金属学报 >>2012 >> >>(1)

金属学报 2012, (1) 115-121 **DOI**: 10.3724/SP.J.1037.2011.00474 **ISSN**: 0412-1961 **CN**: 21-1139/TG

论文

热轧螺纹钢化学剂冷却过程温度场的数值模拟及实验研究

魏洁, 董俊华, 柯伟

中国科学科院金属研究所腐蚀与防护国家重点实验室, 沈阳 110016

摘要： 本文对化学剂冷却热轧螺纹钢在两段式冷却(前段化学剂FM冷却+后段水冷)过程中的温度场进行了有限元模拟, 并在实验室对前段化学剂FM冷却生成的氧化皮的耐蚀性能进行了评价. 采用工业现场一段式水冷的工艺参数, 模拟了一段式水冷的温度场. 对比一段式水冷的温度场, 分析了两段式冷却的工艺参数对冷却过程温度场的影响. 结果表明, 在前段化学剂FM冷却时, 采用较小的对流换热系数, 有利于提高前段化学剂冷却时的氧化温度, 从而改善氧化皮的质量; 在后段水冷时, 在保持原一段水冷的对流换热系数的情况下, 两段式冷却水冷段的冷却曲线与一段式水冷非常接近, 能够满足III级热轧螺纹钢的力学性能的要求. 采用有限元模拟优化的工艺参数, 在实验室模拟了前段化学剂FM冷却过程, 获得了致密的氧化皮, 其耐蚀性能显著优于水冷钢筋, 说明采用前段化学剂冷却来改善水冷钢筋的耐蚀性能是可行的.

关键词： 螺纹钢\化学剂冷却 温度场 有限元 耐蚀性 高强度

NUMERICAL SIMULATION AND EXPERIMENTAL STUDY ON TEMPERATURE FIELD DURING CHEMICAL REAGENT COOLING PROCESS OF HOT ROLLED REBAR

WEI Jie, DONG Junhua, KE Wei

State Key Laboratory for Corrosion and Protection, Institute of Metal Research, Chinese Academy of Sciences, Shenyang 110016

Abstract: The corrosion resistance of water cooled rebar is improved by applying a chemical reagent cooling process on the basis of maintaining the high mechanical property. To provide the reference basis for the on-site application of chemical reagent cooling process, the temperature field of the two-stage cooling process (first stage of chemical reagent of FM cooling and second stage of water cooling) of rebar produced by chemical cooling is simulated using the finite element method. Furthermore, the corrosion resistance of scale formed during the first stage of chemical reagent cooling was evaluated in laboratory. Applying the processing parameters of water cooling in steel mill, the temperature field of one-stage cooling was simulated. Compared with the temperature field of the one-stage cooling, the influence of processing parameters on the temperature field during two-stage cooling is analyzed. The results showed that the smaller heat transfer coefficient is applied to increase the oxidation temperature and improve the quality of the oxide scale in the first stage of FM cooling. In the second stage of water cooling, the cooling curve is very approximate to that of one-stage cooling when the heat transfer coefficient of one-stage cooling is remained. Therefore, the mechanical property of hot-rolled rebar of grade III can be ensured. Furthermore, the first stage of FM cooling process was implemented in lab using the optimizing parameters obtained from finite element analysis. The oxide scale forming using FM cooling is compact. And its corrosion resistance is much better than water-cooled rebar, which proves that it is feasible to improve the corrosion resistance of water-cooled rebar using FM cooling before water cooling.

Keywords: rebar chemical reagent cooling temperature field finite element corrosion resistance high strength

收稿日期 2011-07-22 **修回日期** 2011-12-25 **网络版发布日期** 2012-02-27

DOI: 10.3724/SP.J.1037.2011.00474

基金项目:

通讯作者: 董俊华

作者简介: 魏洁, 女, 1980年生, 助理研究员, 博士

通讯作者E-mail: jhdong@imr.ac.cn

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