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MAIN TOPICS , ABSTRACTS & KEY WORDS

Computer Simulation and Experimental Research on CO₂ Short-circuit Transfer Welding Under Waveform Control LI Huan (Tianjin University, Tianjin 300072, China), HU Lian-hai, LI Jun-yue, YANG Li-jun. p1 ~ 4

Abstract One of the methods of getting better CO₂ arc welding technology performance and decreasing spatter efficiently is improving the arc welding power source and controlling the behavior of arc and droplet transfer. According to the reasonable instantaneous electric current characteristic of short-circuiting transfer, the AWP (Adapting Welding Physics Process) waveform control thought of CO₂ short-circuiting transfer is put forward in this paper. A simulation study is made and a simulation waveform is obtained. The experimental system is set up and a great number of data is carried out. The result of simulation is suitable for that of experiment on the whole. It shows that the simulation model is rational and practicable.

Key words: CO₂ gas shield arc welding; computer simulation; short-circuiting transfer; welding spatter; adapting welding physics process waveform control

Effect of Activating Fluxes and Welding Parameters on Weld Depth to Width Ratio in A-TIG Welding LIU Feng-yao (National Key Laboratory of Advanced Welding Production Technology, Harbin Institute of Technology, Harbin 150001, China), UN San-bao, YANG Chun-li, WU Lin. p5 ~ 8

Abstract The effect of activating fluxes with single component (SiO₂, CaF₂, TiO₂, Cr₂O₃, NaF) on weld depth to width ratio (D/W) is firstly studied in this paper during the TIG welding of stainless steel. After that, the flux SiO₂ is selected to investigate the effect of coating quantity and welding parameters (i. e. welding current, traveling speed, and arc length) on D/W . The experimental results show that the D/W increases with coating quantity of activating fluxes described above. The depth to width ratio of welds made with SiO₂ also increases with increasing welding current, traveling speed and arc length compared with welds made without flux. By applying the activating flux during TIG welding of stainless steel, the weld pool depth to width ratio is greatly improved compared with conventional TIG welding. Therefore, the manufacturing cost and cycle time can be apparently reduced and the activating

TIG welding has a better application prospect in welding industry.

Key words: activating flux TIG welding; activating flux; depth to width ratio; welding parameter

Effect of Stress and Plastic Strain on Hydrogen Diffusion In Welded Joint of Implant Test ZHANG Xian-hui (Harbin Research Institute of Welding, Harbin 150080, China), CHEN Pei-yin, TAN Chang-ying. p9 ~ 12

Abstract In this paper, the stress/strain field and hydrogen diffusion in implant specimen under different external loads are calculated by ABAQUS finite element software and the simulation technology for hydrogen diffusion in weldment. The results show that there exists an evident stress/strain concentration area in the vicinity of implant notch, and the stress near the tip of implant notch increases with the external load, but the stress concentration factor decreases gradually. With the same initial hydrogen content, the diffusible hydrogen peak value appearing in the stress/strain concentration area near the tip of implant notch increases gradually with the external load, and the time at which the peak value appears is delayed correspondingly. It is concluded that the stress and strain concentration near the tip of the implant notch is the important reason for hydrogen accumulation in this area.

Key words: stress; strain; hydrogen diffusion; implant test

Mathematic Analysis and Parameters Definition of Circuit of High-Frequency Oscillator for Arc Ignition ZHANG Xiao-nan (Tianjin University, Tianjin 300072, China), LI Jun-yue, YANG Yun-qiang, YANG Li-jun, LI Huan. p13 ~ 17, 21

Abstract On the working principle of the high frequency oscillator for arc ignition, the circuit model of the high frequency oscillator is set up in this paper. After the mathematic analysis of the model, the waveform functions in the instantaneous process of the current and voltage are obtained. Based on the real condition, these functions are analyzed deeply in the review. In order to improve the effect of arc ignition of high frequency oscillator, the problems of relationship among the parameters and parameters definition in the circuit are discussed on the result of the mathematical analysis. Some significant conclusions and calculation functions

of the circuit parameters are reached. Those supply theoretical foundation to a certain extent for the design and debugging of the high frequency oscillator.

