化工学报 2007 58 (05): 1091-1096 ISSN: 0438-1157 CN: 11-1946/TQ

传递现象

蜗壳式旋风分离器内气相流场非轴对称特性分析

宋健斐, 魏耀东, 时铭显

中国石油大学（北京）重质油国家重点实验室

收稿日期 2006-3-10 修回日期 2007-1-30 网络版发布日期 2007-5-29 接受日期

摘要 采用Fluent软件对蜗壳式旋风分离器内气相流场进行了数值模拟，并在此基础上对流场的非轴对称特性进行了机理分析。蜗壳式旋风分离器入口结构的非轴对称以及气相旋流的不稳定性造成了气流的旋转中心与旋风分离器的几何中心不重合，从而导致了气相流场三维速度的非轴对称分布以及速度分量由于基准不同而产生的大小和方向变化。环形空间流场的非轴对称性主要是非轴对称入口结构影响的结果，分离空间流场的非轴对称性主要是旋流的不稳定性造成的。根据Rayleigh准则，旋风分离器内旋流流场的不稳定性是固有的，提高流场的旋流数可使流场的不稳定性降低，流场的非轴对称性降低。入口速度的变化不影响旋流数，也不影响流场的非轴对称性，但增加入口截面积比或减小量纲1升气管内径均可提高流场的旋流数，使流场的非轴对称性降低。旋风分离器的非轴对称性可以用角动量参量来描述。

关键词 蜗壳式旋风分离器 流场 非轴对称 角动量

分类号

Analysis of asymmetry of gas-phase flow field in volute cyclone

SONG Jianfei,WEI Yaodong,SHI Mingxian

Abstract

The asymmetry characteristics of the gas-phase flow field in a volute cyclone were analyzed with software package FLUENT 6.1 and its asymmetry mechanism was investigated based on the simulated results.Because of the asymmetry of the inlet structure and the unstable characteristics of the swirl flow，the spinning center of the gas flow deviated from the geometrical center of the cyclone，which resulted in the asymmetry of the flow field and the change of the three dimensional velocity components.Based on the Rayleigh criterion，the unstable characteristics of the swirl flow in the cyclone were intrinsic.The instability decreased with increasing swirl number，which weakened the degree of asymmetry of flow field.The swirl number did not vary with inlet velocity，which indicated that the inlet velocity did not affect the asymmetry of flow field.However，the swirl number increased with increasing ratio of cyclone body cross section area to the inlet area KA and decreasing ratio of the internal diameter of the exit tube to the cyclone body diameter de，which weakened the degree of asymmetry of flow field.The degree of asymmetry could be evaluated by the tangential angular momentum.

Key words cyclone separator flow field asymmetry angular momentum

DOI:

通讯作者 魏耀东 weiydmail@sina.com