IRRADIATION CREEP AND STRESS-ENHANCED SWELLING OF Fe-16Cr-15Ni-Nb AUSTENITIC STAINLESS STEEL IN BN-350 - A. N. Vorobjev, Yu. V. Konobeev and S. I. Porollo (Institute of Physics and Power Engineering, Obninsk, Russia), N. I. Budylkin and E. G. Mironova (Bochvar's Research Institute for Nonorganic Materials, Moscow, Russia), and F. A. Garner (Pacific Northwest National Laboratory)

To be presented at the 8th International Conference on Fusion Reactor Materials in Sendai, Japan, October 1997.

Extended Abstract

Irradiation creep and void swelling will be important damage processes for stainless steels when subjected to fusion neutron irradiation at elevated temperatures. The absence of an irradiation device with fusion-relevant neutron spectra requires that data on these processes be collected in surrogate devices such as fast reactors.

This paper presents the response of an annealed austenitic steel when exposed to 60 dpa at 480°C and to 20 dpa at 520°C. This material was irradiated as thin-walled argon-pressurized tubes in the BN-350 reactor located in Kazakhstan. These tubes were irradiated at hoop stresses ranging from 0 to 200 MPa. After irradiation, both destructive and non-destructive examination was conducted.

At 480°C and 60 dpa the swelling, as measured by both microscopy and density change, was very large and enhanced by applied stress, ranging from 20 to 30%. Swelling was much lower at 520°C and 20 dpa, but was also enhanced by stress. In both irradiation conditions, the creep rate was linear with applied stress. The creep-swelling coupling coefficient D in both irradiation conditions was found to have fallen to the low level characteristic of the swelling-dominated "creep disappearance" regime.

At 480°C microscopy examination showed that the stress-enhancement of swelling was reflected only in the void density and not the void size. Frank loops did not exist at this high dose and the network dislocation density was found to be independent of the stress level.