Zr 함량 변화에 따른 합금형 U-Zr 연료와 HT9 피복재의 계면반응
Interfacial reaction between alloy type U-Zr fuel and HT9 according to concentration of Zr

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1 Introduction

Blanket fuel assembly contains a bundle of 331 pins arrayed in triangular pitch which has hexagonal bundle structure. TRU(transuranic)-Zr alloy fuel is considered as a blanket fuel for HYPER (Hybrid Powder Extraction Reactor) In alloy type TRU-Zr fuel, the blanket fuel slug is immersed in lead for thermal bonding with the cladding The blanket fuel cladding material is ferritic-martensitic steel HT9

During irradiation, fuels swell and come into contact with the cladding, then metallurgical reaction at the fuel-cladding interface occurs and affects the integrity of the cladding The reaction between the fuel and the Fe-base cladding materials should be well understood in order to evacuate the fuel performance

Several studies were conducted on the reactions between U-Zr or U-Pu-Zr alloys and stainless steels We fabricated U-xZr fuel(x=55,59 5,64wt%) instead of the actual (TRU-10wt%Zr)-Zr fuel for HYPER This study investigates the solid-states reaction layers formed at 700°C at diffusion interfaces alloy type U-Zr fuel/HT9 according to concentration of Zr

2 Experimental procedure

The alloy type U-xZr(x=55, 59 5, 64wt%) fuels were fabricated by mixing, pressing, sintering and extrusion The cladding steel in this investigation is stainless steel HT9

Both fuel and cladding steel were cut into disks about 2mm thick Each of the diffusion couple assemblies was encapsulate in a quartz tube The diffusion couples were annealed isothermally at 700°C The alloy type U-Zr fuel/HT9 couples were annealed at 700°C for 100 h After completion of the diffusion anneal, the couples were quenched in water, then sectioned parallel to the diffusion direction The sectioned couple was embedded in epoxy resin and then the cross-sectional surface was polished with 3 ㎛ diamond paste for SEM The reaction layer thickness and concentration distributions of diffusion reaction layer were measured by SEM equipped with EDAX

3 Result and discussion

In U-Zr fuel/HT9 couple, the U in the fuel diffuses into HT9 cladding material with below 1 ㎛ reaction layer The elemental Fe in cladding material diffuses into the fuel core and then forms reaction layer of about 2 ㎛