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Marquis A. Kirk, Meimei Li, Donghua Xu, Brian D. Wirth

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Predicting neutron damage using TEM with in situ ion irradiation and computer modeling

Marquis A. Kirk[1], Meimei Li[1], Donghua Xu[2], and Brian D. Wirth[3]

[1]Nuclear Engineering Division, Argonne National Laboratory, Argonne, IL 60439 USA.
[2]School of Mechanical, Industrial and Manufacturing Engineering, Oregon State University, Corvallis, OR 97331 USA.
[3]Department of Nuclear Engineering, University of Tennessee, Knoxville, TN 37996 USA.

Key words: TEM, in situ ion irradiation, computer modeling, neutron irradiation, predicted dislocation loop density and sizes.

Abstract

We have constructed a computer model of irradiation defect production closely coordinated with TEM and *in situ* ion irradiation of Molybdenum at 80 °C over a range of dose, dose rate and foil thickness. We have reexamined our previous ion irradiation data to assign appropriate error and uncertainty based on more recent work. The spatially dependent cascade cluster dynamics model is updated with recent Molecular Dynamics results for cascades in Mo. After a careful assignment of both ion and neutron irradiation dose values in dpa, TEM data are compared for both ion and neutron irradiated Mo from the same source material. Using the computer model of defect formation and evolution based on the *in situ* ion irradiation of thin foils, the defect microstructure, consisting of densities and sizes of dislocation loops, is predicted for neutron irradiation of bulk material at 80°C and compared with experiment. Reasonable agreement between model prediction and experimental data demonstrates a promising