Application of the Bison fuel performance code to EBR-II data

C. Matthews[1], S. Novascone[2], A. Casagranda[2], C. Unal[1],

[1]Los Alamos National Laboratory, Los Alamos, NM, USA
[2]Idhao National Laboratory, Idaho Falls, ID, USA

The MOOSE based fuel performance code Bison has been used extensively for LWR oxide fuel performance simulations. A parallel effort has focused on implementing both material and physical models in Bison to capture the behavior of metallic nuclear fuels. Early analysis focused on qualitative calculations that broadly answered questions related to U-Zr and U-Pu-Zr fuel types and more advanced designs and materials, such as temperature distributions in historical fuel irradiations, behavior of annular fuel designs, and advanced fabrication techniques. Following the initial successes, some difficulties have been encountered in modeling the drastically different fuel behavior (compared to LWR, e.g. extensive swelling, large fission gas bubble populations, sodium infiltration, zirconium redistribution) coupled with a lack of data have slowed the development of advanced metallic fuel models such as fuel-cladding chemical interaction and mechanistic fission gas release. Newly available features in the underlying MOOSE framework, along with simplified model formulation, have helped eliminate some of the barriers to capturing the expected behavior of advanced metallic fuel. Simultaneously, comparison with EBR-II experimental results has helped provide confidence in the validation of the current metallic fuel models in Bison. Through the combination of a better underlying code structure and quantitative analysis, success in matching Bison calculations to EBR-II data can be used to provide a baseline fuel performance code suitable for experimental design, advanced fuel calculations, and advanced modeling implementation.