



HAL
open science

Identification of grain growth mechanisms during the sintering of Cr-doped UO₂

Antonin de Azevedo, Fabienne Audubert, Nathalie Moncoffre

► **To cite this version:**

Antonin de Azevedo, Fabienne Audubert, Nathalie Moncoffre. Identification of grain growth mechanisms during the sintering of Cr-doped UO₂. ECerS XIX, Aug 2025, Dresden, Germany. cea-04911654

HAL Id: cea-04911654

<https://cea.hal.science/cea-04911654v1>

Submitted on 24 Jan 2025

HAL is a multi-disciplinary open access archive for the deposit and dissemination of scientific research documents, whether they are published or not. The documents may come from teaching and research institutions in France or abroad, or from public or private research centers.

L'archive ouverte pluridisciplinaire **HAL**, est destinée au dépôt et à la diffusion de documents scientifiques de niveau recherche, publiés ou non, émanant des établissements d'enseignement et de recherche français ou étrangers, des laboratoires publics ou privés.

Identification of grain growth mechanisms during the sintering of Cr-doped UO₂

Antonin De Azevedo¹, Fabienne Audubert¹, Nathalie Moncoffre²

¹ CEA , DES, IRESNE, DEC. Cadarache F 13108 Saint Paul Lez Durance, France

² Univ Lyon, Univ Claude Bernard Lyon 1, CNRS/IN2P3, IP2I Lyon, UMR 5822, F 69622, Villeurbanne, France

In the global consideration of improving nuclear safety, the Cr-doped UO₂ nuclear fuel is a promising candidate for “Accident Tolerant Fuels” (ATF). Due to a larger grain size compared to a pure UO₂ fuel, Cr-doped UO₂ shows a better fission gas retention and a limited pellet/cladding interaction. Although the synthesis of this fuel has been studied extensively, the grain growth mechanisms are not yet fully understood. Two mechanisms are discussed: a dissolution precipitation mechanism created by the formation of a liquid chromium phase, and a mechanism of accelerated uranium diffusion due to atomic defects caused by solubilized chromium. In addition, many studies have shown a strong sensibility of grain growth on process parameters (powder preparation and sintering). This behavior therefore makes it difficult to identify the mechanisms of grain growth and the influential factors.

Thus, a parametric study of the synthesis of Cr-doped UO₂ was carried out. Different powder preparation methods were tested, and several sintering atmospheres (fixed and variable) were applied. The different factors that influence grain growth were identified and isolated. It appears that the key factors are the homogeneity of dopant distribution and the progressive solubilization of Cr in UO₂ which is directly linked to the oxygen partial pressure of the sintering atmosphere.