

Neutron Irradiation Technology in the HANARO

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HANARO (High flux Advanced Neutron Application ReactOr) is a multipurpose research reactor of an open-tank-in-pool type. It was designed to provide a peak thermal and fast flux of 5×10^{14} n/cm²·sec ($E < 0.625$ eV) and 2.1×10^{14} n/cm²·sec ($E > 1.0$ MeV) at a 30MW thermal power, respectively. Since the commencement of HANARO operation in 1995, some parts of the reactor systems have been gradually improved for a stable operation of the reactor, while the operation mode has been flexibly adjusted to meet users' demands. During the same period, a significant number of experimental facilities has been developed and installed for the use of the 32 vertical holes and the 7 horizontal beam ports. Owing to a stable operation of the reactor and a rapid proliferation in the utilization fields, more experimental facilities are continuously being added to satisfy various fields of study increasing and new research needs arising. As a nation-wide neutron research facility, the HANARO is now successfully utilized in various fields including nuclear fuel and material irradiation tests. The equipments for irradiation tests of nuclear fuels and materials in the HANARO are classified into capsule and FTL (Fuel Test Loop). Capsules for irradiation tests of nuclear fuels and materials in the HANARO have been developed. And then, extensive efforts have been made to establish design/manufacturing and irradiation technologies for irradiating nuclear fuels and materials by using capsules and their control systems, which should be compatible with HANARO's characteristics. These capsules have been actively utilized for the various material irradiation tests requested by users. Based on the accumulated experiences and the user's sophisticated requirements, capsules for creep test and fatigue test of materials during irradiation in the HANARO have been developed. Now, superconductor materials and others, such as MgB₂, YBCO, SiC, and quartz etc., are being irradiated to evaluate the variation in their characteristics by neutron irradiation. The FTL is one of the irradiation devices, which can conduct the irradiation test of nuclear fuel in the HANARO under the operating conditions of commercial nuclear power plants. The 3-test fuel rods can be irradiated in the HANARO by using the FTL. The installation of the FTL was completed in March 2007. Currently, the commissioning test of the FTL is being performed. And, the FTL will be firstly used for the irradiation test of an advanced nuclear fuel for PWR from the end of this year.

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