Irradiation Performance of Fe-Cr Base Alloys

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Program: Advanced Structural Materials

ABSTRACT

The objective of this research is to conduct a coordinated set of experiments with post-irradiation examination and analyses that will provide significant new insight into the irradiation performance of ferritic alloys for advanced reactor applications. The research is based on neutron irradiation experiments on a matched set of ferritic alloys in a high flux test reactor. The irradiation exposures have been completed (see the table below) – the objectives of this proposal are to: (1) perform post-irradiation analysis of this suite of ferritic materials, and (2) to develop a materials evaluation and modeling base for future development and application of this class of alloys. The new insight will be both in the form of unique experimental results and their use as a basis for developing and improving materials irradiation performance models. This program is also directly linked to complementary, ongoing research programs at national labs. The results of this program will provide highly relevant data and modeling techniques to other DOE-NE advanced reactor and advanced fuels research programs.

This alloy system for study in this program, based on the Fe-Cr system, is the lead alloy system for a variety of advanced reactor components and applications. It is designated as the primary choice for reactor fuel cladding and reactor structural applications for all advanced reactor applications. The research will focus one a unique set of irradiation conditions on these alloys. The suite of alloys ranges from model alloys to commercial and developmental alloys. This spectrum of simple to complex Fe-Cr base alloys will provide the basis for assessing the processes underlying radiation performance even in complex alloy systems. This new level of understanding of the irradiation performance of this alloy system will also serve as a mechanism to develop modeling capabilities to better predict future alloy performance and development. The work is based on a set of on-going experiments at the four cooperating national laboratories.

Alloy	Temp (C)	Dose (dpa)	Specimen Types
Model Alloys: Fe, Fe-9Cr, Fe-12Cr,Fe-14Cr, Fe-19Cr	300, 450, 550	0.01, 0.1, 0.5, 1, 5, 10	TEM, Miniature Tensile
Commercial Alloys: Mod 9Cr-1Mo,HT-9	300, 450, 550	0.01, 0.1, 0.5, 1,5,10	TEM, Miniature Tensile
Developmental Alloys: MA-957	300, 450, 550	0.01, 0.1, 0.5, 1,5,10	TEM, Miniature Tensile