

多相流和计算流体力学

聚合物稀溶液的微观-宏观确定性模拟

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摘要

采用确定性方法数值求解了聚合物稀溶液的微观-宏观模型, 其中, 宏观尺度上用有限体积法求解守恒方程, 介观尺度上用谱方法求解Fokker-Planck方程和聚合物对偏应力张量的贡献, 模拟了聚合物稀溶液FENE哑铃模型的平板Couette流动, 给出了速度随时间变化的剖面图, 分析了移动平板速度、哑铃的量纲1有限拉伸参数和Deborah数对流动的影响, 同时也验证了有限体积法与谱方法结合求解聚合物微观-宏观模型的有效性。

关键词 [聚合物稀溶液](#) [Fokker-Planck方程](#) [微观-宏观模拟](#) [FENE哑铃](#) [平板Couette流动](#)

分类号

Micro-macro methods for deterministic simulation of dilute polymeric fluids

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Abstract

Deterministic simulation approach was applied to calculating numerically the micro-macro model describing the dynamics of dilute polymeric fluids, in which the finite volume method (FVM) was used to solve the conservation equations on the macroscopic level and the spectral method was used to solve the Fokker-Planck equation and the polymeric contribution to the extra-stress tensor on the mesoscopic level. This approach was used to simulate plane Couette flows of dilute polymeric fluids by the FENE dumbbell models. The evolution of the velocity profile was obtained and the influences of the moving plate velocity, the dimensionless finite extensibility parameter of dumbbells and Deborah number on the polymeric fluids flows were analyzed. The combination of FVM and the spectral method was effectively used to solve the micro-macro model describing the polymeric fluids flows.

Key words

[dilute polymeric fluids](#) [Fokker-Planck equation](#) [micro-macro simulation](#) [FENE dumbbell](#) [plane Couette flows](#)

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