

In-situ high Temperature X-ray Diffraction for Structural Transition of Uranium Oxide

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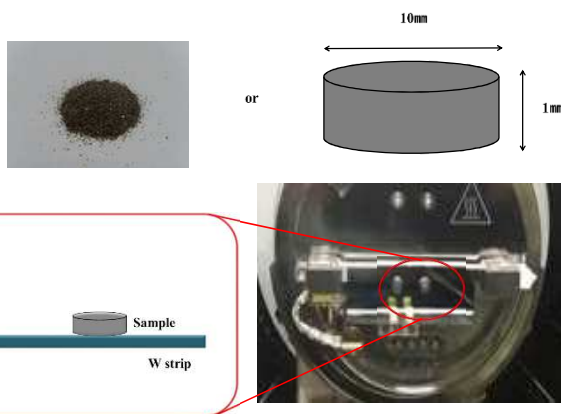


Introduction

- After nuclear power generation, amount of spent nuclear fuel is steadily increased, researchers have been increasingly interested in methods of disposal spent nuclear fuel.
- It is very important to structural changes according to temperature because various compounds between nuclear fuel and fission products can exist by heat generated from nuclear fuel.
- To observe the structural behavior between UO_2 and fission product in spent nuclear fuel depending on temperature using powder x-ray diffraction.
- Uranium oxide materials have been of particular interest in broad nuclear fuel fields because of the structural changes derived from various oxidation state numbers such as UO_2 , U_4O_9 , U_3O_8 and UO_3 .
- X-ray diffraction is too difficult to measure while controlling the temperature, we can the temperature by adding a special device, and acquire the powder diffraction pattern at the controlled temperature to check the structural change in real time.

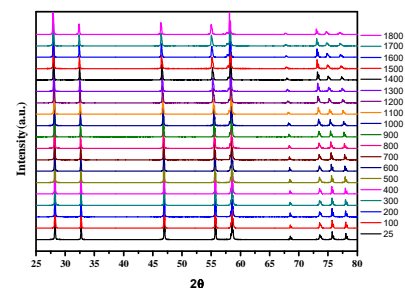
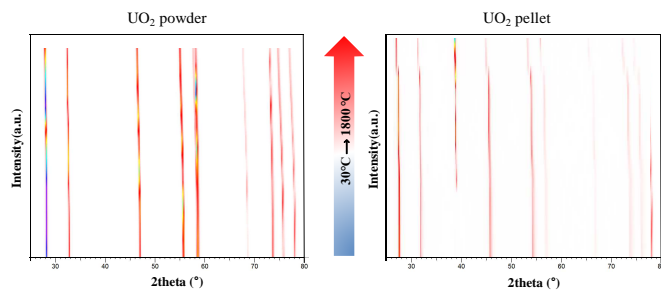
Experimental

Powder and Pellet Samples

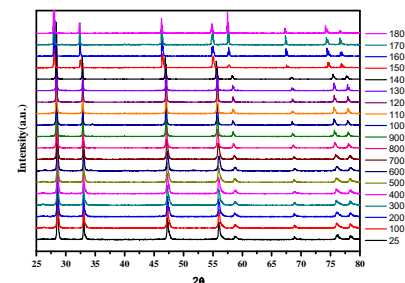


- UO_2 powder : 30°C → 1800°C
- UO_2 pellet : 30°C → 1800°C

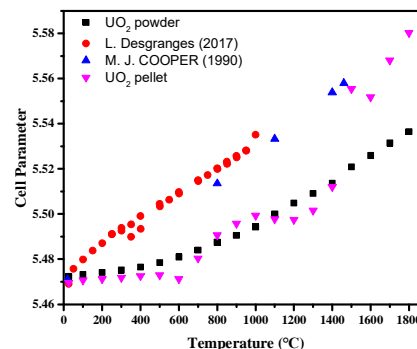
Results & Discussion



- UO_2 powder : PXRD patterns shifted slightly to the left shift.



- UO_2 pellet : PXRD patterns shifted slightly to the left more than the UO_2 powder at high temperature.



- UO_2 powder : the cell parameters did not match the reference.
- UO_2 pellet : the cell parameters matched the reference.

Conclusion

- The UO_2 powder and UO_2 pellet structures were observed using in-situ high temperature x-ray diffraction.
- The cell parameters were characterized by calculation methods (TOPAS).
- The controlled condition of materials were heated gradually to above 1,800°C
- The change of lattice parameters of materials crystal structures were confirmed by XRD patterns.

ACKNOWLEDGEMENT

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