Key words high frequency oscillator; arc ignition; mathematic analysis; parameters definition

Surface Nanocrystallization of SS400 Steel Butt Welded Joint and Its Effect on the Fatigue Strength

LI Dong (Institute of Metal Research, the Chinese Academy of Sciences, Shenyang 110016, China), CHEN Huai-ning, LIU Gang, LU Ke. p18 ~ 21

Abstract The welded joint of SS400 steel was treated by high-energy shot peening (HESP) technique. The surface layer was characterized by means of the XRD and TEM, and the changes of hardness, residual stress and fatigue strength were examined. Experimental results showed that nanostructured surface layer might form in the surface layer of welded joint after the HESP treatment, of which the crystallographic orientations were nearly random; therefore uniform microstructure could be obtained. The microhardness of the nanostructured surface layer was found to be much higher than that of the sample before the HESP treatment, and the welding residual stresses in this layer became entirely compressive. This kind of nanostructured surface layer with compressive stress could significantly increase the fatigue strength of butt-welded joint.

Key words butt-welded joint; high-energy shot peening; surface nanocrystallization; fatigue strength

Investigation on Microstructural Characteristics of ZrC-reinforced Metal Matrix Composite Layer Produced by Laser Cladding

ZHANG Qing-mao (The Center of Laser Processing, Department of Mechanical Engineering, Tsinghua University, Beijing 100084, China), HE Jin-jiang, U U Wen-jin, ZHONG Min-lin. p22 ~ 24, 58

Abstract Metal matrix composite layer reinforced in situ ZrC particles was formed by laser cladding overlapping on the medium carbon steel. The morphology, microstructure, interface structure and the distribution of the ZrC particles were observed with optical microscope, scanning electron microscope (SEM) and EDAX. The microstructural characteristics of ZrC reinforced metal matrix composites are the typical austenite dendrite and cellular distributed on the eutectic substrate. Most of the dispersed, ultrafine ZrC particles are uniformly distributed within dendritic and interdendritic regions owing to the trapping effect of the advanced solid-liquid interface. The martensite transformation is observed after the rapid cooling processes also. The microstructural characteristics of the interface between the coating and the substrate are martensite transformation which shows that there is good metallurgical bonding. With the overlapping scanning speed increases, the orientation of the dendrite becomes to bulge, the quantities of the martensite transformation increase, the sizes and the quantities of ZrC particles become larger and more.

Key words laser overlapping cladding; in situ; hypoeutectic; martensite transformation

Analysis of Microstructure in the Interface of Diffusion Welding for Fe₃

Al/Q235 Dissimilar materials LI Ya-jiang (National Key Laboratory of Advanced Welding Production Technology, Harbin Institute of Technology, Harbin 150001; School of Materials Science and Engineering, Shandong University, Jinan 250061, China), WANG Juan, YIN Yan-sheng, WU Hui-qiang, FENG Ji-cai. p25 ~ 28

Abstract Phase structure characteristics nearby the interface of Fe₃Al/Q235 diffusion welding are researched by X-ray diffraction (XRD) and transmission electronic microscope (TEM), etc. The test results indicated that obviously diffusion transition zone forms nearby the interface of Fe₃Al/Q235 under the condition of heating temperature 1 050 ~ 1 080 °C, holding time 60 min and pressure 9.8 MPa, which indicated that the diffusion interface of Fe₃Al/Q235 was combined well. The diffusion transition zone consists of Fe₃Al and α-Fe(AD) solid solution. Microhardness in the diffusion transition zone nearby is HM 480 ~ 540. There is not brittle phase of high hardness in the interface transition zone. This is favorable to enhance toughness of Fe₃Al/Q235 diffusion welded joint.

There is crystal orient relation of (110)_{Fe₃Al}//(011)_{α-Fe(AD)} and [001]_{α-Fe(AD)}//[100]_{Fe₃Al} between Fe₃Al phase and α-Fe(AD) solid solution in the diffusion transition zone.

Key words Fe₃Al intermetallic compound; diffusion welding; interface; phase structure

Brazing of Single Layer Cubic Boron Nitride Wheel with AgCuTi Alloy Under Vacuum Atmosphere

XIAO Bing (Department of Mechanical Engineering, Nanjing University of Aeronautics & Astronautics, Nanjing 210016, China), XU Hong-jun, WU Zhi-bin, YAO Zheng-jun. p29 ~ 32

