化工学报 2009 60 (11): 2729-2736 ISSN: 0438-1157 CN: 11-1946/TQ

多相流和计算流体力学

充模过程的Level Set两相流模拟

杨斌鑫, 欧阳洁, 郑素佩, 赵智峰

西北工业大学理学院

收稿日期 2009-5-20 修回日期 2009-7-7 网络版发布日期 2009-11-5 接受日期

摘要

采用Level Set两相流方法模拟了熔体充模过程，避免了处理复杂的边界以及用Ghost方法将熔体内的速度值外推到熔体外的情况。分别对型腔水平中面与垂直中面的充模过程进行了模拟。讨论了不同注射速度、不同注射口数量以及不同Reynolds数对充模过程的影响，得出了不同时刻各种情况下熔体界面的位置与充模过程刚结束时型腔内的压力分布，分析了熔体在型腔内运动的不同阶段的特点及形成不同阶段的原因。结果表明，在注射口宽度与型腔宽度相差不大的情况下，如果采用中低速充模，则整个充模运动过程以比较平稳的扩展性运动为主，充模较完全，熔体不发生破裂，制件效果较好。充模速度越大，熔体达到平稳流动的时间越短，充模过程越短。数值模拟结果与实验结果一致，同时表明Level Set两相流方法在求解拓扑性质发生较大变化问题时具有很大的优势。

关键词

注塑成型 Level Set 两相流 运动界面

分类号

Simulation of injection molding process with Level Set two-phase flow method

YANG Binxin,OUYANG Jie,ZHENG Supei,ZHAO Zhifeng

Abstract

The interface motion in the injection molding process is simulated with the Level Set two-phase flow method，which can avoid both to deal with the complex boundary conditions and to extend the melt velocity to out of the melt boundary by the Ghost method at each time step. The physical governing equation systems are solved by the finite volume method on a non-staggered grid. The Level Set and its reinitialization equation are solved by the finite difference method. Two injection processes，that is the injection process at the horizontal central plane and the vertical central plane of the cavity，are simulated. The influences of different injection velocities，different quantities of the inlets and different Reynolds numbers on the interface motion are studied. The positions of the interface at different time and the pressure distributions when the injection process is over are presented. The features at different stages of the melt motion and how such stages generated are analyzed. The numerical results，which coincide with the experiments，show that when the difference between the width of the injection inlet and that of the mold is not large，if low or middle injection velocities are used，the melt will not break and can be transported steadily to the whole mold cavity. The higher the injection velocity，the shorter the time to reach stable extension flow.

Key words

injection molding Level Set two-phase flow moving interface

DOI:

通讯作者 欧阳洁 jieouyang@nwpu.edu.cn