CURRENT STATUS AND FUTURE PLANS FOR RESEARCH AND DEVELOPMENT OF REDUCED-ACTIVATION FERRITIC/MARTENSITIC STEELS IN USA

R. L. Klueh
Metals and Ceramics Division
Oak Ridge National Laboratory
Oak Ridge, Tennessee USA

The U.S. materials program for fusion seeks to develop materials through a science-based program of theory, experiment, and modeling. For the ferritic/martensitic steels, the objectives are: (1) to develop an understanding of the behavior of the candidate steels in the fusion environment to determine the property limits, (2) to seek to develop steels that can meet the requirements for service in the fusion environment, and (3) to provide the materials technology required for production, fabrication, and system design.

The design window for the use of ferritic/martensitic steels is determined primarily by the fracture behavior at low irradiation temperatures and the creep strength at elevated temperatures. Therefore, two research areas are recognized by the U.S. materials program as exceedingly important if the ferritic/martensitic steels are going to be used for fusion applications. These are: the effect of helium on the fracture properties and how this may affect the low-temperature limit and the extension of the upper operating temperature limit.

Research on the U.S. ferritic/martensitic steels program is carried out at three institutions: the Pacific Northwest National Laboratory, the University of California at Santa Barbara (UCSB), and the Oak Ridge National Laboratory. The present program involves primarily experimental studies of unirradiated and irradiated 7.5-9% Cr reduced-activation steels. Base metal, weld metal, and weldments are being investigated. Irradiation studies are carried out in the High Flux Isotopes Reactor in collaboration with the Japanese programs of MONBUSHO and JAERI to achieve the program objectives. Along with the experimental program, modeling efforts are underway to understand the behavior. Work is beginning on oxide dispersion-strengthened steels as possible materials that will allow for the increase in the upper temperature end of the design window for fusion.

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