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A-FNSプロジェクトの進捗
Progress on A-FNS project

佐藤聡、落合謙太郎、太田雅之、小柳津誠、権セロム、
見城俊介、蛯沢貴
SATO Satoshi, OCHIA Kentaro, OHTA Masayuki, OYAIDZU Makoto, et al.

量子科学技術研開発機構 六ヶ所研究所
National Institute for Quantum Science and Technology, Rokkasho Fusion Institute

In Japanese roadmap of fusion DEMO reactor, one of the key milestones is to acquire initial irradiation data on fusion reactor materials by using fusion neutron source. We plan to construct Fusion Neutron Source A-FNS facility in Rokkasho. In order to solve common issues between Japan and Europe for development of the fusion neutron source, we are implementing the activities in the IFMIF/EVEDA project on lithium target R&D and neutron source design since 2021. We designed Li loop purification system to conduct demonstration test on the purification performance for the A-FNS. We evaluated tritium migration from the lithium loop and redesigned the heat exchanger between lithium and oil. In addition, we started engineering design activity of A-FNS to solve unique issues for the A-FNS since 2022.

The A-FNS is composed of the intense linear accelerator, the liquid lithium target loop and the irradiation test facility. Table 1 shows the main design parameters of the A-FNS [1]. It generates high energy neutrons by reaction between deuteron and lithium. Figure 1 shows the conceptual view of the A-FNS [1].

Table 1. Main design parameters of A-FNS.

Ion beam	Deuteron
Incident energy/current	40 MeV/125 mA
Beam footprint	200 mm^W x 50 mm^H
Target	Liquid lithium
Target temperature	250 ℃
Target thickness/ velocity	25±1 mm/15 m s^{-1}
Neutron source intensity	6.8 x 10^{16} n s^{-1}

In order to meet the requirements on the materials irradiated data for the DEMO reactor, we will install a variety of irradiation test modules (TMs) in the irradiation test cell. Figure 2 shows the conceptual view of the TMs configuration in the test cell [1,2]. Figure 3 shows the irradiation capsule installed in the TM for the blanket structural material, F82H [1,2]. We have conducted nuclear analyses for the TMs. From the results, the maximum dpa of F82H specimens is about 10dpa/fpy, which is designed to fulfil critical requirement, 20 dpa, by operation duration for four years with the operation availability of 50 %. We will irradiation tests using the TMs shown in Figs 2 and 3 in the A-FNS.

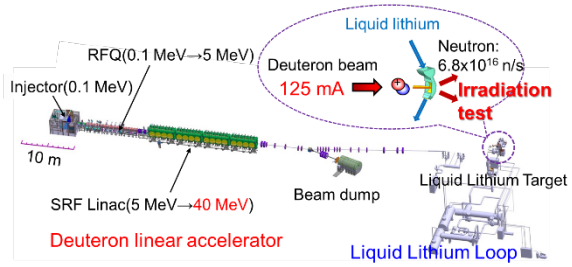

Figure 1. Conceptual view of A-FNS.

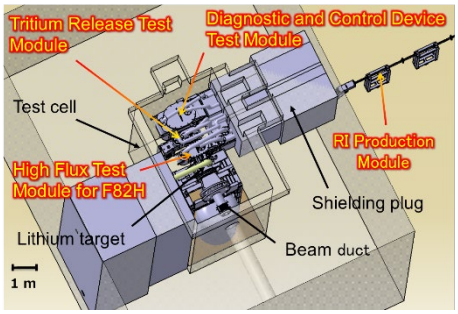

Figure 2. Conceptual view of the test cell.

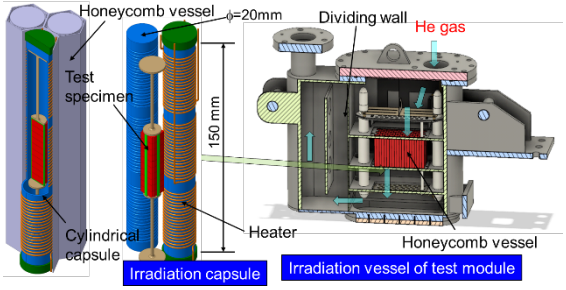

Figure 3. Conceptual view of the test module.

[1] S. Sato et al Nucl. Fusion 61 (2021) 1062026
[2] S. Sato et al Fus. Eng. Des. 155 (2020) 111714