# §1. Overall Examination of Tritium Transfer and Thermofluid Control in Fusion System

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The TITAN collaboration started April 2007 to provide the scientific foundations for tritium and thermofluid control and materials performance in the first wall and blanket under conditions characteristic of fusion reactors, including interactive neutron irradiation effects. FY2009 is the last year of the first half period of the program.

TITAN program is composed of two tasks with six subtasks and the Common Task. Task 1 "Tritium and mass transfer" is composed of three subtasks. Task 2 "Irradiation synergism" is also composed of three subtasks. The Common Task "System integration modeling" has a subtitle of "MFE/IFE system integration modeling". Major facilities being used are High Flux Isotope Reactor (HFIR) in ORNL, Tritium Plasma Experiment (TPE) and tritium research facilities in Safety and Tritium Applied Research Facility (STAR) in INL, Plasma Interactive Surface Component Experimental Station (PISCES) in UCSD, and Magneto-Thermofluid Omnibus Research Facility (MTOR) in UCLA.

Figure 1 is the schematic representation of the role of TITAN in liquid blanket researches. The research responsibility is being shared with other domestic or international collaboration programs.

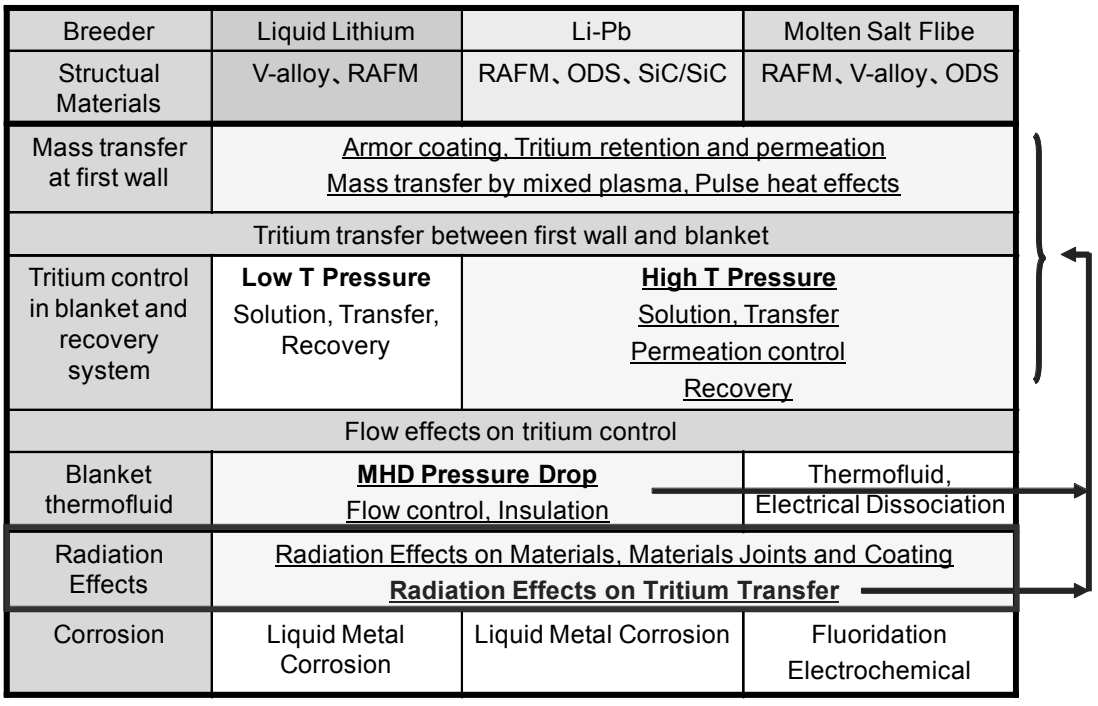
TITAN covers mass trakfer at first wall which is the issue common to all liquid blanket concepts. TITAN takes care of the permeation and recovery of tritium in high partial pressure system such as Li-Pb and Flibe. The permeation and recovery in low pressure system is investigated by IFMIF-EVEDA collaboration.

Research in TITAN includes MHD pressure drop in liquid metal system. The thermofluid issues for molten salt blanket is being covered by NIFS collaboration including continuation of JUPITER-II activities.

Radiation Effecst researches are common to the first wall and balnkets. In particular, one of the emphases of TITAN is placed on irradiation-tritium synernism.

Corrosion is the critical issue of liquid blankets but the subjects are very different in different blanket systems. The issue is investigated in domestic activities including NIFS collaboration programs.

The achievements in the first half period is highlighted by (1) effects of mixed plasma with D, He and Be on plasma-material interaction processes, (2) measurements of tritium solubility in Li-Pb liquid breeder, (3) supersonic flow rate measurements for Li-Pb, (4) exposure of neutron-irradiated materials to D and T plasma, (5) fabrication of joint and coated advanced materials for neutron irradiation (W/RAFM,ODS,V-alloys etc.), (6) design and fabrication of irradiation capsules for creep measurements of SiC/SiC composites. The results are being applied in the Common Task by integration modeling to designing tritium and heat control in Fusion Energy Systems. Also being explored is collaboration on MFE-IFE common technology research such as ablation plume behavior under pulse high heat load.




Researches in TITAN are underlined

Figure 1 Liquid blanket research in TITAN Program.