Contribution ID: **107** Type: 海报展示

考虑颗粒床流动不稳定性的流动传热模型开发

摘要

核热推进系统反应堆为紧凑型超高温气冷堆，极高的功率密度使其很有可能出现流动不稳定，不稳定性与堆芯流量-传热-压降的耦合与反馈有关。考虑到颗粒床特殊的堆积结构类似于多孔介质，可以将其简化为多孔介质模型分析。目前对颗粒床的流动传热特性研究还很少，选用的压降与换热模型与颗粒床实际结构存在较大差异。本文广泛调研各种填充床流动传热模型，分析关键影响因素，结合颗粒床的结构特征评估适用模型。同时基于简化的颗粒床二维模型，采用计算流体力学方法分析流动传热模型的两项参数对不稳定性边界的影响，从不稳定性安全分析的保守性出发，开发出建议的阻力与换热模型。

关键词

颗粒床反应堆；流动不稳定性；多孔介质模型；流动传热模型

Abstract

The reactor of the Nuclear Thermal Propulsion System is a compact ultra-high-temperature gas-cooled reactor, whose extremely high-power density makes it highly likely to experience flow instability, which is related to the coupling and feedback of core flow, heat transfer and pressure drop. Considering the special packing structure of the particle bed is similar to that of a porous medium, it can be simplified as a porous medium model for analysis. At present, there are few studies on the flow and heat transfer characteristics of particle beds, and the pressure drop and heat transfer models selected have significant differences from the actual structure of the particle beds. This paper conducts a comprehensive investigation of flow and heat transfer models for various packed beds, analyzes the key influencing factors, and evaluates the applicable models with the structural characteristics of the particle beds. Based on the simplified two-dimensional model of the particle bed, the influence of two parameters of the flow heat transfer model on the instability boundary was analyzed using the computational fluid dynamics method. Starting from the conservativeness of the instability safety analysis, a recommended resistance and heat transfer model was developed.

Keywords

Particle bed, Flow instability, Porous medium, Flow and heat transfer model

Author: 友纯, 陈 (清华大学核研院)

Presenter: 友纯, 陈 (清华大学核研院)

Session Classification: 海报展示

Track Classification: 海报展示: 海报展示