

反应堆工程

高温气冷堆大晶粒二氧化铀核芯研究

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摘要 大晶粒的 UO_2 核芯可更有效地阻止反应堆运行时裂变气体的释放, 实现反应堆燃耗的加深和延长反应堆燃料元件的运行寿命。采用溶胶凝胶工艺制备高温气冷堆燃料元件的 UO_2 核芯, 在胶液中加入含有Al的化合物 $Al(NO_3)_3 \cdot 9H_2O$, 以增大核芯晶粒尺寸。研究了添加剂对核芯晶粒尺寸的影响及烧结过程中分解的O离子与核芯U离子的扩散系数之间的关系。通过添加含有Al的化合物, UO_2 核芯的平均晶粒尺寸由 $18 \mu m$ 增加到 $30 \mu m$ 。对添加 $Al(NO_3)_3 \cdot 9H_2O$ 的 UO_2 核芯的烧结机理研究表明, UO_2 核芯晶粒的长大主要受空位扩散机制的影响。

关键词 [UO₂](#) [烧结](#) [高温气冷堆](#) [燃料元件](#)

分类号

Study on Large Grain Sizes of HTGR's UO_2 Fuel Kernel S

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Abstract Large grain UO_2 fuel kernels are expected to reduce fission gas release which can achieve extended burn up and life of reactor. The UO_2 fuel kernels of HTGR were prepared by sol-gel method, and doped with $Al(NO_3)_3 \cdot 9H_2O$ to increase their grain sizes. Microstructure of UO_2 fuel kernels of HTGR and the relations of the O ions released by the dissociation of $Al(OH)_3$ and the diffusion coefficient of U ions were studied. The effect of dopant content on the grain sizes of UO_2 fuel kernels was investigated. It indicates that the grain sizes are increased from $18 \mu m$ to $30 \mu m$. The sintering mechanism of UO_2 fuel kernels by the addition of $Al(NO_3)_3 \cdot 9H_2O$ shows that the grain sizes of UO_2 are affected by the diffusion of vacancy.

Key words [UO₂](#) [sintering](#) [HTGR](#) [fuel](#) [element](#)

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