§27. Integration of Tritium, Irradiation and Thermofluid Research

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Blankets are component systems whose principal functions are extraction of heat and tritium. Thus it is crucial to clarify the potentiality for controlling heat and tritium flow throughout the first wall, blanket and out-of-vessel recovery systems. The joint project in Japan-US fusion cooperation program named TITAN (FY2007-2012) has a title of "Tritium and thermofluid control for magnetic and inertial confinement systems". The objective of the project is to clarify the mechanisms of tritium and heat transfer throughout the first-wall, the blanket and the heat/tritium recovery systems under specific conditions to fusion such as irradiation, high heat flux, circulation and high magnetic fields. Based on integrated models, the breeding, transfer, inventory of tritium and heat extraction properties will be evaluated for some representative liquid breeder blankets and the necessary database will be obtained for focused research in the future.

In the NIFS collaboration program, discussion and coordination on Japanese side were carried out for planning the TITAN collaboration. In FY2010, planning of examination for neutron irradiated specimens were carried out. Figure 1 is the schematic shipping routes for the irradiated specimens.

The neutron irradiation was carried out in HFIR (ORNL). Some of the PIE (Post Irradiation Examinations) were carried out on-site (ORNL Hot lab) and some in Oarai Center of Tohoku University by shipping the specimens to Oarai Center. Some specimens were shipped to INL for D/T plasma exposure tests. Some of the D plasma-exposed specimens were then shipped to U. Wisconsin for carrying out Nuclear Reaction Analysis with an accelerator.

In this collaboration, the emphases in the second half of the project were discussed and summarized as follows.

(1) Unique results are being obtained for irradiation-tritium synergism studies. These activities will be enhanced.

(2) The task on thermofluid of Li-Pb in magnetic filed will enhance the analysis of the impact on tritium transfer including modeling studies.

(3) Neutron irradiation and post-irradiation examination will be accelerated including timely shipping of the irradiated specimens to Japan.

(4) Interaction between each task and the Common Task will be reinforced for enhanced contribution to the integration modeling and the reactor design.

In conclusion, the Japan-USA Fusion Cooperation Program TITAN successfully completed its first half period with progress toward its objectives and with significant scientific accomplishments that address key issues for several attractive first wall and blanket systems.

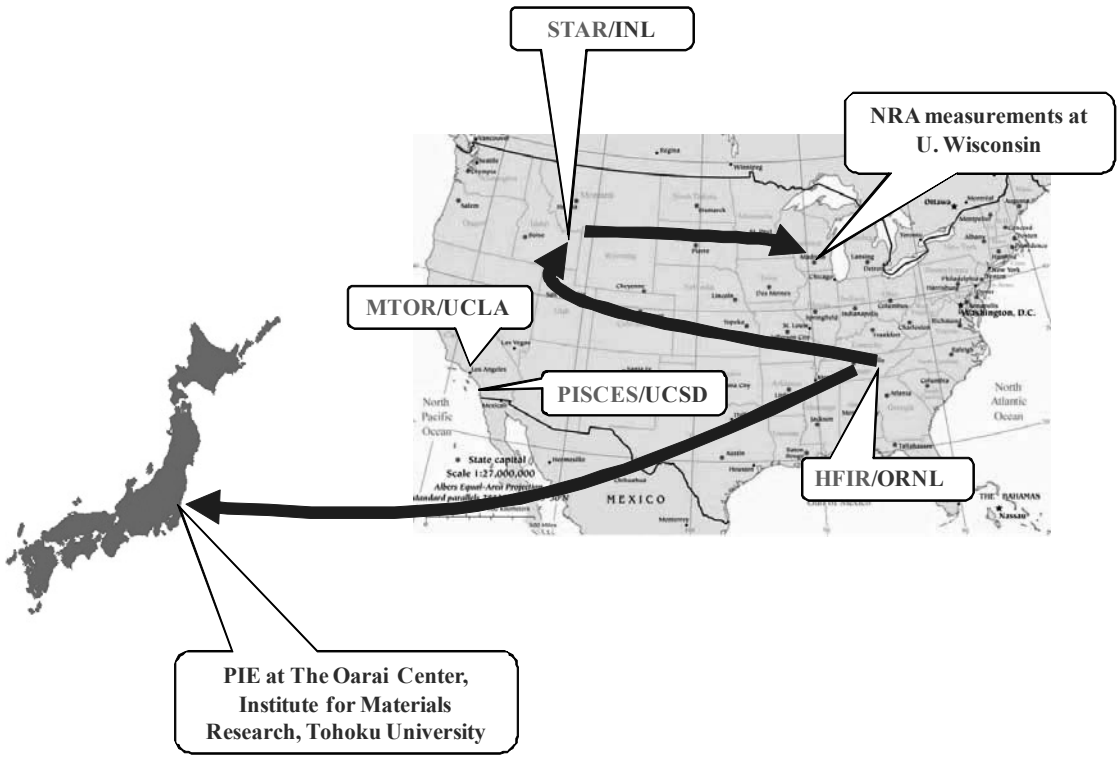

Fig.1 Schematic specimen transportation routes for irradiation, tritium exposure and characterizations in TITAN program