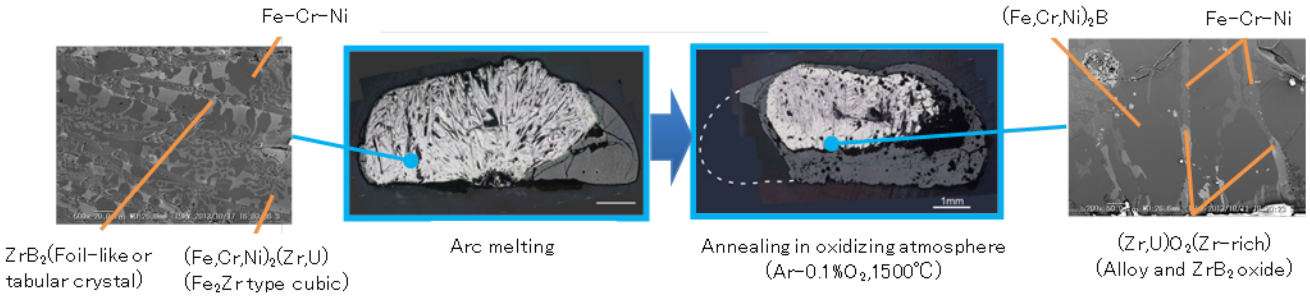
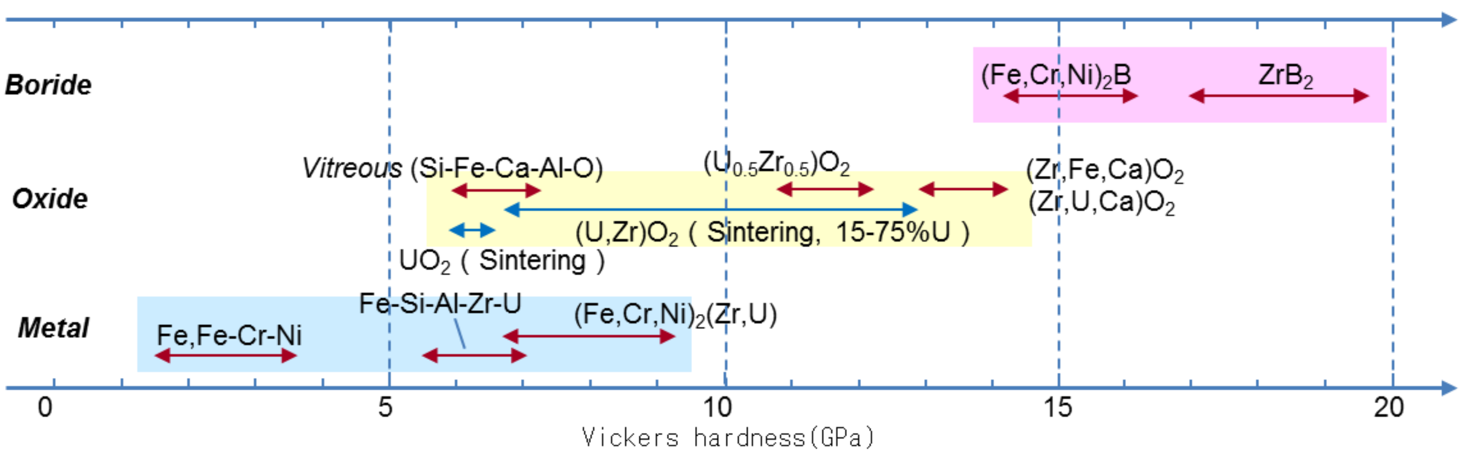


Reaction by control material (B$_4$C+SUS)
(Example of observed cross-sectional image of molten slag)

Vickers hardness in the various resulted phases



Study on characterization of debris and development of debris disposal technology using simulated debris

Manufactured simulated debris and obtained data such as hardness in order to estimate the property of actual debris to investigate the fuel debris retrieval technology. Also, in order to verify disposal scenario after retrieving fuel debris, extracted applicability and technology issues on existing fuel treatment technology and compared options to be taken, and clarified those advantage and disadvantage.

Contents of implemented measures

Study on characterization of debris(2-(3)-1)

(1) Verification of physical property required for fuel debris retrieval

- Identified the level of impact to the machinability of physical property such as hardness, for each type of simulated material.
- Assuming the incorporation of metallic components in the reactor, measured mechanical characteristics of $(U,Zr)O_2$ in high Zr area and Fe contained simulated debris, and reflected the measurement value to the estimation of physical property distribution for each chemical system.

