

## The Effect of $U_3O_8$ Powder on the Sintered Density of $UO_2$ Pellet II. Oxidation Time at 450 °C

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### 1. Introduction

In general, the pellet scrap is approximately 5% during the manufacturing process of PHWR(CANDU)  $UO_2$  pellets. These scraps under an air atmosphere at constant temperature are oxidized into  $U_3O_8$ . Those  $U_3O_8$  are recycled by addback with  $UO_2$  powder in the powder prepare process. The sintered density of  $UO_2$  pellet decreases and pore becomes coarse by the addition of  $U_3O_8$ . In other words,  $U_3O_8$  is a density controller as well as a pore-former.

In this study, when  $U_3O_8$  powder formed by the various oxidation times at 450 °C oxidation temperature adds to  $UO_2$ , the influence of the sinter ability was investigated.

### 2. Methods and Results

CANDU-type pellet(97%TD, ~8 $\mu$ m) into a platinum crucible was heated to 450 °C at 4 °C per minute in a muffle furnace. Oxidation times were carried out in the 5 conditions (0.5, 1, 4, 7 & 10 hr.). XRD analysis showed that oxidized powder formed by the oxidation time at 450 °C was confirmed as  $U_3O_8$ . (Fig. 1)

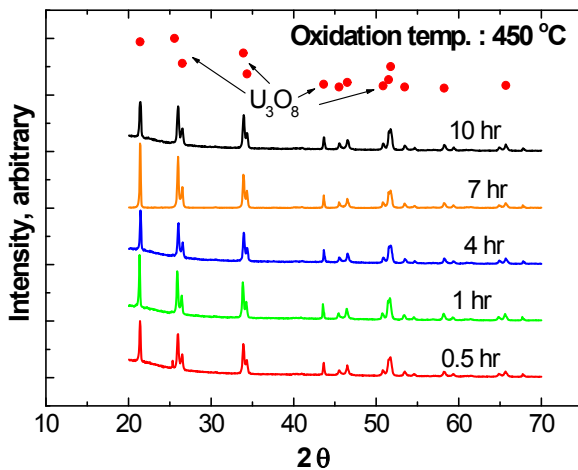


Fig. 1. XRD pattern of powder formed according to the oxidation time at 450 °C

5wt%  $U_3O_8$  powder which is formed by the temperature was added to ex-ADU natural  $UO_2$  powder. Next those powders were mixed for 30 min. in a tubular mixer with

0.2wt% Acrawax for a lubricant. The compacts were formed under 3 conditions (150, 300, 450MPa). The green density was measured by the geometric method. Each density of compacting pressure was estimated as 4.6 ~ 4.7g/cm<sup>3</sup>, 5.3 ~ 5.4g/cm<sup>3</sup> and 5.8 ~ 5.9g/cm<sup>3</sup>, respectively. The green pellets were sintered at 1700 °C for 4 hours in a  $H_2$  atmosphere. The sintered density of the pellet was measured by an immersion method.

Fig. 2 shows the sintered density of  $UO_2$  pellet which was added the 5wt% of  $U_3O_8$  powder formed by each oxidation time.

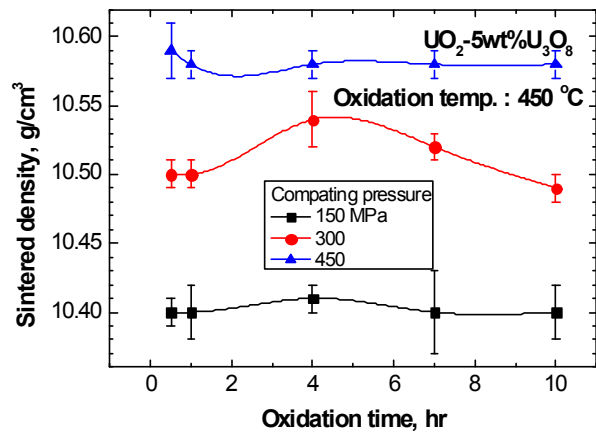


Fig. 2. Sintered density according to the oxidation time

As shown in Fig. 2, the sintered density of  $UO_2$  pellet increases as the compacting pressure increases regardless of the oxidation time. But the oxidation time does not influence on the sintered density under the same compacting pressure. This is thought to be caused by the specific surface area of  $U_3O_8$  powder formed by the oxidation temperature. In other words, the specific surface area of powder does not seem great differences in the oxidation time of 0.5~10 hours[1]. The difference of the oxidation time does not have an effect on the sintered density of  $UO_2$  pellet when it is added 5wt% of  $U_3O_8$ .

### 3. Conclusion

- XRD analysis showed that oxidized powder that was formed by the oxidation time at 450 °C was confirmed as  $U_3O_8$ .

- The difference of the oxidation time at 450°C does not have an effect on the sintered density of UO<sub>2</sub> pellet when it is added 5wt% of U<sub>3</sub>O<sub>8</sub>.

#### **REFERENCES**

[1] S.H. Na et al., Proc. of the Korean Radioactive Waste Society, Autumn 2011, Jeju, 9(2) 2011, pp.163-164