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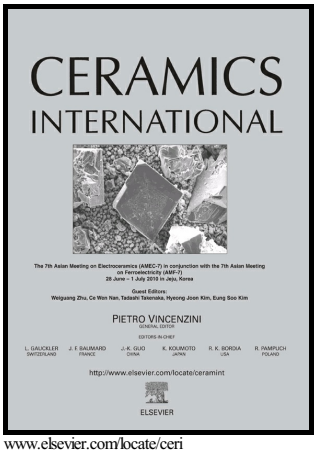

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ACCEPTED MANUSCRIPT

Sub-micrometre grained UO_2 pellets consolidated from sol gel beads using spark plasma sintering (SPS)

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Keywords: spark plasma sintering, SPS, sol gel, UO_2, nanocrystalline, high burnup structure, HBS.

Abstract

UO_2 beads from the sol supported precipitation method were calcined at a low temperature in order to obtain porous micro-beads, composed of nanometric particles. The sintering behaviour of the beads in spark plasma sintering was investigated. The powder had a good sinterability and the final grain size of the pellets could be tailored by varying the processing conditions, in order to resemble the microstructure of the traditionally fabricated UO_2 pellets (i.e. grains of several µm size), or to achieve sub-micrometre size as observed in the high burnup structure. Dense UO_2 pellets with a grain size as small as 300 nm were obtained by sintering at 835°C without dwell time, whereas 3 µm grained pellets were obtained at 1000°C and a 5 min dwell time.

Accepted manuscript

1.1 Introduction

Recent studies are beginning to disclose the potential of field assisted sintering technologies (FAST) in the domain of nuclear reactor fuel safety research [1-5]. The literature published in the last two years clearly shows the possibilities to create functional microstructures that were unconceivable up to only few years ago. For example, the spark plasma sintering (SPS) technique was employed to

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