

To Subscribe and Advertise Are Welcome

TRANSACTIONS OF THE CHINA WELDING INSTITUTION (TCWI) was started in 1980. This periodical (Bimonthly) is sponsored by Chinese Mechanical Engineering Society. It is to be distributed both at home and abroad. It mainly reports the recent scientific and technological achievements on welding. Many of them belong to the frontier in the fields of learning. It basically reflects China welding level and possesses the academic authority in China welding field. This periodical was affirmed the first batch core periodical of China science. It has a large number of subscribers at home and has made an international reputation.

Our periodical will devote its services to the reading public. Cordially wish it to become your good teacher and helpful friend.
Distributed Abroad by: China International Book Trading Corporation P. O. Box 399, Beijing, China **Code:** BM 322

MAIN TOPICS, ABSTRACTS & KEY WORDS

Study on Real-Time Control of Welding Pool in Welding Flexible Manufacturing Cell ZHANG Yong (Department of Mechanical Engineering, Tsinghua University, Beijing 100084, China), CHEN Shan-ben, QIU Tao, WU Lin, ZHAO Dong-bin, p1~5

Abstract: Control system of weld quality in real time, which can ensure an excellent weld, is an important sub-system of welding flexible manufacturing cell (WFMC). A sub-system for weld quality control in real time and reliable communication between penetration control sub-system and the center computer of WFMC were investigated in this paper. Based on measurement of weld pools' characteristics parameters, artificial neural network models for topside and backside of welding pool were established. With the models, backside weld width could be deduced from topside parameters of welding pool in real time. A neuron self-learning proportional summational differential (PSD) controller was designed, which could control backside weld width through sensing topside parameters of welding pool and adjusting welding peak current during robotic pulsed GTA welding. Controlling experiments verified that the controllers were effective.

Key words: robotic welding; welding flexible manufacturing cell; pulsed gas tungsten arc welding; proportional summational differential control

Effects of Joining Temperature on Shear Stress in Brazing Fillet of TiC Ceramic/ Iron ZHANG Li-xia (National Key Laboratory of Advanced Welding Production Technology, Harbin Institute of Technology, Harbin 150001, China), FENG Ji-cai, LI Zhuo-ran, LIU Hui-je, p6~8

Abstract: By means of finite element numerical simulation, when using the Ni-based brazing filler metal, the shear stress distribution in the brazing fillet of TiC ceramic/ iron and the effects of joining temperature on the maximum value of the shear stress were researched. The result shows: the shear stress always centres on the brazing fillet tip of TiC ceramic/ iron; with the joining temperature increasing, the maximum value of the shear stress in the brazing fillet increases and the strength of the joint decreases.

Key words: finite element; numerical simulation; shear stress

Welding of Railway Rail and High Manganese Steel Frog II ZHAO Min-hai (National Key Laboratory of Advanced Welding Production Technology, Harbin Institute of Technology, Harbin 150001, China), GUO Mian-huan, DONG Wei-guo, DENG Bing-wei, p9~12

Abstract: Welding of high manganese steel and high carbon steel is difficult because there are so many different between these steels such as chemical, physical and mechanical properties respectively. The welding property of high manganese steel and high carbon steel was examined through the study in paper I and paper II. By the microstructure analysis, SEM analysis and energy spectrum analysis of welded joint, the welding method of high manganese steel and high carbon steel was determined. The method supplies particulate welding technology. It is studied in the paper II for welding the two kinds of steel directly or with intermediate layer between them. Then the best welding technology was worked out.

Key words: high manganese steel; high carbon steel; welding technology

Evaluation of Powder's Thermal Behavior in Plasma Transferred-Arc Space (I) — Study on Heat Transfer Between Powder Particle and Plasma WANG Xi-bao (The Centre of Surface Engineering Research, The College of Materials Science and Technology, Tianjin University, Tianjin 300072, China), JIA Feng-suo, WANG Xiao-feng, p13~16

Abstract: The heat transfer between powder particles and the argon plasma transferred-arc (PTA) fluid was theoretically analyzed and measured in this article based on heat conduction theories. It was found that the elevating velocity of particle's temperature in PTA plasma fluid mostly depend upon the plasma fluid's thermodynamics, particle's thermodynamics, mass density and particle's sizes. In the central plasma fluid with 100~200 A surfacing currents, not only the Fe-base particles with a relatively lower melting point but also the boron carbide (B₄C) particles with a relatively much higher melting point might be fully fused within milliseconds. However, the temperature elevation of Fe-base particles is about one time faster than that's of boron carbide (B₄C) particles.

