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Effect of manganese doping on sintering mechanisms and microstructure of UO_2

In nuclear reactors, the fuel consists of uranium dioxide (UO_2) pellets stacked inside zirconium alloy cladding. These pellets must withstand extreme temperatures and pressures while maintaining limited chemical interactions with the cladding, particularly during the migration of fission products from the pellet center to the periphery. One notable example is stress corrosion cracking assisted by iodine, which may occur under accidental transients.
A strategy to mitigate such interactions consists in doping UO_2 with metal oxides to control its microstructure and thermochemical behavior, thereby limiting both the mobility and corrosive nature of fission gases. Among potential dopants, manganese oxide (MnO) appears particularly promising as an alternative to chromium oxide (Cr2O3), which is currently an established industrial solution
In this study, we investigate the role of manganese in the sintering of UO_2. Mn-doped UO_2 ceramics were fabricated under varying conditions of Mn content, temperature, and oxygen partial pressure (pO_2). Experiments focused on the interplay between densification, grain growth, dopant solubilization, and dopant volatilization during sintering, providing insights into the optimization of the fabrication process when using Mn as an additive. The microstructure of the final samples is examined in relation to the amount of manganese dissolved in the UO_2 matrix, measured by EPMA, or present as a secondary phase.

Professional Status of the Speaker

Senior Scientist

Interest in submitting a paper in a special issue of

No interest

Invitation letter for visa

No

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