

Development of HINEG and its experimental campaigns

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A high intensity D-T fusion neutron generator is an important experimental platform for research and development (R&D) of nuclear energy and nuclear technology applications. High Intensity D-T Fusion Neutron Generator (HINEG) has been developed by the Institute of Nuclear Energy Safety Technology (INEST), Chinese Academy of Sciences (CAS)/FDS team to perform researches on fusion nuclear technology and safety including validation of neutronics theory and software, neutronics performance of blanket/reactor, materials irradiation damage mechanism, etc. Also, the application of HINEG can be extended to neutron radiography, neutron radiotherapy, and so on. The R&D of HINEG includes three phases: HINEG-I has been finished, and successfully produced the D-T fusion neutrons with the yield up to 6.4×10^{12} n/s. Meanwhile, HINEG-I has been operated to drive the Lead-based Zero Power Critical/Subcritical Reactor CLEAR-0. HINEG-II aims at a high neutron yield of 10^{15} - 10^{16} n/s and the R&D for key components is on-going. HINEG-III is designed as a volumetric fusion neutron source with neutron yield of 10^{18} n/s, which is based on the gas dynamic trap.

Recently, a series of experiments have been carried out on HINEG facility by FDS team, such as neutronics performances of fusion reactor blanket, biological effects of neutron irradiation, fast neutron radiography, and so on. A dual function lithium-lead (DFLL) test blanket module (TBM) has been developed by FDS team to demonstrate the technologies of the liquid lithium-lead breeder blankets. The neutronics experiment of DFLL-TBM mockup was carried out to validate the tritium breeding and shielding performances. The comparison of experiment results and corresponding calculation performed using SuperMC and FENDL3.1 library was obtained, and a good agreement was observed between the experimental and calculated values. This presentation will introduce the R&D activities as well as the experimental campaigns of HINEG.

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