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论文

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变幅载荷下改善焊接接头疲劳性能的超声冲击与TIG熔修方法之比较

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Comparison of Ultrasonic Peening Method on Improving the Fatigue Behavior of Welded Joints with TIG Dressing under Variable-Amplitude Load

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摘要

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摘要 在恒幅和变幅两种加载条件下,对16Mn 钢原始焊态和经过超声冲击及TIG熔修处理的焊接接头进行了对比疲劳试验。结果表明: (1) 在恒幅载荷作用下,TIG熔修试件与焊态试件相比,疲劳强度提高37 %左右,疲劳寿命延长2.5 倍;而在变幅载荷作用下, TIG熔修试件与焊态试件相比,疲劳强度提高34 %左右,疲劳寿命延长1.7~1.9 倍。(2) 在恒幅载荷作用下,超声冲击处理试件与焊态试件相比,疲劳强度提高84 %左右,疲劳寿命延长3.5~27 倍;而在变幅载荷作用下,超声冲击处理试件与焊态试件相比,疲劳强度提高80 %左右,疲劳寿命延长2.5~17 倍。(3) 在低中应力水平、中长寿命区域内,无论是在恒幅载荷作用下还是在变幅载荷作用下,使用超声冲击法提高焊接接头疲劳强度较TIG熔修法的效果更好。

关键词: 变幅载荷 超声冲击 TIG熔修 疲劳性能

Abstract: Treated by ultrasonic peening or TIG dressing, the fatigue performance of welded joints and structures is to be improved significantly. This has been verified by many constant amplitude fatigue tests. Subjected to variable amplitude loads, the fatigue performance of the structures will be affected, so that the fatigue contrast tests of 16Mn steel welded joints with fillet welds in three different conditions : TIG dressing, ultrasonic peening and as welded condition were performed. Test results indicated that : (1) Contrasted with the specimens in as welded condition the fatigue strength of the specimens treated by TIG-dressing is increased by about 37 % and the fatigue life is prolonged by 2.5 times when acted by constant amplitude load. When acted by variable amplitude load, contrasted with the specimens in as welded condition the fatigue strength of the specimens treated by TIG dressing is increased by about 34 % and the fatigue life is prolonged by 1.7~1.9 times. (2) When acted by constant amplitude load, contrasted with the specimens in as welded condition the fatigue strength of the specimens treated by ultrasonic peening is increased by about 84 % and the fatigue life is prolonged by 3.5~27 times. But when acted by variable amplitude load, contrasted with the specimen in as welded condition the fatigue strength of the specimens treated by ultrasonic peening is increased by about 80 % and the fatigue life is prolonged by 2.5~17 times; (3) Whether acted by constant amplitude loads or by variable amplitude loads, in the low-medium stress level and medium-long life states the improvement of fatigue strength of the welded joints created by ultrasonic peening is larger than that created by TIG dressing.

Keywords: variable amplitude load ultrasonic peening TIG dressing fatigue performance

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