

Densification and Grain Growth of UO_2 Pellet by Microwave Sintering

150

가 2.45GHz
 UO_2
96%TD
가
ADU- UO_2
5 μ m
가
1600
1
가

Abstract

Microwave sintering process of UO_2 pellets was studied using a multi-mode type cubic applicator, and a magnetron which generates maximum output of 10kW and operates at a frequency of 2.45GHz. The densification and grain growth behaviors of UO_2 green pellets were investigated to find out sintering variables such as sintering temperature and time during the microwave sintering. The results showed that microwave processing enhanced the densification and grain growth process. The sound sintered pellet having more than 95% theoretical density and 5 μ m average grain size can be obtained by 1hour holding at 1600 in H_2 atmosphere. The effects of heating rate and thermal shielding on sintering process were also investigated.

1.

. UO_2 1700
가
가 가 . UO_2

가 가 .

가 가 .

가 가 .

가 가 .

가 가 .

가

. [1-3]

가

, - 가 [4,5] 가

UO₂ 1983 Thornton[6] . 1.6kW

가 4

가 95% UO₂ . Subramanian[7] 1kW

Microwave 1 95.5%TD

가 SIEMENS [8,9] 가

가

가

가

2.

ADU UO₂ 0.2wt% Zn-strate 가

3ton/cm² 가 2.45GHz 10kW . 1

가

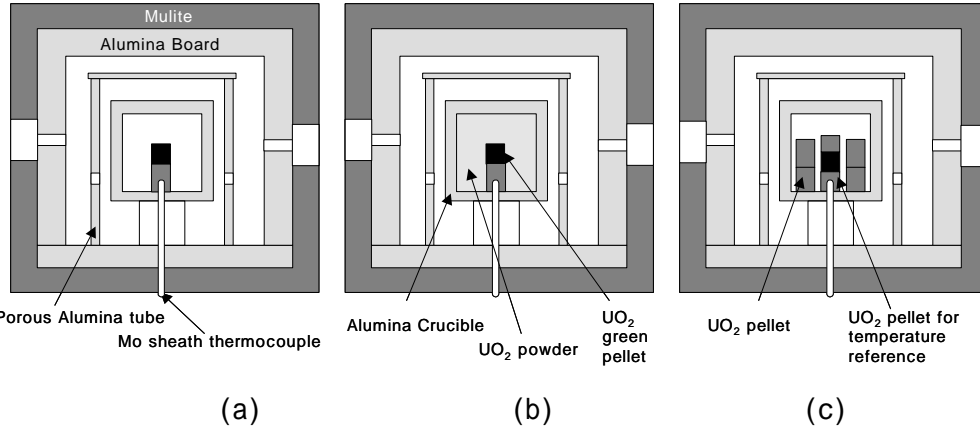
alumina board, 가

mulite board 가 pellet

thermocouple

가 (b) UO₂ powder 1(a) (c)

Powder pellet 가 .
 UO₂
 PID control
 100cc



1. UO₂

1

	()	(hrs)	(/min)
MT1	1600	1	7(~ 1550), 3(1550 ~)
MT2	1650	1	7(~ 1550), 3(1550 ~)
MT3	1700	1	7(~ 1550), 3(1550 ~)
MT4	1750	1	7(~ 1550), 3(1550 ~)
MD1	1700	0	7(~ 1550), 3(1550 ~)
MD2	1700	1	7(~ 1550), 3(1550 ~)
MD4	1700	2	7(~ 1550), 3(1550 ~)
MD4	1700	4	7(~ 1550), 3(1550 ~)
RH1	1700	4	:30
RH2	1700	4	:20

3.

