传递现象

淬火过程流动与传递现象数值模拟

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摘要　　根据淬火过程中多相流动与传热的特点，提出了简化模型。基于两相流体动力学及流固耦合传热建立了流动与传热方程。推导出了计算模型并结合大型软件Fluent进行了用户子程序（UDF）设计，利用此方法对影响流动与沸腾传热的几个因素进行了数值研究，数值计算结果与理论分析吻合。最后对金属铝块的淬火过程进行了计算，计算得到的金属表面测点温度随时间变化历程与文献中实验数据误差在15%以下，表明计算方法可行并且把握了物理过程的本质。

关键词　　淬火　两相流动　流固耦合传热

分类号

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Numerical simulation of flow and heat transfer during quenching process

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Abstract

 A simplified model based on multi-phase flow and heat transfer during the quenching process was developed.A set of equations of fluid flow and heat transfer were derived from two-phase fluid dynamics and fluid-solid conjugated heat transfer (CHT）.User-defined functions of the commercial CFD software Fluent were designed for the numerical simulation of fluid flow and heat transfer during the quenching process according to the model.Some influence factors were analyzed and the results showed that the numerical results were consistent with the theoretical analysis.Finally numerical simulation was also done with a rectangular aluminum block, and the computed temperature history within the aluminum block was compared with the temperature history of measured data by using thermocouples in the literature.The error was below 15%.The present model is feasible and captures the major aspects of the quenching process.

Key words　quenching process　two-phase flow　fluid-solid conjugated heat transfer

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