TRANSMUTATION-INDUCED EMBRITTLEMENT OF V-Ti-Ni AND V-Ni ALLOYS IN HFIR - S. Ohnuki, H. Takahashi (Hokkaido University), F. A. Garner (Pacific Northwest National Laboratory), J. E. Pawel (Oak Ridge National Laboratory), K. Shiba, and A. Hishinuma (Japan Atomic Energy Research Institute)

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Extended Abstract

Vanadium, V-1Ni, V-10Ti and V-10Ti-1Ni (at%) were irradiated in HFIR to doses ranging from 18 to 30 dpa and temperatures between 300 and 600C. Since the irradiation was conducted in a highly thermalized neutron spectrum without shielding against thermal neutrons, significant levels of chromium (15-22%) were formed by transmutation. The addition of such large chromium levels strongly elevated the ductile to brittle transition temperature. At higher irradiation temperatures radiation-induced segregation of transmutant Cr and solute Ti at specimen surfaces leads to strong increases in the density of the alloy. The resultant shrinkage, possibly compounded by thermal cycling, leads to cracks developing at all intersections of grain boundaries with the specimen surface. This causes specimens irradiated at 500C or below to often fail during retrieval from the reactor, as well as during electropolishing and other handling operations. At 600C, the cracking and embrittlement processes are so severe that only a fine dust, composed mostly of individual grains or chunks of grains, was found in the irradiation capsule.

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