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Thermal-hydraulics and Decay Heat Removal in GFR ALLEGRO

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One of the key issues in the design of the Gen IV GFR ALLEGRO, a helium-cooled experimental fast reactor, is the core cooling in accident conditions, mainly due to the low thermal inertia of the coolant.
After a brief description of the reactor, this paper presents the currently adopted approach to decay heat removal, and the analysis of some of the most penalizing pressurized and depressurized scenarios.
The results of the benchmarking activities on system codes (CATHARE, RELAP, MELCOR), carried out to optimize the modeling capabilities, are presented.
Starting from the reference design studied up to 2009, the project now explores new possibilities of further development, with a new target nominal power (in the range of 30 –75 MW thermal) and power density (in the range 50 –100 MW/m3), which will be compatible with the safety limits and the design requirements linked mostly to the steel cladded oxide start-up core fuel.
The decay heat removal systems (DHR loops), and their main components must be studied under such conditions to check and improve their efficiency in both forced and natural circulation operation. In addition, the performance of gas injection from the accumulators for the depressurized conditions are studied.
In addition, the paper summarizes planned experimental programs on validation of the analytical tools and testing of thermal-hydraulics in different flow regimes, using the existing and scheduled experimental helium facilities.

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