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分离工程

催化裂化沉降器内两端敞开型旋风分离器内气相流动规律

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摘要 研究考察了催化裂化沉降器内两端敞开型旋风分离器内油气流动规律. 用CFX软件采用DSM模型进行了数值模拟，并与用五孔探针测试的流场进行了比较，表明DSM模型有良好的预测精度. 在此基础上，采用标量输运方程研究了气体在旋风分离器内的停留时间分布规律. 实验和模拟结果均表明，该类旋风分离器内流场与常规旋风分离器的有很大的不同，升气管和料腿均存在回流区，升气管回流区最大可波及分离空间，对分离空间流场有很大干扰. 气体示踪模拟结果表明，由入口进入旋风分离器，由升气管、料腿排出的气体的停留时间近似呈对数正态分布;升气管、料腿回流区内气体停留时间呈双峰分布;升气管回流区的存在可使总气体平均停留时间增大约5%～10%；料腿直径的减小以及灰斗的存在均可增大由升气管排出的气量并使升气管、料腿回流区大幅减小，进而减小粗旋风分离器内气体总平均停留时间.

关键词 旋风分离器 数值模拟 流场 回流区 停留时间 标量输运

分类号

GAS FLOW BEHAVIOR IN A ROUGH-CUT CYCLONE IN FCC DISENGAGER

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Abstract

Gas flow behavior in a rough-cut cyclone in FCC disengager was studied. DSM model provided by CFX 5.5 was adopted to predict the gas flow field, and simulation results were compared with experimental data measured by means of five-hole probe. The comparison verified the good power of DSM model. The simulation and experimental results both revealed great differences between a rough-cut cyclone and a traditional one in terms of flow field.There existed reversed flow in the exit tube and dipleg,which could get to the separation space and strongly disturb the flow field. On the basis of the flow field, scalar transport equation was used to compute the gas residence time distribution. Simulation results of gas tracing showed that residence time distribution of the gas from the inlet and out of the dipleg and exit tube assumed logarithmic normal distribution. Gas residence time of the reversed flow took on a double-peak profile. Average gas residence time was increased by 5%—10% approximately for the existence of reversed flow in the exit tube. Decrease of diameter of the dipleg and existence of a hopper could increase mass flux out of the exit tube as well as decrease the reversed flow distinctly, thus the average gas residence time was decreased significantly.

Key words

cyclone simulation flow field reversed flow residence time scalar transport

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