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CLEAR-S: A Large Pool-type Components and Thermo-hydraulic Integrated Test Facility for China Lead based reactor

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Liquid lead-alloy is a potential candidate coolant for fast reactor and Accelerator Driven System (ADS) subcritical system because of its many unique nuclear, thermophysical and chemical attributes. Chinese Academy of Sciences (CAS) had launched a project to develop ADS and lead-based fast reactors technology since 2011. China LEAd-based Reactor (CLEAR) was selected as the reference reactor. China LEAd-based Research Reactor CLEAR-I is a 10MW lead-bismuth cooled integrated pool-type reactor proposed by Institute of Nuclear Energy Safety Technology (INEST), CAS-FDS Team. In order to verify the key components and investigate the thermal-hydraulics phenomena for CLEAR-I and even for pool type lead-based reactor, an integrated multifunctional non-nuclear test facility named CLEAR-S is being built and commissioning in the end of 2016.

CLEAR-S is a pool type test facility with electrically heating core simulator as 2.5 MW. It would be used to test the 1:1 prototype components for CLEAR-I, such as primary pump, heat exchanger, control rod driven system, in-vessel refueling system, and to verify the design and safety analysis codes, and could verify the specific thermal and security characteristics for liquid heavy metal pool-type reactor. In addition, CLEAR-S could provide the integrated test platform with international advanced level for engineering verification and basic research of liquid heavy metal cooled reactor technology.

CLEAR-S will be the largest full-scale integrated lead-based pool-type experimental facility in the world, which has some advantages for the key components and structure materials verification, thermal hydraulics phenomena investigation, instrumentation and chemistry control technology development, and will become an integral facility for the design and licensing of CLEAR-I and R&D work of ADS and lead-based reactor system. In this contribution, the design and latest progress has been presented for CLEAR-S.

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