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Die Existenz von Restspannungen durch das Schweißen verursacht wird, ist ein wichtiger Grund für die Rissbildung und Verformung in geschweißten Metallstrukturen, die die Dauerfestigkeit und Dimensionsstabilität erheblich beeinträchtigen können. Wärmebehandlung ist eines der herkömmlichen Verfahren, um Restspannungen abzubauen. Aber es wird oft durch die Herstellungsbedingungen und der Größe der Strukturen beschränkt. In diesem Beitrag wird ein Verfahren namens Vibrationsstressabbau (VSR) diskutiert. VSR ist ein Prozess, durch Post-Schweiß Vibrationen verringert und neu verteilen die interne Restspannungen von Schweißkonstruktionen. Die Wirksamkeit der VSR auf die Eigenspannungen von geschweißten Strukturen, einschließlich der Trommeln der Fördermaschine und dicke Edelstahlplatte untersucht. Parameter der VSR-Verfahren werden in der Papier beschrieben. Eigenspannungen auf Schweißnaht vor und nach Behandlung durch VSR Bohrlochmethode gemessen und etwa 30% ~ 50% ige Reduktion der Eigenspannungen eingehalten werden. Die Ergebnisse zeigen, dass VSR-Verfahren kann die Restspannung die beiden mittleren Kohlenstoffstahl (Q345) und Edelstahl (304L) geschweißten Strukturen effektiv zu reduzieren.

The existence of residual stresses caused by the welding process is an important reason of cracking and distortion in welded metal structures that may affect the fatigue life and dimensional stability significantly. Heat treatment is one of the traditional methods to relieve the residual stresses. But it is often limited by the manufacturing condition and the size of the structures. In this paper a procedure called vibratory stress relief (VSR) is discussed. VSR is a process to reduce and re-distribute the internal residual stresses of welded structures by means of post-weld mechanical vibration. The effectiveness of VSR on the residual stresses of welded structures, including the drums of hoist machine and thick stainless steel plate are investigated. Parameters of VSR procedure are described in the paper. Residual stresses on weld bead are measured before and after VSR treatment by hole-drilling method and about 30%~50% reduction of residual stresses are observed. The results show that VSR process can reduce the residual stress both middle carbon steel (Q345) and stainless steel (304L) welded structures effectively.

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Reduce the Residual Stress of Welded Structures by Post-weld Vibration

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Abstract: The existence of residual stress caused by the welding process is an important reason of cracking and distortion in welded metal structures that may affect the fatigue life and dimensional stability significantly. Thus requires a new of the residual stress to reduce the residual stress. But it is often limited by the manufacturing conditions and the size of the structures. In this paper a practical method vibration stress relief (VSR) is discussed. VSR is a process to reduce and re-distribute the internal residual stress of welded structures by means of post-weld mechanical vibration. The effectiveness of VSR on the residual stress of welded structures, including the stress of heat treatment and thick sections and plate are investigated. Parameters of VSR by random and sine vibration method are studied. Residual stresses on steel beam are measured before and after VSR treatment by hole-drilling method and about 30%-50% reduction of residual stress are observed. The results show that VSR process can reduce the residual stress both locally and over the VSR-treated structure and VSR is a residual stress relief method effectively.

1. Introduction

Welding process is a hot forming process which may introduce internal residual stresses in the structure after cooling. The existence of residual stresses is an important reason of cracking and distortion in metal structures that may affect the fatigue life and dimensional stability significantly. Therefore, the reduction of the residual stresses is an essential task in the manufacturing production of metal. The traditional method to reduce the residual stress is thermal stress relief (TSR) or post-weld heat treatment. TSR process usually high stresses, high treatment and the process is more consuming (usually 2-7 days for one piece with high energy cost). The distortion of metal parts under TSR is limited by the size of the structure and the practical need of labor cost reduction. The other disadvantage of the heat treatment is the growth of oxidation on the component surface. The VSR is a process to reduce and re-distribute the internal residual stress of components by means of vibration. It can improve the dimensional stability and stress of the components. Compared with TSR, it can reduce the residual stress of the component in the whole short time, no transport cost, no work with the surface and dimensional distortion. VSR process, as a convenient, interesting and efficient stress relief and stress reduction of manufacturing technology, and it is widely used in reduction of residual stress, metal hot working, forming, transportation, post-welding, structural health, etc. In several important process of steel, such as stress relaxation, stress relief, and stress reduction, VSR makes by combination of cyclic vibrating stress and local residual stress according the cold point of the component and the local plastic deformation region with the local residual stress reduction. The process can reduce residual stress relief and because within the cyclic stress wave also reduce distortion stress and a maximum cyclic stress if it can not approach the yield point. The stress concentration occurs in form of the plastic deformation regions and that causes

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