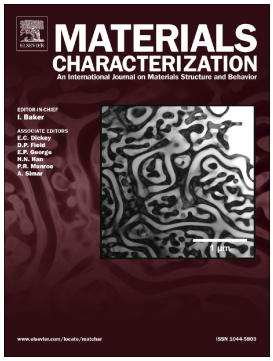
Accepted Manuscript



Sub-boundaries induced by dislocational creep in uranium dioxide analyzed by advanced diffraction and channeling electron microscopy

M. Ben Saada, N. Gey, B. Beausir, X. Iltis, H. Mansour, N. Maloufi

PII: S1044-5803(17)30783-0
DOI: doi:10.1016/j.matchar.2017.09.023
Reference: MTL 8839

To appear in: *Materials Characterization*

Received date: 21 March 2017
Revised date: 15 September 2017
Accepted date: 20 September 2017

Please cite this article as: M. Ben Saada, N. Gey, B. Beausir, X. Iltis, H. Mansour, N. Maloufi , Sub-boundaries induced by dislocational creep in uranium dioxide analyzed by advanced diffraction and channeling electron microscopy. The address for the corresponding author was captured as affiliation for all authors. Please check if appropriate. Mtl(2017), doi:10.1016/j.matchar.2017.09.023

Sub-boundaries induced by dislocational creep in Uranium Dioxide analyzed by Advanced Diffraction and Channeling Electron Microscopy

M. Ben Saada[1,2*], N. Gey[1,3**], B. Beausir[1,3], X. Iltis[2], H. Mansour[1], N. Maloufi[1,3]

[1]. *Laboratoire d'Etude des Microstructures et de Mécanique des Matériaux (LEM3), UMR CNRS 7239, Université de Lorraine, 54045 Metz Cedex 1, France*
[2]. *CEA, DEN, DEC, Cadarache, 13108 Saint-Paul-Lez-Durance, France*
[3] *Laboratory of Excellence on Design of Alloy Metals for low-mAss Structures (DAMAS), Université de Lorraine, France*

Corresponding Authors:

*Nathalie GEY: Nathalie.gey@univ-lorraine.fr

Abstract:

The network of sub-boundaries formed in a sintered UO_2 pellet after dislocational creep was examined. Very low angle boundaries, down to 0.1° were reliably detected by Electron BackScattered Diffraction (EBSD). This angular resolution was achieved by optimizing EBSD data collection and processing. Moreover, Accurate-Electron Channeling Contrast Imaging (Accurate-ECCI) was able to image the dislocations produced by creep, directly on the bulk sample. The dislocations were mostly organized in sub-boundaries with low energy configurations. Only a limited number of isolated dislocations were observed. Finally, the deformation substructure obtained after 8% creep deformation (at 1500°C under a 50 MPa uniaxial state) was quantified. The original grains with a mean size of 20 µm were in average fragmented in sub-grains of about 5 µm. The geometrically necessary dislocations density (GND) was evaluated from the filtered EBSD data to 7.9 $x10^{12}$ m^{-2}. This value was 10 times higher than that measured on the as-sintered sample. This confirms that the GND density calculation is sensitive to the dislocation increase after 8% deformation by creep.

Keywords: Uranium dioxide, Creep, EBSD, ECCI, Dislocation, Porous material.

Corresponding Author: N. GEY (nathalie.gey@univ-lorraine.fr)