Abstract In order to develop new generation monolayer brazing CBN (cubic boron nitride) grinding wheels, two types of active filler alloys (Ni-Cr and Ag-Cu-Ti) were tested in vacuum furnace. The results show that a Ni-Cr alloy fails to wet and bond CBN grits, while a Ag-Cu-Ti alloy exhibits good wetting and bonding towards CBN grits. SEM-EDS microanalyses have shown that during brazing Ti in Ag-Cu-Ti alloy segregated preferentially to the surface of the CBN to form a Ti-rich reaction product. X-ray diffraction reveals that the wetting and bonding behaviour on CBN surface by Ag-Cu-Ti alloy melt are realized through TiN and TiB which are produced by interaction between Ti atoms of Ag-Cu-Ti alloy and N or B atoms of CBN surface at elevated temperatures. The rupture occurs in Ag-Cu-Ti alloy layer. It can be considered that chemical metallurgical bonding has formed in the interface between CBN grits and Ag-Cu-Ti alloy. Finally a monolayer brazing CBN grinding wheel with regular abrasive distribution was put forward to try a grinding test. The experimental results show distinct advantages over conventional electroplated CBN grinding wheel.

Key words grinding wheel; monolayer; brazing; cubic boron nitride; chemical and metallurgical bonding

Effect of Mesh Sizes on Welding Deformation Prediction Precision of Buick's Underframe Assembly

CHEN Jun-mei (Shanghai Jiaotong University, Shanghai 200030, China), LU Hao, WANG Jian-hua, CHEN Wei-xin, HAO Da-jun. p33 ~ 35, 39

Abstract: In welding process the structure undergoes a locally high temperature cycle. The thermal expansion of the welds and nearby areas is restricted by the constraint of surrounding metals where the temperature is rather low. The compressive plastic strains in the welds and nearby area will be caused and remained at room temperature after welding. The residual plastic strain, also named inherent strain, is considered as a source causing the welding stresses and deformations. Welding deformation of underframe is one of main factors determining the car's quality. Residual plastic strain method is applied to the welding deformation prediction of the large structure-GM's Buick's chassis underframe beam assembly which is made of four bridges with 21 welds. Two kinds of mesh sizes are used in welding deformation analysis of the underframe. The results show that 15mm is permitted for meshes near the welds in the analysis. The analysis method and results can be used for the instruction of practical production of others cars.

Key words: underframe; welding deformation; residual plastic strain; finite element method

Design and Realization of Welding Expert System In Pressure Vessel

Lü Bo (Dalian University of Technology, Dalian 116024, China), YAO Wei-li, WANG Yan-zhang. p36-39

Abstract Based on the development of commercialized software, welding expert system in pressure vessel designing method of expert system is proposed in this paper. With the help of knowledge and experience from many experts, the method of knowledge classification and representation is researched, and system designing of dynamic knowledge base is discussed. Furthermore, storage and management mechanism are described.

Key words: expert system; knowledge representation; knowledge base

Study on Microstructures and Corrosion-wear Performance of Plasma Surfacing Alloy Deposits

SI Song-hua (Research Center for Laser Processing, Anhui Technological University, Anhui Ma'anshan 243002, China), HE Yi-zhu. p40-42

Abstract Microstructures, X-ray diffractions, hardness and wear-corrosion resistance of iron-based, nickel-based and nickel-based WC plasma surfacing alloy deposits on the 16Mn steel were tested. It was shown that the microstructures of alloy deposits were consisted of γ phase and some intermetallic compounds, for example $Fe_{23}(C, B)_6$, (Cr, Fe) $_7C_3$, Cr $_7C_3$, NiB and WC etc. Nickel-based WC alloy overlay deposits had the highest hardness and wear-corrosion resistance. The wear resistance of alloy overlay deposits in (pH6) acid and NaOH (pH8) liquor media were the lower than that in the neutral water, especially in HC1 acid liquor.

Key words: plasma surfacing; alloy deposit; microstructure; corrosion-wear

Study on Development Process of Welding Materials Based on Concurrent Engineering

LEI Yu-cheng (Jiangsu University, Jiangsu Zhenjiang 212013, China), CHENG Xiao-nong, DAI Qi-xun, XING Yin-ing. p43-46

Abstract Concurrent engineering is a systematic work pattern in which products are developed integrately and cooperately. It stresses the process integration based on the information, instead of conventional serial working mode. In this paper, on the idea of concurrent engineering and the development of welding consumables, a model of concurrent development of welding consumables is established and the supporting environment of concurrent development of welding consumables is presented. Results of initial application show that using the concurrent working mode can expedite process, shorten the cycle and decrease the cost of product development. Furthermore, it is established synthetic evaluation system to evaluate the design quality of development of welding consumables from all directions so as to better ensure the design quality of products.

