航空学报
ACTA AERONAUTICA ET ASTRONAUTICA SINICA
ISSN 1000-6893
CN 11-1929/V

航空学报 » 2013, Vol. 35 » Issue (11) :2492-2499 DOI: 10.7527/S1000-6893.2013.0216

涡轮叶栅内粒子沉积特性的数值研究

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Numerical Investigation on Particle Deposition Characteristic Inside Turbine Cascade

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摘要

为了揭示叶栅内部粒子沉积分布，减少叶栅内粒子沉积，数值研究了二维涡轮叶栅内部固体粒子运动与沉积特性，重点研究了粒径和气流进气角对叶栅内粒子运动与沉积特性的影响。基于EI-Batsh沉积模型，考虑了粒子与壁面碰撞所形成的黏附/反弹和离去机制，编制了相应的粒子沉积计算模块集成在Fluent软件中，并利用相关实验数据对本文计算方法进行了验证。研究结果表明，较大粒径粒子随流性较差，碰撞率较高，黏附率较小，较小粒径粒子则相反;粒子沉积主要分布在叶片压力面中部，气流进气角对粒子沉积分布具有重要影响。

关键词： 沉积 两相流 叶栅 粒径 数值分析

Abstract:

In order to reveal the particle deposition distribution inside the cascade, reduce the particle deposition, a numerical investigation is performed on the movement and deposition of dilute particles inside a two-dimensional turbine cascade, focusing on the effects of particle diameter and flow incidence angle on movement and particle deposition characteristics. Based on the EI-Batsh deposition model including particle sticking/rebounding and particle detachment, the investigation links user definition functions with Fluent to predict particle deposition. A comparison of the numerical results with existing experimental data shows that the present numerical model is valid. The research results show that particles with larger particle diameters do not follow air flow easily, thus exhibiting a higher collision rate and lower sticking rate. Particles with smaller particle diameters have the opposite tendency. Particle deposition mainly occurs on the central area of the blade pressure surface. The flow incidence angle has important influence on particle deposition distribution.

Keywords: deposition two phase flow cascade particle diameter numerical analysis

Received 2013-01-16; published 2013-04-24

Fund:

国家自然科学基金（51276090）;江苏省普通高校研究生科研创新基金（CXLX13_166）;中央高校基本科研业务费专项资金

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引用本文:

周君辉, 张靖周. 涡轮叶栅内粒子沉积特性的数值研究[J]. 航空学报, 2013, 35(11): 2492-2499.DOI: 10.7527/S1000-6893.2013.0216

ZHOU Junhui, ZHANG Jingzhou. Numerical Investigation on Particle Deposition Characteristic Inside Turbine Cascade[J]. Acta Aeronautica et Astronautica

Sinica, 2013, 35(11): 2492-2499.DOI: 10.7527/S1000-6893.2013.0216