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Development of HINEG and its experimental campaigns

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Fusion energy becomes essential to solve the problem of increasing energy demands. A high intensity D-T fusion neutron generator is keenly needed for the research and development (R&D) of fusion technology, especially for fusion materials research.
The Institute of Nuclear Energy Safety Technology (INEST), Chinese Academy of Sciences (CAS) has launched the High Intensity D-T Fusion Neutron Generator (HINEG) project. The R&D of HINEG includes three phases: HINEG-I has been constructed and successfully produced a D-T fusion neutron yield of up to 6.4E12 n/s. The mechanism research of irradiation damage for materials can be carried out. HINEG-II aims at a high neutron yield of 1E15~1E16 n/s neutrons via high speed rotating tritium target system and high intensity ion source, which could be used to conduct material irradiation damage testing. The preliminary design and research on key technologies are on-going. HINEG-III is a volumetric fusion neutron source with yield of more than 1E18 n/s. The integration testing of nuclear system engineering could be performed.
As an important platform for fusion technology and safety research, HINEG can be used to carry out the neutron activation and irradiation testing not only for structural but also functional materials to assess the performance and reliability, such as structural materials for the blanket, neutron multipliers and ceramic breeders for tritium fuel production, suitable radiation resistant thermosets for the electrical insulation of the superconducting magnets, in-vessel conductor coils, liquid-metal coolants, etc. The fusion neutron irradiation testing is being conducted on China Low Activation Martensitic (CLAM) steel, which has been developed by INEST and selected as the primary candidate structural material for Chinese Helium Cooled Ceramic Breeder ITER Test Blanket Module (CN HCCB TBM). Moreover, the performance of components under neutron irradiation can also be assessed on HINEG platform, such as the tritium breeding blanket and shielding blanket.

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