反应堆工程

真空石墨加热器温度场数值模拟与分析

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摘要　　石墨加热器是测量球床堆芯等效导热系数实验的关键部件，加热器温度场对系统安全及数据准确性有重要影响。本文基于Fluent计算平台，分别采用DTRM模型、P1模型、ROSSELAND模型、DO模型对真空保护环境下的石墨加热器温度场进行数值模拟，确定适合真空保护石墨加热器温度场的计算方法并讨论石墨导热系数、表面发射率对温度场分布的影响。比较分析表明：DO模型计算得到的温度分布较为接近真实情况，导热系数小于35 W/(m•K)时，最高温度对其敏感；导热系数大于35 W/(m•K)时，其对加热体最高温度影响较小，最高温度较为稳定。

关键词　石墨加热器　真空环境　辐射换热　数值模拟

分类号

Numerical Simulation and Analysis of Temperature Field in Vacuum Graphite Heater

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Abstract Graphite heater is the key component of the thermal conductivity measuring system of the pebble bed reactor core. Temperature field of the heater has a major influence to safety of the system and data accuracy. DTRM model, P1 model, ROSSELAND model and DO model were employed to simulate the temperature field of the graphite heater in the protection of vacuum environment. The method for calculating the temperature field of graphite heater was discussed and the influence of graphite thermal conductivity and surface emissivity on the temperature field was studied. Comparison results show that result obtained by DO model is most reasonable. The highest temperature of the heater drops as the thermal conductivity of graphite increases. When the thermal conductivity of graphite is less than 35 W/(m•K), the highest temperature is sensitive to graphite thermal conductivity. When the graphite thermal conductivity is greater than 35 W/(m•K), the highest temperature tends to be stable.

Key words　graphite　heater　vacuum　environment　radiation　heat　transfer　numerical　simulation

通讯作者