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Development of Flow Identification Technology for the PGSFR Thermal Fluidic Design Validation

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Korea Atomic Energy Research Institute (KAERI) is currently developing the prototype SFR under the program of mid and long term project of the Korean government. Various experimental programs were selected for the validation of thermal fluidic design of the reactor system and design codes as the results of the PIRT. For a core thermal design, the assessment of the thermal margin is very important for the reactor safety where a friction coefficient, mixing factor, and pressure drop are important parameters having significant uncertainties in the model and correlations of the core thermal design code. The experimental database for core inlet flow and outlet pressure distribution are also essential for the evaluation of the core thermal margin. The identification of the pool side flow distribution including the pressure drop of the major flow path of the PHTS is important for the validation of the fluidic design of the reactor. The current validation program of the PGSFR design of our study includes a core subchannel flow experiment, a reactor flow distribution test and an IHX flow characteristic test. To identify the core subchannel flow rate and mixing characteristic, an iso-kinetic method, wire mesh and LIF technique were developed and optimized for the purpose of our experiment. For the identification of the reactor flow, the PHTS of the prototype plant was reduced to a 1/5 length scale in our test facilities with a preservation of the internal structures affecting the flow characteristics. The experimental techniques for each fuel assembly inlet flow rate and outlet pressure were developed. To validate the pressure drop correlations used in the design code for the IHX, a test facility was design for the flow characteristics of the shell side of the IHX with proper scaling approach. In this paper, a brief experimental technology for the identification of the reactor flow behaviors were described including the design feature of the test facilities and results of the finished experiment. The experimental database constructed in the current project will contribute to acquire the license of the core thermal and reactor fluidic design of the PGSFR.

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KOREA/Korea Atomic Energy Research Institute

Primary author: Dr EUH, Dongjin (Korea Atomic Energy Research Institute)

Presenter: Dr EUH, Dongjin (Korea Atomic Energy Research Institute)

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