化工学报 2004 55 (6): 902-906 ISSN: 0438-1157 CN: 11-1946/TQ

多相流

# EDB中微米单颗粒振荡特性

冯昭华, 朱家骅, 杨雪峰, 夏素兰, 关国强, Davis E J

四川大学化学工程学院，四川 成都 610065;华盛顿大学化工系,华盛顿 西雅图 98195-1750,美国

收稿日期 2003-12-8 修回日期 2004-3-23 网络版发布日期 2008-9-1 接受日期

摘要 改进了Davis关于微米单颗粒在EDB（electrodynamic balance）中悬浮的两区理论，通过引入Oseen曳力公式和非齐次项，建立了振荡条件下颗粒完整的运动微分方程，并对其运动轨迹进行了数值模拟. 从理论上证实了颗粒在EDB中存在稳定的阻尼振荡过渡区，给出了不同于Davis理论的三区状态图（$\delta$-$\beta$图），从而构建了振荡条件下颗粒EDB研究的理论基础. 这些理论结果的可靠性通过实验也得到了很好的验证.

关键词 EDB 微米单颗粒 振荡特性 运动轨迹 数值模拟

分类号

# OSCILLATION CHARACTERISTICS OF SINGLE MICROPARTICLE IN ELECTRODYNAMIC BALANCE

FENG Zhaohua,ZHU Jiahua,YANG Xuefeng,XIA Sulan,GUAN Guoqiang,Davis E J

**Abstract**

Based on the two-regime theory of Davis, a complete motion differential equation for a single oscillating microparticle in an electrodynamic balance (EDB) has been put forward by introducing Oseen’s formula and inhomogeneous term and solved numerically by using the classic Runge-Kutta method in this paper. The fact that there exists a transitional regime, in which the charged particle can be in steady damped oscillation, has firstly been demonstrated by theoretical method. By virtue of the simulated trajectories, a three-regime state curve ($\delta$-$\beta$), which is different from Davis theory, has been delineated and the theoretical foundation of EDB research on microparticle oscillation has further been built up.And the above-mentioned theoretical results have been verified experimentally hereby.

**Key words** electrodynamic balance single microparticle oscillation characteristics trajectory numerical simulation

DOI:

通讯作者 朱家骅 jhzhu@scu.edu.cn