

多相流和计算流体力学

细颗粒对气固流化床中静电行为的影响

王芳, 徐怡, 于恒修, 王靖岱, 阳永荣

化学工程国家重点实验室, 浙江大学化学工程与生物工程学系, 中石化长岭分公司军事代表室

收稿日期 2007-8-15 修回日期 2007-10-22 网络版发布日期 2008-2-20 接受日期

摘要 聚合物颗粒粒径和残余催化剂量(又称灰分)不同,会影响颗粒的功函数、接触面积和发生接触时的电荷转移数目等,故粒径和灰分含量不同的同种聚合物颗粒在相互接触时对静电的贡献并不相同,尤其是灰分含量较高的细颗粒对静电的影响至关重要.通过在 $\phi 150\text{mm}$ 的流化床冷模装置中,对聚乙烯颗粒-氮气体系进行流态化实验,分别测量了向含较大聚乙烯颗粒的流化床中添加不同粒径的同种聚乙烯细颗粒后的静电电压,发现床内电压与所加细颗粒粒径、细颗粒重量分率及细颗粒中灰分含量密切相关,根据上述现象进而提出了包含颗粒粒径作用项和灰分含量作用项的细颗粒作用因子.在实验条件范围内,作用因子小于1.0的三种细颗粒的加入对床内静电电压产生影响甚微.而平均粒径最小同时灰分含量最高的细颗粒加入后对床内静电电压影响明显,当其作用因子小于1时,同样不会引起床内静电电压的太大改变;且当作用因子小于0.5时,静电电压还略有降低;而作用因子一旦大于1,床内静电电压显著升高;当作用因子继续升高,静电电压又有所下降,但同时由于细颗粒的含量增加,粘壁现象变得非常严重.

关键词

[气固流化床](#) [静电荷](#) [摩擦起电](#) [双极带电](#)

分类号

Electrostatic behavior with fines of different sizes added into gas-solid fluidized bed

WANG Fang, XU Yi, YU Hengxiu, WANG Jingdai, YANG Yongrong

Abstract

Polymer particles having the same chemical makeup but different sizes would have their own special contributions to the generation of static charges, owing to the differences in catalyst residue and surface properties among them. Experiments were performed in a gas-solid fluidized bed to determine the changes in the electrostatic charges with addition of various fine polyethylene particles, which were the same material as the coarse polyethylene particles, to better understand their role in influencing electrostatic charge generation/dissipation. By measuring the electrostatic potential at different bed axial heights, it was found that the electric field inside the bed was significantly influenced by the size of added fine polyethylene particles, mass fractions and catalyst residue. Consequently, an impact factor of fine particles (F_b) was proposed, which was the sum of particle diameter term and catalyst residue term. Within the experimental limits in this paper, after three kinds of fines with F_b all less than 1 were added in the fluidized bed, the electrostatic potential in the bed was just influenced slightly. However, the bed electrostatic potential changed significantly following the addition of the fines with the smallest particle diameter and highest residual catalyst content. While F_b of this kind of fines was less than 1, the static potential did not change much but even decreased slightly with the addition of fines. Once F_b of the fourth kind of fines was more than 1, the electrostatic potential in the bed increased greatly. With F_b of the fourth kind of fines increasing further, the electrostatic potential fell a little, and meanwhile it was found that a large amount of fine particles adhered to the column wall.

Key words

[gas-solid fluidized bed](#) [electrostatic charge](#) [triboelectrification](#) [bipolar charging](#)

扩展功能

本文信息

- ▶ [Supporting info](#)
- ▶ [PDF\(651KB\)](#)
- ▶ [\[HTML全文\]\(0KB\)](#)
- ▶ [参考文献](#)

服务与反馈

- ▶ [把本文推荐给朋友](#)
- ▶ [加入我的书架](#)
- ▶ [加入引用管理器](#)
- ▶ [复制索引](#)
- ▶ [Email Alert](#)
- ▶ [文章反馈](#)
- ▶ [浏览反馈信息](#)

相关信息

- ▶ [本刊中 包含“](#)

[气固流化床” 的相关文章](#)

- ▶ [本文作者相关文章](#)

- [王芳](#)
- [徐怡](#)
- [于恒修](#)
- [王靖岱](#)
- [阳永荣](#)

DOI:

通讯作者 王靖岱 wangjd@zju.edu.cn