TENSILE BEHAVIOR OF IRRADIATED MANGANESE-STABILIZED STAINLESS STEEL - R. L. Klueh (Oak Ridge National Laboratory)

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EXTENDED ABSTRACT

Tensile tests were conducted on seven experimental, high-manganese austenitic stainless steels after irradiation up to 44 dpa in the FFTF. An Fe-20Mn-12Cr-0.25C base composition was used, to which various combinations of Ti, W, V, B, and P were added to improve strength. Nominal amounts added were 0.1% Ti, 1% W, 0.1% V, 0.005% B, and 0.03% P. Irradiation was carried out at 420, 520, and 600°C on the steels in the solution-annealed and 20% cold-worked conditions. Tensile tests were conducted at the irradiation temperature. Results were compared with type 316 SS.

Neutron irradiation hardened all of the solution-annealed steels at 420, 520, and 600°C, as measured by the increase in yield stress and ultimate tensile strength. The steel to which all five elements were added to the base composition showed the least amount of hardening. It also showed a smaller loss of ductility (uniform and total elongation) than the other steels. The total and uniform elongations of this steel after irradiation at 420°C was over four times that of the other manganese-stabilized steels and 316 SS. There was much less difference in strength and ductility at the two higher irradiation temperatures, where there was considerably less hardening, and thus, less loss of ductility.

In the cold-worked condition, hardening occurred only after irradiation at 420°C, and there was much less difference in the properties of the steels after irradiation. At the 420°C irradiation temperature, most of the manganese-stabilized steels maintained more ductility than the 316 SS. After irradiation at 420°C, the temperature of maximum hardening, the steel to which all five of the elements were added had the best uniform elongation.