

反应堆工程

ADS无窗靶件自由界面模拟实验和数值研究

苏冠宇; 顾汉洋; 程旭

上海交通大学 核科学与工程学院, 上海200240

收稿日期 修回日期 网络版发布日期:

摘要 冷却剂自由界面形态的形成和控制是加速器驱动的次临界系统(ADS)无窗靶件设计的关键技术之一。采用水介质对无窗靶件模型的自由界面特征进行了实验和数值研究。实验中采用激光诱导荧光的示踪方法实现了流场的可视化, 得到 $Re=30\ 000\sim 50\ 000$ 范围内的自由界面和可视化流场。在高 Re 工况下, 流场中出现大尺度的非稳定涡结构, 随着 Re 的降低, 流场中涡结构的紊流程度增加。分别采用大涡模型(LES)和两方程动能-特征耗散率模型($k\omega$ -SST)对无窗靶件实验工况进行了数值分析, 计算结果表明, LES能较好地模拟实验中所得的流场现象和界面特征。

关键词 [无窗靶件](#) [自由界面](#) [流场可视化](#) [大涡模型](#)

分类号

Experimental and Numerical Study on Free Surface Behavior of Windowless Target

SU Guan-yu; GU Han-yang; CHENG Xu

School of Nuclear Science and Engineering, Shanghai Jiao Tong University, Shanghai 200240, China

Abstract The formation and control method of coolant free surface is one of the key technologies for the design of windowless target in accelerator driven sub-critical system (ADS). Experimental and CFD investigations on free surface behavior were performed in a scaled windowless target model by using water as test fluid. Laser induced fluorescence was applied for flow field visualization. The free surface and flow field visualization were obtained at $Re = 30\ 000\sim 50\ 000$. Under high Re conditions, an unsteady vortex pair was obtained. By decreasing Re , the structure of the vortex becomes more turbulent. CFD simulation was performed using LES and $k\omega$ -SST turbulence models, separately. The numerical results show that LES model can qualitatively reproduce the characteristics of flow field and free surface.

Key words [windowless](#) [target](#) [free](#) [surface](#) [flow](#) [field](#) [visualization](#) [LES](#)

DOI

扩展功能

本文信息

- ▶ [Supporting info](#)
- ▶ [\[PDF全文\]\(4069KB\)](#)
- ▶ [\[HTML全文\]\(0KB\)](#)
- ▶ [参考文献](#)

服务与反馈

- ▶ [把本文推荐给朋友](#)

相关信息

- ▶ [本刊中 包含“无窗靶件”的 相关文章](#)
- ▶ 本文作者相关文章

- [苏冠宇](#)
- [顾汉洋](#)
- [程旭](#)

通讯作者