UO₂ Pellet 산화로의 분말 비산 방지를 위한 최종속도 측정

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요 약

방사선 독성이 높은 사용후핵연료를 취급해야하는 협소한 공간에서 실증용 UO₂ Pellet 산화로는 소형화되어야 하며, 장치 출구에서 분말이 비산되지 않아야 한다. 본 논문의 목적은 실리카의 최종속도를 이용하여 U_3O_8의 최종속도를 예측하고 최적공기유량을 결정하고자 한다. 실험 방법으로는 실리카의 이론최종속도를 구하고 검증실험을 한다. 실리카와 U_3O_8의 밀도 비 대 입자크기와 이론기울기 관계식에서 U_3O_8의 최종속도와 유량을 예측하며, 산화실험을 통하여 배출필터의 U_3O_8분말 검출유무로 이론식을 검증한다. Mock -up에서 기존의 실험용 산화로를 사용하여 U_3O_8 분말의 비산실험을 수행하였다. U_3O_8가 비산되지 않는 최적유량과 실험결과는 실증용 UO₂ Pellet 산화로 설계에 적용되었으며 산화로 운전조건을 결정하였다.

중심단어 : SiO₂, UO₂ Pellet, 최종속도, U_3O_8, 실증용, 산화로,

Correlation of Diffusion Models Describing Efflux from a Cathode of an SF Electrolytic Reduction Process

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The advanced spent fuel conditioning process (ACP) proposed and developed by KAERI has drawn attention by its technological advance on proliferation resistance and reduction of environmental contaminants. An electrolytic reduction of spent fuels is adopted as a central unit process of ACP, in which uranium, plutonium and minor actinide oxides are reduced to corresponding metals and alkali and alkaline earth oxides dissolve into a molten salt electric cell. The mass transfer behaviors of cesium, strontium, and barium which represent the alkali and alkaline earth compounds in SF and oxygen ion leaving an integrated cathode of the electrolytic reduction are measured and correlated with a parallel diffusion process model and an analytic diffusion model. The parallel diffusion model treats an integrated cathode of the electrolytic reduction process as a pseudo-homogeneous medium and assumes that the diffusion of active ingredients occurs in two steps; one faster and one slower. The concentrations of the concerned elements are plotted against time for each step. The Fick's second law is solved to obtain an infinite series solution for a cylindrical shape. The solution which is referred as an analytic diffusion model is also correlated with experimental data. The two models are compared in this study and the evaluated diffusion coefficients based on the models are reported with discussion.