kg and a dwell time of 15 s. SSJ specimens for tensile tests with gauge section of 5 mm (L)×1.2 mm (W)×0.25 mm (T) were machined along rolling direction (RD) and transverse direction (TD). The tensile properties were examined with an initial strain rate of 6.7×10−4/s. Results show that microstructure was not homogeneous, and consisted of coarse recrystallized grains and fine elongated grains with high density of dislocations, which gave rise to the deviation of Vickers hardness. Texture was also clearly characterized, which was <110> axis parallel to the RD, mainly {001}<110> and {111}<110> components. The tensile properties in the RD were better than that in the TD, especially for the elongation. The fracture morphology at RT in RD and TD revealed a mixture of flat cleavage planes and shallow dimples, and a majority of elongated cleavage planes, respectively. The ultimate tensile strength and yield strength were decreased as the testing temperature increased. The fracture morphology and the damage mechanisms in the RD and TD will be discussed in detail.

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