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Pressure Drop Measurements In A Versatile Experimental Facility of Packed Spheres

Advanced High-Temperature Reactors (AHTRs) concept leverages a particle-based fuel format consisting of discrete spherical graphite pebbles arrayed in a packed bed architecture. A pebble bed reactor (PBR) is named after its utilization of TRISO pebbles for fission. In the pebble bed reactor, thermal regulation can be achieved via flow of gas (helium) or liquid (molten salt) as coolants through void spaces between pebbles in the bed. The characteristic diameters of pebbles are approximately 6 cm and 3 cm for gas-cooled and liquid-cooled reactors. The PBR design is one of the most promising concept of the fourth generation of nuclear reactors (Gen IV), and is most interest of very high temperature reactors (VHTRs). This design is of interest owing to inherent advantages including passive safety features and highly efficient heat transfer characteristics that enable high power densities to be achieved. Fully leveraging these advantages requires a fundamental understanding of the complex coolant flow structure within the pebble-packed fuel bed. Texas A&M University is conducting isothermal and non-isothermal measurements of pressure drops, flow and heat transfer in a pebble bed experimental facility to support the research on advanced nuclear reactors sponsored by Department of Energy. Pressure drop measurements in the experimental loop are performed with air and water. The main purpose of these tests is to perform high spatial and temporal resolution measurements, and use the obtained results for code validation and model development. In this communication, we present our pressure drop measurements in an experimental facility of randomly packed bed of spheres that represents the core of a pebble bed reactor. Pressure drop across the reactor core is a critical parameter for the reactor design because it is related to the flow distribution, pumping power, and operational cost of the reactor.