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Microstructural Effect of $p(\text{O}_2)$ Variation in Mixed Oxides (MOX) Sintering

FR-5 Nuclear fuel materials - Processing, microstructure, and properties relationship

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ABSTRACT (max 1300 characters)

The atmosphere imposed during sintering of mixed oxide (MOX) pellets can influence the diffusion phenomena involved for densification, grain growth and to ensure chemical homogeneity.

In this work the microstructural effects of the sintering atmosphere $p(\text{O}_2)$ variation was studied for $(\text{U,Pu})\text{O}_{2\pm x}$ containing 11 mol% of Pu/(U+Pu). Polished cross sections were characterized using electron probe microanalyses. They showed a chemical homogeneity of the material and the presence of a single phase for all the $p(\text{O}_2)$ values used.

With electron backscatter diffraction (EBSD) mappings, the average grain size measured by intercepts method showed an increase with the increase of $p(\text{O}_2)$. Following the same behavior, the distribution of grain size also presented a greater homogenization.

The pellets were at least 95% of the theoretical density (TD) with a good reproducibility in all atmospheres. However, the gradual decrease of the relative density with the increase of $p(\text{O}_2)$ indicates the existence of an optimum value of the (Density/Average grain size) couple.