金属学报 >>2011 >> >>(12)

金属学报 2011, (12) 1495-1502 **DOI**: 10.3724/SP.J.1037.2011.00149 **ISSN**: 0412-1961 **CN**: 21-1139/TG

论文

高速钢复合轧辊连铸复合过程温度场的数值模拟 I. 石墨铸型法

冯明杰,王恩刚,赫冀成

东北大学材料电磁过程研究教育部重点实验室, 沈阳 110819

摘要： 以Ansys 10.0和Fluent 6.3为计算平台, 利用2者之间的接口和Fluent 6.3软件提供的用户自定义函数功能, 研究了辊芯初预热温度、拉坯速度、预热和补热功率等因素对石墨铸型连续铸造复合成型法制备高速钢复合轧辊坯内非稳态温度场的影响,并对各工艺参数之间的匹配关系进行了探讨. 结果表明, 当辊芯表面的终预热温度一定时,所需的感应预热功率随拉坯速度的增加而增大, 随初预热温度的升高而减小;辊芯移出线圈时, 高温区仅限于表层附近, 芯内大部分区域几乎不受感应预热的影响.进入预热坩埚后, 随着辊芯的下移, 辊芯表面能达到的最高温度及在固相线温度以上持续的时间随补热功率的增大和拉坯速度的减小而相应升高或增长; 拉坯速度和补热功率之间存在严格的匹配关系, 当2者匹配得当时, 辊芯和外层高速钢之间可形成牢固的冶金结合.

关键词： 高速钢复合轧辊 温度场 连铸复合 冶金结合

NUMERICAL SIMULATION ON TEMPERATURE FIELD IN HIGH SPEED STEEL COMPOSITE ROLL DURING CONTINUOUS POURING PROCESS FOR CLADING I. Graphite Mould Method

FENG Mingjie, WANG Engang, HE Jicheng

Key Laboratory of National Education Ministry for Electromagnetic Processing of Materials, Northeastern University, Shenyang 110819

Abstract: The effects of original preheating temperature of core, casting speed, preheating power and supplement heat power on unsteady state temperature field in high speed steel composite roll billet and the parameters match relationship during graphite mould continuous pouring process for cladding have been numerically simulated by use of interface and user – defined functions based on Ansys 10.0 and Fluent 6.3 software. The results indicate that the required induced preheating power increases with increasing casting speed and decreasing original preheating temperature of core when the finishing preheating temperature of core – surface is constant. The higher temperature zone only lies in the surface layer of core and the temperature in mostly zone of core is not affected by inducing coil when the core moves off the preheating coil. The highest temperature of core – surface and duration above its solidus increase with increasing supplement heating power and decreasing casting speed. When the casting speed matched with supplement heat power, the high speed steel can tightly bond with core to form the composite roll.

Keywords: high speed steel composite roll temperature field continuous pouring process for cladding metallurgy bounding

收稿日期 2011-03-22 **修回日期** 2011-05-21 **网络版发布日期** 2011-12-29

DOI: 10.3724/SP.J.1037.2011.00149

基金项目:

国家高技术研究发展计划项目2003AA331050和国家自然科学基金项目200809123资助

通讯作者: 王恩刚

作者简介: 冯明杰, 男, 1971年生, 副教授, 博士

通讯作者E-mail: fengmj@epm.neu.edu.cn

参考文献：

[1] Kang Y J, Oh J C, Lee H C, Xiao Q Y, Shao K Z. Metall Mater Trans, 2001; 32A: 2515

[2] Twadoh S, Mori T. ISIJ Int, 1992; 32: 1131

[3] Kudo T, Kawashima S, Kurahashi R. ISIJ Int, 1992; 32: 1190

[4] Ichino K, Kataaoka Y, Koseki T. Kawasaki Steel Technol Rep, 1997; 37(8): 13

[5] Hashimoto M, Otomo S, Yoshida K, Hokimoto K, Oda T. ISIJ Int, 1992; 32: 1202

[6] Shimizu M, Shitamura O, Matsuo S. ISIJ Int, 1992; 32: 1244

[7] Fu H G. Iron Steel, 2000; 35(5): 67

[8] Zhou L, He J A. Foundry, 2002; 51: 666

[9] Gong K L. Steel Roll, 2008; 25(2): 39

[10] Shao K Z, Wei S Z, Long R, Liu Y M, Wang S C. Foundry, 2006; 55: 160

[11] Wu C J, Shen D Z, Yang G M, Jia T C, Huang Y X. Iron Steel, 1999; 34(4): 61

[12] Zhou L Y, Chen B Q, Du X M, Wang H. Cast Nonferrous Alloys, 2009; 29: 621

[13] Feng M J, Wang E G, Wang J G, He J C. Northeast Univ (Nat Sci), 2007; 28: 1401

[14] Han Z C. Electrom Agnetic Technique and Equipment of Metallurgy. Beijing: Metallurgical Industry Press, 2008: 19

[15] (韩至成. 电磁冶金技术及装备. 北京: 冶金工业出版社, 2008: 19)

本刊中的类似文章

1．冯明杰 王恩刚 赫冀成.高速钢复合轧辊连铸复合过程温度场的数值模拟 II. 铜结晶器法[J]. 金属学报, 2011, (12): 1503-1512

2．李宝宽 代凤羽 齐凤升 杨冉.双水口注流连铸复合钢坯结晶器流场和合金元素浓度场研究[J]. 金属学报, 2010,46(6): 736-742

3．张晓华 罗守靖.AZ91D镁合金等通道角挤压温度场数值模拟[J]. 金属学报, 2010,23(1): 35-40

4．于海岐 朱苗勇.圆坯结晶器电磁搅拌过程三维流场与温度场数值模拟[J]. 金属学报, 2008,44(12): 1465-1473

5．张琦; 王同敏; 李廷举; 金俊泽 .行波磁场作用下空心管坯的两相凝固数值模拟[J]. 金属学报, 2007,43(6): 668-672

6．杨刚; 李宝宽; 于洋; 齐凤升 .薄板坯连铸结晶器铜板的三维传热分析[J]. 金属学报, 2007,43(3): 332-326

7．封小松; 陈彦宾; 李俐群 .镀锌板激光钎焊温度场的数值模拟[J]. 金属学报, 2006,42(8): 882-886

8．高士友; 石力开; 席明哲; 纪宏志; 张永忠; 杜宝亮 .金属直薄壁件激光直接沉积过程的有限元模拟 Ⅰ. 沉积过程中温度场的模拟[J]. 金属学报, 2006,42(5): 449-453

9．刘郁丽; 杨合.Effects of Process Parameters on the Temperature Field in Ti-6Al-4V Alloy Blade Precision Forging Process[J]. 金属学报, 2006,22(04): 473-477

10．陈波; 高明; 马颖澈; 刘奎; 李依依 .空心管坯电磁离心过程的数值模拟[J]. 金属学报, 2005,19(6): 634-638