3.1

2 . 1(a) 가 1700 1 가

가 . UO₂ micro

가 . UO₂ 1 (b) 1600 4

1650 가 3 pore

가 . hyperstoichiometric O/U

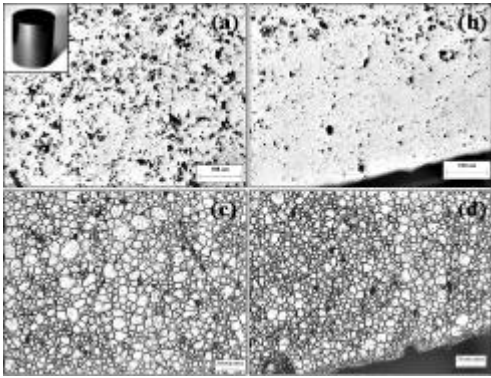
O/U 가 가

UO₂ 가 UO₂ 가

1(b) 가

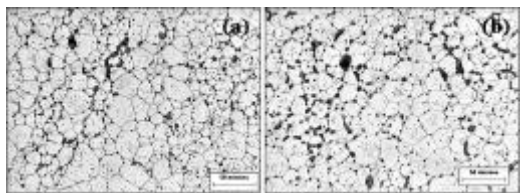
1(c) 가

가 .



2. 1(a)
1700 1

(a) (b)
(c) (d)



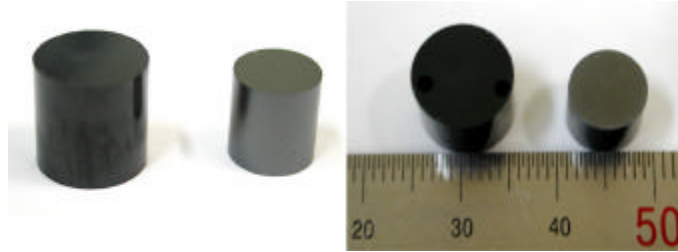
3. 1(b)

(a) 1600 4
(b) 1650 0

3.2.

4 1(c) 가

1700 4
가



4.

(

.)

(가)

5 6

1 가

가

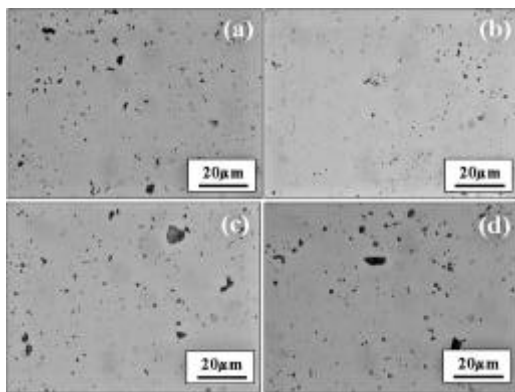
가 가

7

가 가

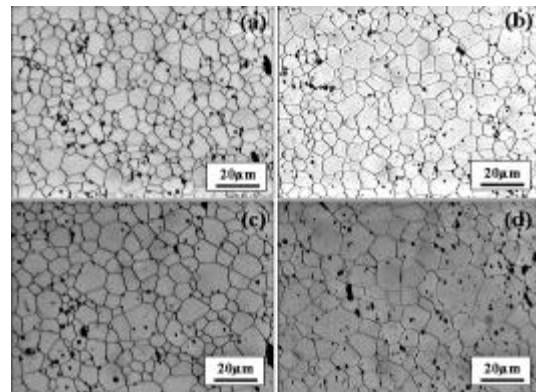
가 5.2 μ m 8.1 μ m 96.4%TD 97.1%TD
가

가



5.

(a) MT1 (b) MT2 (c) MT3 (d) MT4



6.

