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Christopher J. Ulmer, Arthur T. Motta

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Characterization of faulted dislocation loops and cavities in ion irradiated alloy 800H

Christopher J. Ulmer[a,*], Arthur T. Motta[a]

[a] *Department of Mechanical and Nuclear Engineering, The Pennsylvania State University, University Park, PA 16802, USA*

Abstract

Alloy 800H is a high nickel austenitic stainless steel with good high temperature mechanical properties which is considered for use in current and advanced nuclear reactor designs. The irradiation response of 800H was examined by characterizing samples that had been bulk ion irradiated at the Michigan Ion Beam Laboratory with 5 MeV Fe^{2+} ions to 1, 10, and 20 dpa at 440 °C. Transmission electron microscopy was used to measure the size and density of both {111} faulted dislocation loops and cavities as functions of depth from the irradiated surface. The faulted loop density increased with dose from 1 dpa up to 10 dpa where it saturated and remained approximately the same until 20 dpa. The faulted loop average diameter decreased between 1 dpa and 10 dpa and again remained approximately constant from 10 dpa to 20 dpa. Cavities were observed after irradiation doses of 10 and 20 dpa, but not after 1 dpa. The average diameter of cavities increased with dose from 10 to 20 dpa, with a corresponding small decrease in density. Cavity denuded zones were observed near the irradiated surface and near the ion implantation peak. To further understand the microstructural evolution of this alloy, FIB lift-out samples from material irradiated in bulk to 1 and 10 dpa were re-irradiated in-situ in their thin-foil geometry with 1 MeV Kr^{2+} ions at 440 °C at the Intermediate Voltage Electron Microscope. It was observed that the cavities formed during bulk ir-

*Corresponding author
Email address: cju5002@psu.edu (Christopher J. Ulmer)