Key words: concurrent engineering; welding consumables; product-development; quality evaluation

Mechanism of New Plasma Powder Surfacing for High Efficiency and High Quality

WANG Hong-ying (Shenzhen Polytechnic, Shenzhen 518055, China), CHEN Zhi-guo, ZHAO Kun, DONG Zu-jue. p47-50, 62

Abstract It is presented preliminary assessment of new plasma technology with both high deposition rate and low rate of dilution, which was developed under the calculation and analysis of compressive properties of plasma arc flame characteristics and kinematics behavior of powder in the arc. Compared with normal plasma surfacing method, the idea using constricting nozzle with small orifice diameter, long plasma arc and increasing the distance from meeting point of two beams of powder to workpiece, to achieve the goals of high deposition rate and low rate of dilution, was put forward here first time. In order to prove this idea a simple set of experimental system was built up and satisfied results including high deposition rate (more than 15 kg/h) and low rate of dilution (less than 1~5%) were obtained. The success of this study offer a promising prospect for developing the powder plasma hardfacing technology in China and may open a way to improve this technology further in efficiency and quality.

Key words: plasma arc flame characteristics; plasma surfacing; deposition rate; ratio of dilution

Study on Arc Force In Plasma Welding

DAI Da-shan (Dept. of Mechatronics Engineering, South China University of Technology, Guangzhou 510640, China), SONG Yong-lun, ZHANG Hui, ZHU Yifeng. p51-54

Abstract The axial force in plasma arc is measured under different welding conditions. The effects of the parameters such as welding current, plasma gas flow rate, electrode setback and nozzle height, on the force in plasma arc are investigated and quantitatively analyzed by significance test method. It reveals the relationship between the weld quality and the matching of parameters in plasma arc welding process. The necessary conditions to obtain stable keyhole plasma arc welding process are also discussed in this paper. This work may be as a useful tool for the understanding of the parameters matching and process optimization in plasma arc welding.

Key words: plasma arc welding; arc force; bead quality

Bonding Mechanism of Interface in Explosive Welding SHI Chang-gen (Engineering Institute of Engineering Corps PLAUST, Nanjing 210007, China), WANG Yao-hua, CAI Li-gen, KANG Li-xia. p55 ~ 58

Abstract: Although the interface has the features of melt, and pressure welding in the mean time, the seam and "hole" brought by the melt weaken the bonding strength of interface greatly, and the effect of melt on interface must be eliminated in explosive welding, so the conventional molten mechanism of explosive welding is negated. The diffusion welding is a kind of form of pressure welding, and the diffusion is not the reason of the bonding of interface but the result of interface high pressure. So the diffusion welding cannot also explain the bonding mechanism of explosive welding. The experiment and theory make it clearly that explosive welding is a special pressure one. In order to get good interface of no melt, explosive charge must be selected on the low limit of welding windows.

Key words: explosive welding; bonding interface; melt; diffusion; pressure welding

Investigation on Microstructure and Phase Structure in TIG Weld of a New Type of ZA Alloy for Mould Material LIU Xiu-zhong (College of Materials Science and Engineering, Shandong University, Jinan 250061, China), DU Hong-yan. p59 ~ 62

Abstract: Microstructure and phase structure of weld seam of a new type of ZA alloy for mould material, which was processed by TIG welding were investigated by optical microscopy and transmission electron microscopy (TEM). It was shown that after the ZA alloy was processed by TIG welding, the weld seam consists mainly of columnar dendrites and a small amount of equi-axial crystals; the microstructures at room temperature are composed of η (Zn) phase, α (Al) phase, β' (ZnCu) phase and compounds of Al_4Cu_9 , $CuTi_2$, $Al_7Cu_3Mg_6$. The microstructure of the weld seam is fine, some fine and thin lamellar η and α , fine dislocation and dislocation loops are found in it. After the new type of ZA alloy for mould material was processed by TIG welding, the fine microstructure of the weld seam and fine compounds in the weld seam intensify the material and improve the mechanical properties of the weld seam.

