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A Review of Microstructural Features in Fast Reactor Mixed Oxide Fuels

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Keywords

Mixed oxide fuel; microstructure; restructuring; fission products; agglomeration; fuel-cladding chemical interaction; experimental techniques;

Abstract

As an alternative to traditional uranium dioxide (UO_2) fuels, mixed oxide (MOX) fuels were developed to dispose of industrial and military stores of plutonium (Pu) through the incorporation of plutonium dioxide (PuO_2) powder into a UO_2 base fuel. The high temperature and chemical stability characteristic of oxide fuels would be maintained, while the added Pu would ultimately be eliminated from long term storage. Plutonium could be extracted from spent light water reactor (LWR) fuels, acting as an additional step to close the fuel cycle and mitigate potential environmental or proliferation concerns. This review summarizes the primary features associated with fast reactor MOX fuels, including fuel restructuring, actinide redistribution, solid fission products, plutonium agglomerates, joint oxide gain, and fuel-cladding chemical interaction. A summary of research efforts within the last 10 years and directions for future research are discussed.

Introduction

The push for Generation IV Sodium-cooled Fast Reactor (SFR) technology has breathed new life into the prospects of MOX as a next generation fuel source[1]. Microstructural changes, fuel-cladding chemical interaction (FCCI) formation, and thermal property evolution are only a few of the challenges that need to be addressed[2] in order to safely implement advanced MOX fuels in Generation IV reactors and beyond.

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