SIMULATING THE INFLUENCE OF RADIATION TEMPERATURE VARIATIONS ON MICROSTRUCTURAL EVOLUTION – Y. Katoh (Kyoto University), R. E. Stoller Oak Ridge National Laboratory), A. Kohyama (Kyoto University), and T. Muroga (National Institute for Fusion Science)

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The influence of temperature variations on microstructural evolution in austenitic stainless steels is discussed in order to help interpret the response of materials in the HFIR-RB-13J temperature variation experiment. A kinetic microstructural evolution model developed for irradiated austenitic stainless steels was modified to provide a fully dynamic calculation of point defect and point defect cluster concentrations. A dislocation density-dependent interstitial clustering model was introduced so that the calculated dislocation loop evolution might fit the experimental data in a broad temperature range. Using the modified model, microstructural evolution was predicted for simulated HFIR-RB-13J temperature variation experiments and variations in material parameters were evaluated.

Repeated temperature excursion to 573 K from 773 K always resulted in increased dislocation loop density and reduced cumulative defect flux within the calculated material parameter range. Repeated temperature excursions to 473 K from 623 K may increase or decrease the loop density and cumulative defect flux depending on material parameters. The influence of temperature variation could mostly be explained by accumulation and release of matrix defects at the temperatures of interest.