Key words: mould; ZA alloy; weld seam; microstructure

Effectiveness Criterion for the in Situ Evaluation of Vibratory Stress Relieving Process XU Yang (Xi'an University of Technology, Xi'an 710048, China), SUN Mao-cai, LI Qing-ben. p63 ~ 67

Abstract: The influence of structural and viscous damping on vibratory response was investigated during vibratory stress relieving process (VSR) of complicated components. The "几"-like dynamic curves obtained with continuous frequency scanning method during VSRP were also explained. It was shown that the structural changes of sympathetic vibration curves were dependent on comprehensive effectiveness of structural rigidity, structural and viscous damping of the components. Because it is the ultimate purpose to realize dimensional stability, decrease or homogenize residual stress by VSR, a new criterion is then put forward to evaluate effectiveness of a vibratory stress relieving process. According to

this criterion, the smooth of the scanning curves is an evaluation on the effectiveness of the results of VSR.

Key words: vibratory stress relief; residual stress; damping; structural rigidity; dynamics curve

Study on Commutating Process and Its Control of Variable Polarity Square Waveform Power Source LI Zhong-you (Shandong University, Jinan 250061, China), LIU Xiu-zhong, CHEN Mao-ai, ZHANG Guang-xian. p68 ~ 71

Abstract: First of all, the characteristics of commutating process in secondary inversion of variable polarity square waveform power source are analyzed in this paper, the switched voltage is lower and the current is higher than those are in first inversion. The flywheel effect of the welding bob plays an important rule in the commutating process, it can provide suitable time for reverse driving switch elements, or promote arc striking induced voltage. The objective case is shown that the reverse driving delay time t_D isn't equal to arc current interrupted time t_D (i. e. arc extinguishing time). Two kinds of the polarity exchanged methods, i. e. $t_d > 0$ and $t_d < 0$, are induced, the mechanisms on their commutating processes are discussed further and corresponding control strategies are proposed, then the realized methods and the experimental results are given. Finally, distinguishing features of the two kinds of control methods and their suitable current limits are noted. From this, the commutating theory of square waveform power source is developed and it makes further foundation for improving operation performance and reliability of the source and for its reasonable design.

Key words: variable polarity square waveform; commutating; control

Study on Digital Trigger of Silicon Controlled Rectifier Welder Based on Digital Signal Process HUA Xue-ming (Shanghai Jiaotong University, Shanghai 200030, China), WU Yi-xiong, JIAO Fu-jie, ZHANG Yong, LI Zhu-guo, YU Qian-bo. p72 ~ 74, 91

Abstract: This paper analyzes that temperature variation affects unijunction transistor phase shift trigger circuit of silicon controlled rectifier (SCR) welder by PROTEL99-SIM simulation software. And the results show that temperature-drift of the unijunction transistor deeply affects the phase shift time, thus affects the stability of welder's outputs. On the other hand, digital welding machine now becomes more and more popular, which demands welder's digital trigger. The study is based on the digital signal process (DSPs), taken use of the software to produce trigger in order to control the main circuit of welding machine. The study shows that the trigger from DSP is credible and the software is comparatively simple. All of these make complex shift trigger circuit into software program. It brings welding machine into true digital control age.

Key words: digital signal process chip; silicon controlled rectifier welder; digital trigger

Research on the Creep Damage and Interfacial Failure of Dissimilar Metal Welded Joint Between Martensite and Pearlite Steel

ZHANG Jian-qiang (Tsinghua University, Beijing 100084, China),

WU Su, ZHAO Hai-yan, WANG Yu, LU An-li, ZHANG Ying-lin, PENG Xiankuan. p75~79

Abstract In this article, the mechanical properties, creep damage, creep rupture strength and features of interfacial failures of welded joints between martensite (SA213191) and pearlite steel (12Cr1MoV) have been investigated by means of argon tungsten pulsed arc welding, high temperature accelerated simulation, creep rupture, mechanical property tests and scanning electronic microscopy (SEM). The research results indicate that the interface between weld and 12Cr1MoV steel is the weakest part of welded joint. However, the interfacial failure tendency of low match welded joint is less than those of medium and high match welded joint. Therefore, it is reasonable that the low match welding material is used as the filler metal of weld between SA21T91 and 12Cr1MoV steel.

