

多相流和计算流体力学

## 底隙设置挡板内循环流化床水力特性分析

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收稿日期 2006-12-11 修回日期 2007-1-29 网络版发布日期 2007-10-11 接受日期

摘要

针对流化床反应器中多相流体混合碰撞的复杂性、突变性的问题,以底隙设置十字形挡板反应器的水力特性改变为研究对象,采用电导法测定反应器内液体循环速度和混合时间等动力学数据及其变化,分析新型内构件的强化作用原理。研究发现,两相条件下,十字形挡板的设置使反应器的升流区及降流区的液体循环速度分别提高 $9.5\% \pm 1.0\%$ 和 $11.8\% \pm 1.0\%$ ,低流速时,液相混合时间变长,高流速时,混合时间反而短缩,变化范围在 $\pm 5\%$ ,计算的摩擦阻力系数由4.13降低为2.75,证明了流体在反应器底部碰撞能量消耗的下降。通过全环路能量衡算得到液体循环速度模型计算参数的实验关联式,应用于三相条件,计算值与实验值误差在8%以内。表明在急剧湍流内循环流化床底部设置挡板所实现的流态有序、矢量归一的目标能有效改善反应器中流体的水力特性而使流体稳定,并进一步实现稳态运行条件下的节能。

关键词 [十字型挡板](#) [流化床](#) [液体循环速度](#) [摩擦阻力系数](#)

分类号

## Hydraulic characteristics of internal loop fluidized bed with baffle setting on bottom

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### Abstract

An investigation was conducted to study the hydraulic characteristics of internal loop fluidized bed with cross shape baffle setting on the bottom of the reactor. According to the properties of multi phase mixing and collision, the cross shape baffle leads to the transformation of chaotic to orderly, offering a new way for controlling hydrodynamics. The liquid circulation velocity and mixing time of the reactor were measured by the conductivity method, and compared with the conventional fluidized bed to indicate the fact of promoting gas liquid solids mixing. It was shown that the liquid circulation velocity in the riser and that in the downcomer were increased by  $9.5\% \pm 1.0\%$  and  $11.8\% \pm 1.0\%$  of those without the cross shape baffle. When superficial gas velocity was less than  $0.86 \text{ cm} \cdot \text{s}^{-1}$ , liquid mixing time increased with setting the cross shape baffle. Liquid mixing time decreased when superficial gas velocity was above  $0.86 \text{ cm} \cdot \text{s}^{-1}$ . Frictional loss coefficient at the bottom section reduced from 4.13 to 2.75 with setting the cross shape baffle, resulting in obvious decrease of energy dissipation due to flow collision. Based on an energy balance over the loop, a correlation equation between liquid circulation velocity and frictional loss coefficient was established. For the three phase system, the prediction values from the above correlation equation agreed.

**Key words** [cross-shape baffle](#) [fluidized bed](#) [liquid circulation velocity](#) [frictional loss coefficient](#)

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