

多相流和计算流体力学

油液对伸缩变形乳胶粒子作用力的计算

龚海峰, 涂亚庆, 史永刚, 彭焱

解放军后勤工程学院油料应用与管理工程系;重庆钢铁集团

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摘要

乳化油中乳胶粒子在脉冲电场作用下产生伸缩振动, 变形粒子受油液作用力的精确解目前尚不明确。通过建立单乳胶粒子在油中的伸缩变形模型, 得到变形粒子内部流体的速度势, 利用椭球谐函数推导出变形粒子外部油液流动的流函数, 结合Stokes流理论计算粒子变形过程中瞬时时刻受到周围油液的作用力, 得出力的解析表达式。数值计算结果表明: 当乳胶粒子的变形较小时, 作用力系数的数值结果与粒子变形按线性分布假设的计算结果基本吻合; 当粒子的长轴大于短轴3倍时, 作用力系数达到最小, 基本趋于零。精确解表达式可解决任意时刻油液对乳胶粒子变形的作用力问题。

关键词

[电场破乳](#) [乳胶粒子](#) [作用力系数](#) [流函数](#) [椭球谐函数](#)

分类号

Calculation of force acting on flexing and deforming latex particle in oil

GONG Haifeng, TU Yaqing, SHI Yonggang, PENG Ye

Abstract

In emulsified oil, flexing oscillation of latex particle happens in the pulse electric field. The exact solution of the force acting on latex particle by oil is not clear yet. By establishing a model of single particle's flexing and deformation in oil, the velocity potential of the liquid inside the particle was obtained. The flow function of the liquid outside the particle was derived from the ellipsoid harmonics function. In the course of latex particle's deformation, the force produced by the oil around was calculated at the instant of deformation with the theory of Stokes flow. The results of numerical calculation showed that at a small deformation of particle, the force coefficients agreed well with the calculation based on the assumption of linear distribution of particle's deformation. When the length of particle's long axis was greater than three times of short axis, the force coefficient tended to a minimal value, close to zero. So the force on deforming latex particle by oil at an arbitrary moment could be solved with the exact expression.

Key words

[electro-demulsification](#) [latex particle](#) [force coefficients](#) [flow function](#) [ellipsoid harmonics function](#)

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通讯作者 龚海峰 ghf79016@163.com

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