Key words: powder; Fe-base alloy; B₄C; plasma transferred-arc; heat transfer

Visual Sensing and Real-Time Control of Weld Pool Dynamics in Pulsed GMAW CHEN Shan-ben (Shanghai Jiaotong University, Shanghai 200030, China), CAO Jian-ming, XU Chen-ming, WU Lin, p17~20

Abstract: This paper addresses the feasibility of visual sensing and real-time control of weld pool dynamics in pulsed GMAW. Because of the complexity of fuse dripping transition in pulsed GMAW, it is simulated for welder to observe welding pool changes and regulate weld parameter for control of weld seam figuration. The visual sensing system was established for monitoring welding pool variety. The fuse dripping transition influences on the weld pool size were considered as black-box process for simplifying complexity, and using arc spectrum distribution of pulsed GMAW and image processing for picking-up weld pool characters, the real-time detecting of weld pool dynamics in pulsed GMAW was realized. The model of weld pool dynamical process was presented in this paper by identification algorithm, and then the PID controller was designed for real-time control of weld bead width during pulsed GMAW. The experiments show that the real-time and precision requirements for detecting and control of weld pool changes and bead width of pulsed GMAW could be satisfied by developed image processing and control algorithm on the established systems.

Key words: pulsed gas metal arc welding; weld pool dynamics; visual sensing; real-time control

Mechanism of Hydrogen-Induced Delayed Crack in EBW of Titanium55 Alloy MENG Xin (Dept. of Material Science and Engineering, Dalian Railway Institute, Dalian 116028, China), CHEN Chun-huan, YAO Xi-ang-jun, SHI Chun-yuan, YANG De-xin, WANG Ya-jun. p21 ~ 23

Abstract: Titanium alloys are widely used in the military aerospace region. However, hydrogen-induced delayed cracks could occur in the weld of some titanium alloys in certain welding condition. And the mechanism concerning hydrogen-induced delayed crack is not clear. In this paper, the pre-cracked CT specimens of Ti55 charged with hydrogen were strained in tension and the effect of hydrogen content was studied on the threshold stress intensity factor K_{th} and the crack growth rate da/dt at a crack tip in EBW of Ti55 alloy. Meanwhile, the mechanism of hydrogen-induced delayed crack was analyzed. The results indicate that the solid solubility of hydrogen in Ti55 is about $79 \times 10^{-4}\%$. At hydrogen contents below $79 \times 10^{-4}\%$, K_{th} decreases with increasing hydrogen content, whereas da/dt increases as the hydrogen content increases. When hydrogen content gets to about $79 \times 10^{-4}\%$, K_{th} reaches the minimum and keeps an invariable value. The mechanism of hydrogen-induced delayed crack in EBW of Ti55 alloy is the diffusion of hydrogen up a stress gradient to form hydride TiH_2 which precipitates at the crack tip.

Key words: electron beam welding; compact tensile specimen; threshold stress intensity factor; crack growth rate; stress-induced diffusion

Numerical Simulation of Heat Transfer Based on PHOENICS During Stationary Plasma Arc Welding Process DONG Hong-gang (National Key Laboratory of Advanced Welding Production Technology, Harbin Institute of Technology, Harbin 150001, China), GAO Hong-ming, WU Lin. p24 ~ 26, 30

Abstract: In this paper, a two-dimensional steady numerical model is developed for the heat transfer in stationary plasma arc welding process. The model considers the radiant heat loss and the heat exchange between the workpiece surface and the ambience, and takes the Joule heat resulted

from the welding current flowing through the workpiece as the source term of the energy equation. Based on the developed model, the large commercial software PHOENICS is employed to simulate the temperature and current density distribution in the workpiece. Using the software, it's conveniently and highly active to operate the independent variables and the boundary conditions. The comparisons show that the simulated results agree well with the experimentally measured results.

Key words: stationary arc; plasma arc welding; heat transfer; numerical simulation

Analysis of Tribology Properties of DD3 and Ren95 at Friction Interface During Friction Welding DU Sui-geng (Northwestern Polytechnical University, Xi'an 710072, China), WANG Qing, FU Li. p27 ~ 30

Abstract: The friction coefficient is an important parameter of energy and tribology. The single crystal superalloy DD3 and powder metallurgy superalloy Ren95 are respectively the blade and disk material to make the blisk of aeroengine. In order to research the friction weldability, the mechanical parameters of friction weld zone are theoretically analysed, and the temperature of friction interface, friction torque and axial pressure during friction welding of DD3 and Ren95 are detected in real time using the computer detected and control system. The method of measuring the temperature is the semi-nature thermocouple method. The following formulations are regressed by mathematic statistics: the friction coefficient at the initial friction stage $f_1 = 1.768 p^{-0.465} (T - 273)^{0.005}$, the flow stress and equivalent friction coefficient at the quasi-steady stage $\sigma = 186.23 \exp \left(\frac{167.156}{T - 273} \right)$ and $f_2 = -9.293 + 0.016 T - 6.918 \times 10^{-6} T^2$. These results are the foundation of analyzing heat mechanism and numerical simulating the process of blisk friction welding.

