

Prediction of Failure Enthalpy and Reliability of Irradiated Fuel Rod under  
Reactivity-Initiated Accidents by Means of Statistical Approach

Cheol Nam, Byeong-Kwon Choi, Yong-Hwan Jeong, and Youn-Ho Jung  
Korea Atomic Energy Research Institute

Abstract

During the last decade, the failure behavior of high-burnup fuel rods under RIA has been an extensive concern since observations of fuel rod failures at low enthalpy. Of great importance is placed on failure prediction of fuel rod in the point of licensing criteria and safety in extending burnup achievement. To address the issue, a statistics-based methodology is introduced to predict failure probability of irradiated fuel rods. Based on RIA simulation results in literature, a failure enthalpy correlation for irradiated fuel rod is constructed as a function of oxide thickness, fuel burnup, and pulse width. From the failure enthalpy correlation, a single damage parameter, equivalent enthalpy, is defined to reflect the effects of the three primary factors as well as peak fuel enthalpy. Moreover, the failure distribution function with equivalent enthalpy is derived, applying a two-parameter Weibull statistical model. Using these equations, the sensitivity analysis is carried out to estimate the effects of burnup, corrosion, peak fuel enthalpy, pulse width and cladding materials used.

.....

UO<sub>2</sub> 핵연료봉 성능분석코드 INFRA 개발

Development of UO<sub>2</sub> Fuel Rod Performance Analysis Code, INFRA

이찬복, 방계건, 김대호, 김영민, 양용식, 정연호

한국원자력연구소

대전시 유성구 사서함 105 호, 305-600

요 약

고연소도 UO<sub>2</sub> 핵연료봉 성능해석코드인 INFRA 를 개발하였다. UO<sub>2</sub> 핵연료의 노내 거동에서 고연소도에서 새로이 발생하거나 다른 경향을 보이는 현상들에 대해 새로운 성능 모델들을 개발하였다. 소결체의 Rim 미세구조의 생성과 영향을 분석하는 모델들, 피복관의 부식 및 크립 모델, 그리고 유한요소법에 의한 기계적해석 모델 등을 개발하였다. INFRA 코드는 U-235 농축도 10 w/o 및 연소도 100 MWD/kgU-rod avg. 까지 UO<sub>2</sub> 핵연료봉의 성능 분석에 사용할 수 있을 것이다.