GOVERNMENT OF INDIA

DEPARTMENT OF ATOMIC ENERGY

LOK SABHA
UNSTARRED QUESTION NO – 2079
ANSWERED ON 12/03/2025

14 MEV NEUTRON FACILITY

2079. SHRI ARUN BHARTI

Will the PRIME MINISTER be pleased to state:-

(a) the current operational status of the 14 MeV neutron facility set up by the Institute for Plasma Research (IPR) including the maximum output capacity and the applications of this facility;

(b) the details of the neutron irradiation studies conducted using this facility, particularly for producing medical radioisotopes such as Mo-99, Cu-64, and Cu-67, including any collaborations with medical or research institutions;

(c) the progress made in utilizing this facility for studying radiation-induced damage in near-reactor components for fusion reactors and its potential impact on the development of fusion energy technologies;

(d) the details of new findings or advancements resulting from the use of this facility in the field of medical radioisotope production or nuclear fusion research; and

(e) the future plans for expanding the capacity or applications of this facility to further benefit these research areas or any other sectors?

ANSWER

THE MINISTER OF STATE FOR PERSONNEL, PUBLIC GRIEVANCES & PENSIONS AND PRIME MINISTER'S OFFICE (DR. JITENDRA SINGH)

(a) IPR 14 MeV neutron irradiation facility is operational and producing neutron yield of ~ 10^{12} n/s. This facility is used for the fusion neutronics experiments such as tritium breeding and shielding, measurement of cross-section for fusion reactor relevant materials, development of fusion neutron diagnostic, neutron activation analysis, neutrons induced radiation effect studies of electronics components, sensors, control cables, superconductors etc.

(b) Exploratory studies have been carried out to demonstrate the production of Mo-99, Cu-64 and Cu-67. Small samples of Molybdenum metal plate, Molybdenum Trioxide (MoO3) powder and Zinc metal powder were irradiated with neutrons. Radioisotope Mo-99 of specific activity 14.54 kBq/gm in Mo plate, Mo-99 of specific activity 0.95 kBq/gm in MoO3 powder, 30.33 kBq/gm of Cu-64 and 0.28 kBq/gm of Cu-67 in Zinc metal powder were produced. The experiments are in exploratory nature to understand the basic science and no collaboration has been attempted with medical or research institutions.

(c) This is a lab scale neutron generator facility designed to carry out fusion neutronics experiments to study immediate effects of neutrons in the materials. The facility is not meant for studying radiation-induced damage in near-reactor components for fusion reactors as the flux is low.

(d) Series of neutron irradiation experiments were conducted for (1) Feasibility studies on Medical Radioisotope generation (Mo-99, Cu-64 & Cu-67) (2) Activation studies in P91 and RAFMS (3) Tritium production in Lithium Titanate (4) Measurement of neutron induced cross-section 85Rb(n,p)85mKr and 85Rb(n,2n)84mRb reaction (5) Studies on electrical properties of HTS ReBCOTape (6) Studies on surface damage for Cyanate ester (7) Radiation damage studies in Opto coupler, FET, PRAM, ADC and INA.

For Medical radioisotope production research: Molybdenum metal plate and Molybdenum Trioxide (MoO3) powder were irradiated with neutrons. Radioisotope Mo-99 of specific activity 14.54 kBq/gm in Mo plate and Mo-99 of specific activity 0.95 kBq/gm in MoO3 powder were generated. For generation of radioisotopes Cu-64 and Cu-67, Zinc metal powder was irradiated and 30.33 kBq/gm of Cu-64 and 0.28 kBq/gm of Cu-67 were generated.

In fusion research area, irradiation were conducted on electronics devices such as FET, Optocoupler, SRAM, ADC and INA. These components were irradiated at different neutrons fluences in step wise. After each irradiation step, performance of the components was evaluated. Optocoupler got partially damaged at neutron fluences of 5.31E+11 n/cm2 and fully damaged at 1.77E+12 n/cm2.

(e) The studies are exploratory in nature and hence, research will continue.

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