(2) Determination of reaction specific to 1F accident

- Confirmed the possibility of generating alloy phase and boride by the reaction with control material. Also, confirmed that trend that oxide (vitreous oxides) and alloy layer were separated by the reaction with concrete (MCCI). The hardest substance was estimated to be boride.
- Confirmed Gd was contained in the some of the fuels, and its impact and area on the thermal properties of simulated debris($(U,Zr)O_2$) of oxide.

(3) Estimation of actual debris characteristics

- Established debris property list (provisional version) from the results above.

Development of debris disposal technology. (2-(3)-3)

(1) Arrangement of technology requirement for fuel debris disposal scenario verification.

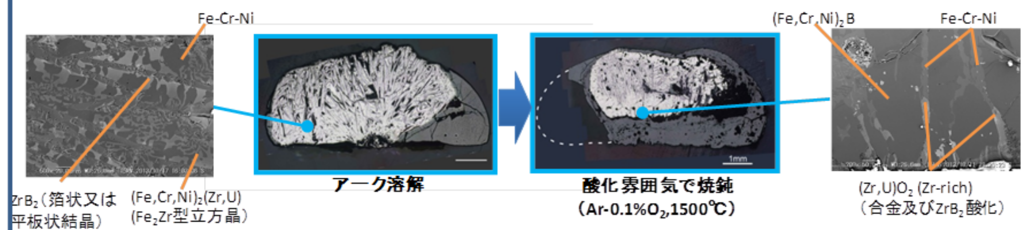
- Compared options for the disposal scenario for the retrieved fuel debris and clarified advantage and disadvantage.
- Evaluated applicability of existing spent fuel transport cask. Found that the water content of fuel debris etc. which has impact on the storage has high priority.

(2) Verification of element technology for debris analysis

- Obtained basic data of melting process, which is a pretreatment technology for analysis of each simulated debris including MCCI product.

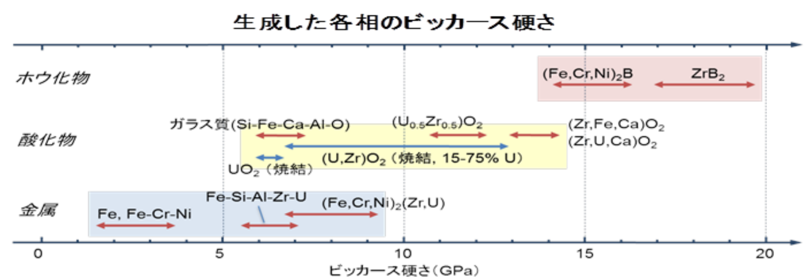
(3) Applicability verification of existing fuel treatment technology.

- Obtained basic date for the applicability of simulated debris to the wet process and dry process.



制御材（B_4C+SUS)との反応（溶融固化物断面観察像の例）

(Obtained knowledge regarding the composition of solidified material generated when control rod and fuel is melted)



(Estimate hardness distribution for each chemical system of debris (boride, oxide, metal))

Direction of next plan

Identify the physical property such as hardness using simulated debris, and evaluate the reactivity with materials in/outside the Pressure Vessel, characteristics evaluation such as of MCCI product material. In 2-(3)-3, verify and evaluate the water content of fuel debris that effects storage technology while continuing the development of analysis element technology.

Table 7. Weighted Average of Elemental Results of Dissolved Sample

Element	Whole[1] Sample	Magnetic[1] Fraction	Non-magnetic Fraction
U	86.7 (82.6)	60.2 (59.0)	88.8 (84.1)
Zr	14.6 (13.9)	15.9 (15.6)	14.5 (13.7)
Fe	2.8 (2.7)	16.7 (16.4)	1.7 (1.6)
Ni	0.9 (.9)	5.2 (5.1)	0.6 (0.6)
Cr	-	1.8 (1.8)	-
Sn	-	-	-
Al	-	-	-
In	-	-	-
Ag	-	2.3 (2.3)	-

Table 10. Immersion Density Results

Sample	Open Porosity (cc)	Pellet Volume (cc)	Matrix* Volume (cc)	% Open Porosity	Matrix Density (g/cc)
1	2.747E-3	2.947E-2	2.673E-2	9.32	4.59
2	2.812E-2	1.719E-1	1.437E-1	16.4	7.52
3	1.116E-2	6.509E-2	5.395E-2	17.1	8.50
4	1.534E-2	1.213E-1	1.059E-1	12.6	9.97
5	1.087E-2	6.400E-2	5.314E-2	17.0	1.29
6	1.989E-2	8.232E-2	8.232E-2	19.5	9.03