REALISTIC CFD SIMULATION OF COMPRESSIBLE FLOW INSIDE THE CORE OF THE PEBBLE BED REACTOR HTR-10

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ABSTRACT

High-temperature gas-cooled reactors (HTGRs) have the potential to be used as possible energy generation sources in the near future, owing to their inherently safe performance by using a large amount of graphite, low power density design, and high conversion efficiency. However, safety is the most important issue for its commercialization in nuclear energy industry. It is very important for safety design and operation of an HTGR to investigate its thermal–hydraulic characteristics. In this article, it was performed the thermal–hydraulic simulation of compressible flow inside the core of the pebble bed reactor HTR (High Temperature Reactor)-10 using Computational Fluid Dynamics (CFD). The realistic approach was used, where every closely packed pebble is realistically modelled. Due to the high computational cost is impossible simulate the full core; therefore, the geometry used is a FCC (Face Centered Cubic) cell with the height of the core, with a total of 42 pebbles. The input data used were taken from the thermal–hydraulic IAEA Bechmark (1). The results show the profiles of velocity and temperature of the coolant in the core, and the temperature distribution inside the pebbles. The maximum temperatures in the pebbles do not exceed the allowable limit for this type of nuclear fuel.

REFERENCES

[1] IAEA-TECDOC-1694, *Evaluation of High Temperature Gas Cooled Reactor Performance: Benchmark Analysis Related to the PBMR-400, PBMM, GT-MHR, HTR-10 and the ASTRA Critical Facility*, ISBN 978-92-0-137610-7, 2013.