Key words: dissimilar metal welded joint; creep damage; interfacial failure

Isolation Effectiveness of Composite Isolation and Its Application in Diffusion Bonding

HE Peng (Harbin Institute of Technology, Harbin 150001, China), QIAN Yi-yu, FENG Ji-cai, MAI Han-hui, LIU Shi-zhou, JIA Jin-guo. p80~82, 88

Abstract Aiming to diffusion bond intermetallic TiAl turbine to steel 40Cr axis, composite isolation diffusion bonding technology was propounded. The isolation effectiveness of the diffusion bonding technology with composite isolation layer was investigated, and the principles of the selecting atomic radius and atomic electronegativity for the layer were found by virtue of the diffusion-bondability of materials. In this paper, according to isolation effectiveness principle, intermetallic TiAl and steel 40Cr are diffusion bonded successfully by using a composite isolation layer Ti/V/Cu. In this case, layers of infinite solid solutions can be found at the V/Cu and Cu/40Cr interfaces which are favorable to the bonding strength, and a diphasic $Ti_3Al + TiAl$ layer and a Ti solid solution which enhance the strength of the joint are obtained at the TiAlVTi interface. The interface of Ti/V/Cu/40Cr was free from TiC, $Ti_3Al + FeAl$, $FeAl_2$ intermetallic compounds and other brittle phases, and the strength of the joint was as high as 420 MPa. Isolation effectiveness principle is effective to the selecting of composite isolation layer.

Key words: isolation effectiveness principle; intermetallic TiAl; diffusion bonding

Hydrogen Induced Martensite Transformation In Weld of Austenitic Stainless Steels

PAN Chuan (Central Iron & steel research Institute, Advanced Technology & Materials Co. Ltd., Beijing 100081, China), LI Zheng-bang, TIAN Zhi-ling, HANG Dong-tu, QL40 Li-jia, CHU Wuyang. p83~88

Abstract X-ray diffraction (XRD) techniques were applied to investigate hydrogen induced martensite and transformation in weld metals of stainless steels during cathodic hydrogen charging and subsequent aging. The results indicate that hydrogen charging can induce austenite lattice

expansion in weld metal of stainless steel corresponding to about 2.7% (308L) and 2.9% (347L) respectively, greater than about 1.2% (304L) in lattice parameter. The transformation from the fcc γ phase to the hcp ϵ phase occurred during cathodic charging. During aging transformation to bcc α' phase from the hcp ϵ phase, however, was incomplete and some ϵ was retained. Martensite transformation followed the sequence $\gamma \rightarrow \epsilon \rightarrow \alpha'$. During cathodic hydrogen charging and subsequent aging, the volume fraction $\epsilon + \alpha'$ remained essentially constant. Even if after long time aging, ϵ and α' martensite did not disappear.

Key words: austenitic stainless steel; weld metal; hydrogen-induced martensite transformation; X-ray diffraction

Spectral Characteristics of High Current Hollow Cathode Vacuum Arc

GUO He-ping (National Key laboratory of Advanced Welding Production Technology, Harbin Institute Technology, Harbin 150001, China), QIAN Yi-yu, FANG Hong-yuan, GUO De-lun, WU Xi-meng. p89~91

Abstract On the condition of 100 A welding current the frequency of optical emission from argon plasma in a hollow cathode has been recorded as 200~1000 nm with water-cooled copper anode. Spatial distribution (along the arc length) of hollow cathode vacuum arc spectrum is also given. The observed spectra shows that strong Ar I and Ar II lines are superimposed on a weak continuum. Large amounts of Ar II spectral lines appear in the region of 350~510 nm, which results in a blue hollow cathode vacuum arc. All the results indicate that the spectral line can be used to analyze the mass and energy transfer in hollow cathode vacuum arc welding plasma arc.

Key words: hollow cathode; vacuum arc welding; spectral characteristics

Finite Element Method Analysis on Welding Residual Stresses of Large Electromotor Rotor

REN Wei-jia (The Department of Mechanical Engineering, Tsinghua University, Beijing 100084, China), WU Ai-ping, ZHAO Hai-yan, ZOU Gui-sheng. p92~96

Abstract Using axisymmetric finite elements model, this study aims to investigate the distributions of the welding residual stresses in a large scale electromotor rotor and the effects of welding procedures such as welding simultaneously at both sides, shrinkage fitting, preheating, welding sequence for multipass welds, etc. The results indicate that high tension stresses in three directions were found in weld bead and its surrounding area; welding simultaneously at both sides can reduce the radial residual stress; heat fitting can reduce the residual stresses in three directions; preheating can reduce the tangential residual stress; the radial residual stress in multipass welds was determined mainly by the last layer, especially the last bead; welding the last beads of both sides simultaneously can reduce the radial residual stress, while it's not important whether the foregoing beads are welded simultaneously. These results are attractive for the knowledge and the control of the welding residual stresses in the large electromotor rotor.

Key words: rotor welding; finite element method; residual stresses