

DESIGN OF PURIFICATION LOOP AND TRAPS FOR IFMIF/EVEDA Li TEST LOOP

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The International Fusion Materials Irradiation Facility (IFMIF) is an accelerator-based D-Li neutron source aimed at producing an intense high energy neutron flux (2 MW/m²) for testing candidate materials and components to be used in the fusion DEMO reactor. To realize such a condition, two 40 MeV-deuteron beams with a total current of 250 mA are injected into a liquid Li stream flowing at 20 m/s speed. Regarding to R&D on IFMIF, Engineering Validation and Engineering Design Activities (EVEDA) were started from July 2007 under Broader Approach. The EVEDA tasks related to the lithium (Li) target facility consists of six tasks which are construction and operation of a Li test loop; diagnostics; erosion/corrosion; purification system; remote handling and engineering design. As a major Japanese activity, EVEDA Li test loop to simulate hydraulic and impurity conditions of IFMIF has already designed and is under construction in a exist building in O-arai site of Japan Atomic Energy Agency. Feasibility of hydraulic stability of the liquid Li target, the purification systems of hot traps are major key issues to be validated in this loop. Toward the validation on these issues, diagnostics applicable to a high-speed free-surface Li flow and hot traps to control nitrogen and hydrogen in Li are under tests and are designed along with the design and construction of the loop itself. This paper presents the completed design and specifications of the purification system of EVEDA Li Test Loop, and the current design of the hot traps to be installed in the purification system.

We have designed the purification system of EVEDA Li Test Loop with two loops: a purification loop and an impurity monitoring loop. The purification loop includes; a cold trap for removal of mainly oxygen (Cold Trap); and interfaces to a hot trap for removal of hydrogen isotopes (H-Hot Trap) and to a hot trap for removal of nitrogen (N-Hot Trap). The two hot traps are planned to be designed and fabricated along with the construction of the loop, and to be installed after completion of the construction. The impurity monitoring loop includes; an off-line monitor with a sampling tube and a cooling equipment; and interfaces to two on-line monitors. The components of the purification system except the two hot traps and two on-line monitors are now being fabricated and will finish to be assembled before July 2010 in the construction site of EVEDA Li Test Loop.

The purification traps have been designed to remove impurities dissolved in Li for the purpose as follows; reducing corrosion metal loss of the components and piping during operation; inhibiting the deposition of impurities at the nozzle of the target assembly system; and preventing system blockage. At present, the cold trap was fabricated and is prepared to be installed, on the other hand the N-hot trap and H-hot trap is completed the detail design and basic design, respectively.