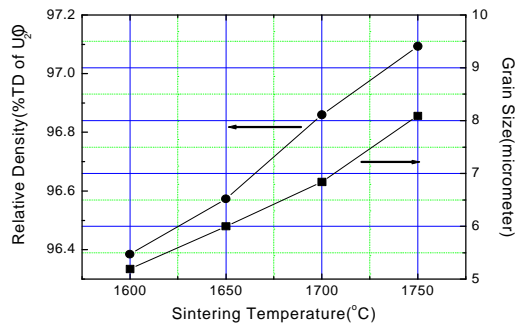
(a) MT1 (b) MT2 (c) MT3 (d) MT4

()

8 9

1700

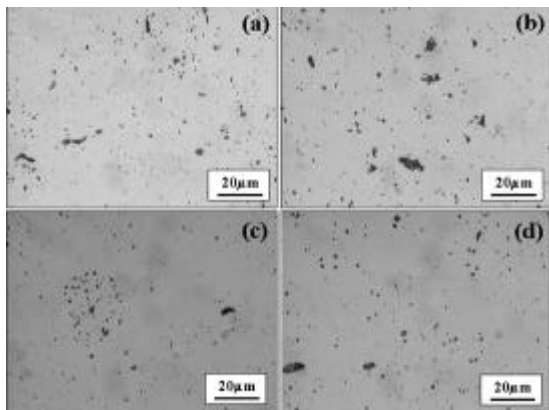
가



7.

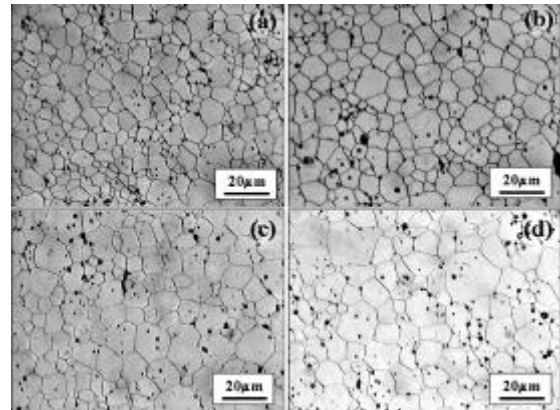
가

가 가 가 가
 0.5%TD 가
 5.7μm 8.2μm 가
 가가



8. 1700

(a) MD1 (b) MD2 (c) MD3 (d) MD4



9. 1700

(a) MD1 (b) MD2 (c) MD3 (d) MD4

()

11

가

12

가

가

가

가

가

가

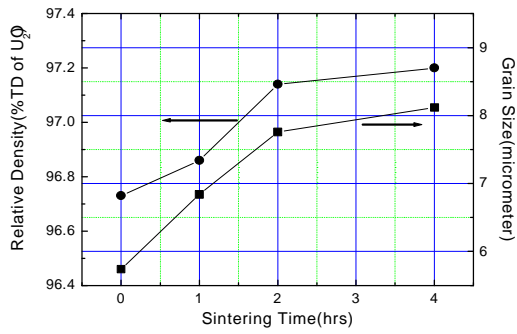
가

가

가

가

가



가

10.



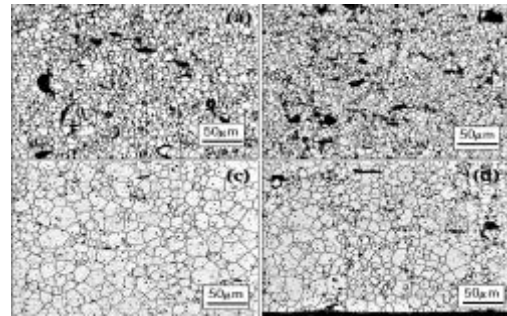
(a)

(b)

11.

(a) RH1

(b) RH2



12.

(a) RH1

(2) RH2

(c) RH1

(d) RH2

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 [3] Bykov, Y.V., Rybakov, K.I., & Semenov, V.E., J. Phys. D:Appl. Phys. (2001) R55
 [4] Ioffe, US Patent US6,228,377 B1
 [5] Chandramouli, V. et al., J. Nucl. Mater. 231 (1996) 213
 [6] Thornton, T.A., and Holaday, V.D., Jr., US Patent 4389355 (1983)

[7] Subramanian, T. et al., Materials Letters 46 (2000) 120

[8] Siemens, World Patent WO 98/08227

[9] Siemens, World Patent WO 99/42778