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多道次热轧对包层钢筋性能及结合面的影响

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摘要: 采用热轧的方式制备了不锈钢/碳钢包层钢筋,研究了包层钢筋的机械性能及界面的结合情况.通过拉伸、剪切实验测试了钢筋的抗拉强度等性能及两金属的结合强度.应用OM, SEM, EDS以及显微硬度仪对界面附近的显微形貌、元素扩散以及显微硬度分布进行分析.实验结果显示:不锈钢/碳钢包层钢筋的轧制过程中双金属等比例延伸,其抗拉强度高达550 MPa,延伸率45%,拉伸过程中出现明显缩颈,断口处两金属未分离.随轧制道次的增加,金属结合更加致密,剪切强度增加,最大剪切强度为333 MPa,剪切断裂面出现典型的塑性韧窝和剪切滑移.界面附近出现了明显的元素扩散,不锈钢中的Cr, Mn和Ni等元素向碳钢扩散,碳钢中的Fe元素向不锈钢扩散,总扩散距离约30 μm,造成界面附近碳钢侧的显微硬度显著增大,第6道次后其值为399.4 HV,远高于碳钢基体的硬度.复合包层钢筋界面间形成了良好的冶金扩散结合.

关键词: 包层钢筋 热轧 结合界面 扩散

EFFECT OF MULTIPASS HOT ROLLING ON THE PROPERTY AND BONDING INTERFACE OF CLAD BAR

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Abstract: Because of climate and human factors, the corrosion of reinforced steel bar has become one of the important reasons of premature deterioration of concrete buildings and infrastructure. Stainless steel bar cannot be widely used due to its high price. Therefore, stainless steel clad carbon steel bar comes into being. It is a new material used in construction, which is made up of corrosion resistant stainless steel outer layer and carbon steel core. In the present study, an experimental study was conducted to investigate the mechanical property and bonding state of stainless steel clad carbon steel bar. The tensile strength of clad bar and bonding strength of two metals were measured using tension test and shearing test. Then, microscopic morphology, element diffusion and microhardness near the interface were analyzed using OM, SEM, EDS and microhardness tester. The results show that the two metals of the bar extend proportionally in the rolling process. The tensile strength is 550 MPa and the percentage of elongation is 45%. The neck phenomenon in the tensile experiment is obvious and the two metals are undivided in the fracture. With the increment of rolling pass, the bonding between the metals becomes denser and this increases the shearing strength. The max shearing strength is 333 MPa and the typical plastic dimples and shearing slip were observed on the shearing fracture surface. Element diffusion occurs at the interface where the Cr, Mn, Ni of stainless steel diffuse into carbon steel and the Fe of carbon steel diffuses into stainless steel, and the total width of diffusion distance is about 30 μm. It makes the microhardness of the carbon steel near the interface increased significantly and the value is 399.4 HV which is higher than carbon steel after sixth pass rolling. Therefore, the metallurgical diffusion bonding is formed in the interface of clad bar.

Keywords: clad bar hot rolling bonding interface diffusion

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参考文献:

- [1] Hwang Y M, Hsu H H, Hwang Y L. *Int J Mech Sci*, 2000; 42: 2417 
- [2] Kang H, Kim J, Huh M, Engler O. *Mater Sci Eng*, 2007; A452-453: 347
- [3] Lee J, Bae D, Chung W, Kim K, Cho Y. *J Mater Process Technol*, 2007; 187-188: 546 
- [4] Soltanalianezhad M, Haerianardakani A. *Mater Des*, 2009; 30: 1103 
- [5] Zhang L, Meng L, Zhou S P, Yang F T. *Mater Sci Eng*, 2004; A371: 65
- [6] Bulent K. *J Mater Process Technol*, 2007; 190: 138 
- [7] Motarjemi A K, Korcak M, Ventzke V. *Int J Pres Ves Pip*, 2002; 79: 181 
- [8] Li S X, Xuan F Z, Tu S T. *J Nucl Mater*, 2007; 366(1/2): 1
- [9] Madaah-Hosseini H R, Kokabi A H. *Mater Sci Eng*, 2002; A335: 186
- [10] Kundu S, Chatterjee S. *Mater Sci Eng*, 2006; A425(1/2): 107
- [11] He P, Yue X, Zhang J. *Mater Sci Eng*, 2008; A486: 171
- [12] Elrefaey A, Tillmann W. *J Mater Process Technol*, 2009; 209: 2746 
- [13] Wu C J, Wu Y, Xue Z Y, Liang H, Liu Q. *Acta Metall Sin (Engl Lett)*, 2010; 23: 206
- [14] Lesik L, Dyja H, Pilarczyk J W, Wiewiorowska S. *Wire J Int*, 2001; 34(2): 94
- [15] Dyja H, Lesik L, Milenin A, Mroz S. *J Mater Process Technol*, 2002; 125-126: 731 
- [16] Berski S, Dyja H, Maranda A, Nowaczewski J, Banaszek G. *J Mater Process Technol*, 2006; 177: 582 
- [17] Manesh H, Taheri A. *J Mater Process Technol*, 2005; 166: 163 
- [18] Yuan J W, Pang Y H, Li T. *J Wuhan Univ Technol*, 2011; 26: 111 
- [19] Dyja H, Mroz S, Milenin A, Lesik L. In: *International Rolling Conference ed., 44th MWSP Conference Proceeding, Orlando: Association for Iron & Steel*, 2002: 40: 653 
- [20] Dyja H, Mroz S, Stradomski Z. *Metalurgija*, 2003; 42(3): 185
- [21] Dyja H, Mroz S, Milenin A. *J Mater Process Technol*, 2004; 153-154: 100 
- [22] Szota P, Dyja H. *J AMME*, 2007; 25(1): 55
- [23] Mroz S, Szota P, Dyja H, Kawalek A. *Metalurgija*, 2011; 50(2): 85
- [24] Ricardo R. Master Dissertation, Cambridge: Massachusetts Institute of Technology, 2001
- [25] Purk Y. Master Dissertation, Raleigh: North Carolina State University, 2003
- [26] Gregory W. PhD Thesis, Blacksburg: Virginia Polytechnic Institute and State University, 2007

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1. 陈业新 常庆刚. 20g纯净钢中氢陷阱对氢扩散系数的作用[J]. *金属学报*, 2011,47(5): 548-552
2. 王维新 姜肃猛 卫广智 马军 宫骏 孙超. NiCoCrAlYSiB+AlSiY梯度涂层恒温氧化行为[J]. *金属学报*, 2011,47(5): 578-586
3. 杨小斌,涂善东. 外力作用对尘化腐蚀过程中碳扩散的影响[J]. *金属学报*, 2011,31(5): 395-398
4. 李贺莱. 微晶化对纯镁钝化膜特性的影响[J]. *金属学报*, 2011,23(4): 313-317
5. 谢胜涛 刘振宇 方园 于艳 王喆 王国栋. 热轧工艺对Cr12钢表面起皱的影响机制[J]. *金属学报*, 2011,25(4): 347-354
6. 张露 石南林 宫骏 裴志亮 高立军 孙超. SiC长纤维表面(Al+Al₂O₃)复合涂层的制备[J]. *金属学报*, 2011,47(4): 497-501
7. 王艳飞,巩建鸣,唐建群,蒋旺,姜莹洁. 冷拔残余应力应变对钢丝氢扩散过程的影响[J]. *金属学报*, 2011,31(3): 202-207
8. 周贤良, 朱敏, 薛会斌, 彭新元, 叶志国. 热轧带钢的初期耐大气腐蚀性能[J]. *金属学报*, 2011,31(2): 139-144
9. 王妙全, 钱余海, 齐慧滨, 王伟, 李明. 模拟热轧工艺条件下304不锈钢的氧化行为[J]. *金属学报*, 2011,23(1): 5-8
10. 冯明杰 王恩刚 赫冀成. 带钢热连轧机工作辊非稳态传热的数值模拟[J]. *金属学报*, 2010,46(8): 1009-1017

