

# Korea KAERI-ICERR Description

## 1. KAERI

The Korea Atomic Energy Research Institute (KAERI) is a government-funded research institute in Korea that was established in 1959 to build a foundation for national nuclear energy self-reliance. KAERI has served as a stepping stone to advancing the nation's science technology development and national economic growth and industrial development. KAERI headquarters is located in Daejeon. KAERI has two affiliate research centers: KOMAC (Korea Multi-purpose Accelerator Complex) in Gyeongju and ARTI (Advanced Radiation Technology Institute) in Jeongeup. KAERI has invested heavily in the construction and operation of large scale nuclear research facilities such as HANARO (High flux Advanced Neutron Application Reactor) and proton accelerator, as well as in the research of basic and fundamental nuclear technologies including nuclear reactors, fuel cycle, nuclear materials, and radiation technology.

## 2. KAERI-ICERR Facilities



HANARO complex is composed of the HANARO research reactor and ancillary facilities such as the Cold Neutron Research Facility (CNRF), Radioisotope Production Facility (RIPF), and Irradiated Material Examination Facility (IMEF). The HANARO and ancillary facilities were designated as an ICERR by the IAEA in 2019.

### HANARO

HANARO, which was designed and constructed with KAERI's own technologies, has been safely and efficiently operating since 1995. It is a 30 MW multi-purpose research reactor designed for neutron beam applications, nuclear fuel and material testing, radioisotope production, neutron activation analysis, neutron transmutation doping, and so on. Its high neutron flux (fast neutron  $2 \times 10^{14}$  n cm<sup>-2</sup> s<sup>-1</sup>, thermal neutron  $4 \times 10^{14}$  n cm<sup>-2</sup> s<sup>-1</sup> at maximum) is essential for carrying out nuclear research and development. There are 36 vertical irradiation holes and seven horizontal neutron beams, including one cold neutron source at HANARO. A wide range of research has been conducted at HANARO and high quality technical services have been provided to users from industry, academia, and research institutes.

### Neutron Beam Facility



The neutron beam research facilities at HANARO have been widely opened to users from industry, academia, and research institutes both at home and abroad. They consist of the thermal neutron beam research facilities in the reactor hall and the cold neutron beam research facilities at CNRF. Thermal neutron beam instruments include the high resolution power diffractometer (HRPD), four cycle neutron diffractometer (FCD), bio camera (Bio-C), residual stress instrument (RSI), neutron radiography facility (NRF), and ex-core neutron irradiation facility (ENF). Instruments operating at CNRF that

use cold neutron beams include the 40M-small angle neutron scattering instrument (40M-SANS), 18M-small angle neutron scattering instrument (18M-SANS), KIST-ultra small angle neutron scattering (KIST-USANS), vertical-type reflectometer (REF-V), bio-reflectometer (Bio-REF), cold neutron triple axis spectrometer (Cold-TAS), and disk chopper time flight spectrometer (DC-ToF).

### Irradiation Facility

The capsule irradiation facilities of HANARO have been actively utilized for various irradiation tests such as research reactor fuels and targets, accident tolerant fuels (ATF), small modular reactor (SMR) fuels, structural materials for fusion reactors, reactor vessel and internals, and in-core instrumentations by users from research institutes, universities, and industries. There are three pneumatic transfer systems installed at neutron activation analysis (NAA) irradiation holes that have been used for neutron irradiation of samples. Prompt gamma-ray neutron activation analysis (PGAA) and delayed neutron activation analysis (DNAA) are available. Neutron transmutation doping (NTD) irradiation services for 5, 6, and 8 inch silicon ingots have been provided using two holes located in the heavy water reflector region.

### RIPF

RIPF is used for convenient processing and handling of irradiated radioactive objects. RIPF is equipped with four banks that consist of various numbers of hot cells depending on the functional requirements. Bank I has four concrete hot cells for sealed source handling such as Co-60 and Ir-192. Eleven lead hot cells in Bank II are dedicated for various research activities. In Bank III with six lead hot cells, medical purpose radioisotopes are produced. Bank IV has four lead hot cells in a clean room facility for radiopharmaceuticals.

### IMEF

IMEF is used to conduct post-irradiation examinations (PIE) of irradiated materials used at HANARO and power reactors. It has been providing PIE service for R&D fuels and structural materials of reactors since 1993. Surveillance tests of integrity and lifetime of the structural parts in the operating reactors, evaluation of the irradiation behavior of fuels and structural materials being developed for next generation and future reactors, and demonstration tests of back end fuel cycles are achieved using IMEF.

### NTC

The Nuclear Training and education Center (NTC) provides a wide range of nuclear education and training programs based on KAERI technology and a world-class education infrastructure to nurture domestic and international nuclear experts. Internationally, NTC offers various education programs including utilization of radioisotopes, medical application of radioisotopes, research reactor experiments, nuclear fuel technology, nuclear power application, etc. for researchers and policy makers of IAEA Member States. Most international education programs are developed and implemented through international cooperation or bilateral cooperation. Key facilities and equipment of NTC are reactor simulators (HANARO simulator, compact nuclear simulator, and 3D simulator), experimental laboratories for radiation measurements, two auditoriums, and lecture/seminar rooms, etc.

### **3. Provide Opportunities for Capacity Building and Joint R&D to Affiliates**

KAERI was designated as an IAEA ICERR in the fields of Hands-on Training and Joint R&D Projects. KAERI provides opportunities for capacity building and joint R&D to IAEA Member States.

#### Hands-on Training

KAERI offers hands-on training of personnel in the field of research reactor operation and engineering as well as utilization of neutron beam facilities, capsule irradiation, NAA, NTD, RIPF, IMEF, etc. KAERI provides regional/international training courses and fellowship programs for IAEA Member States.

#### Joint R&D Programs

KAERI has accumulated a wealth of R&D experience in the utilization of HANARO and ancillary facilities. KAERI offers joint R&D programs on the utilization of HANARO and ancillary facilities such as utilization of neutron beams, fuel and material irradiation, NAA, NTD, manufacturing and application of radioisotopes, PIE, and so on.

### **Contact**

KAERI welcomes foreign scientists and engineers to collaborate at KAERI-ICERR facilities. The contact point for KAERI-ICERR is Sung Ho Ahn, KAERI-ICERR representative to the IAEA.

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More information on KAERI can be found at <http://www.kaeri.re.kr/eng/>