Key words: blisk; friction welding; friction coefficient; flow stress

Development of TiC-VC Hardfacing Electrode with Non-Preheating and Wear Resistance Properties WANG Xin-hong (School of Materials Science and Engineering Shandong University, Jinan 250061, China), ZOU Zeng-da, SONG Shi-li, QU Shi-yao. p31 ~ 34

Abstract: In this paper, a new hardfacing electrode with high wear resistance and non-preheating properties was developed. The ferrotitanium (Fe-Ti), ferrovanadium (Fe-V), rutile and graphite were used as the coating of electrode. The effect of content of composites of coating on the wear resistance, resistance to cracking and microstructure of hardfacing layer was also studied by means of SEM, EDAX, abrasive wear test, welding technical and hardness test. The results show that TiC, VC particles, which depressively distributed in the matrix of lath martensite and retained austenite, were formed by arc metallurgy reaction. The hardness and wear resistance of deposited metal were increased with the increase of content of Fe-Ti, Fe-V and graphite. However, the slag detachability of slag became bad when the content of Fe-Ti beyond 18%, the hardness and wear resistance of deposited metal decreased as the content of graphite beyond 12%.

Key words: hardfacing electrode; non-preheating; resistance to cracking; TiC-VC; wear resistance

A Study on Zero-Voltage Switch Inverter with Current Mode Control for Arc Welding Inverter

XUE Jia-xiang (South China University of Technology, Guangzhou 510640, China), YU Wen-song, LUO Wei-hong. p35 ~ 36, 40

Abstract: A novel topological circuit with full bridge soft-switching is developed by adopting phase-shift chip UC3879 with current mode and phase-shift control. The output waveform characteristics of driving circuit, detecting over-current point and main circuit transformer have been researched by practical experiment. Furthermore based on designing of a large power inverter for arc welding the soft-switching conditions of leading and lagging legs have been analyzed. Following conclusions have been achieved by experiments. No matter what value of the duty is the primary current of power transformer keeps the maximum value when its primary voltage equals zero. In the midpoint voltage of leading leg transition, its soft-switching is easily realized because of the primary current of transformer keeping the maximum. Two pieces of IGBT of lagging leg also achieve soft-switching due to the magnetizing inductance participating in the transition of lagging leg.

Key words: current mode; zero-voltage soft-switching; arc welding inverter.

Investigation on New Technique of Adjusting Welding Residual Stresses in Butt Joint

YOU Min (Three Gorges University, Hubei Yichang 443002, China), ZHENG Xiao-ling. Hubei Yichang. p37 ~ 40

Abstract: The principles of the common techniques for adjusting or relieving of residual stress in welded joints are analyzed in the paper. The authors believe that if the technical measure to reduce the restrained contraction of weld during cooling is taken the extent of the residual stress could be adjusted effectively in actual joint under the condition of no phase transition in base metal taking place. The relation between the longitudinal and transverse residual stress based on the Hook's Law and the principle of volume keeping constant during metal deformation is established (i. e. the value of transverse residual stress may affect that of longitudinal residual stress) and the new explanation for the low temperature stress relieving method is given. The authors have suggested and investigated a new method to adjust and control the transverse residual stress in butt joint based on the viewpoint of reducing the friction between the welding platform and work piece. The results obtained from the experiments showed that both transverse and longitudinal residual stress in butt joint could be decreased evidently after the measure to reduce the friction resistance being taken for Q235 mild carbon steel butt joints with 8 mm thickness.

Key words: welding residual stress; principle; butt joint; new adjusting technique; self-weight restrain; Q235 mild carbon steel;

Microstructure of Brazed Joint of Bilayer Ceramic Composite and Steel

LIU Jun-hong (Shandong University, Jinan 250061, China), SUN Kang-ning, TAN Xun-yan, BIAN Shou-min. p41 ~ 43, 47

Abstract: Brazing bilayer ceramic composite fabricated by authors with steel in the air have been investigated. The ultrasonic microstructure of bilayer ceramic composite, the microstructure and pattern of the brazed joint and the composite of the characteristic points have been studied by ultrasonic micro-

scope, optical microscope, SEM and energy spectrum analysis etc. It is concluded that after brazing bilayer ceramic composite with steel the three interfaces of the form multiplayer composite structure have been jointed well, which gives a new method for brazing ceramic with metal.

Key words: ceramics; composite; interface structure; brazing in the air; microstructure

Investigation on Microstructural Characteristics and Properties of (1.2%Zr+40%WC)/FeSiBRE Layer Produced by Laser Cladding

ZHANG Qing-mao (The Center of Laser Processing, Department of Mechanical Engineering, Tsinghua University, Beijing 100084, China), HE Jiu-jiang, LIU Wen-jin, ZHONG Min-lin. p44 ~ 47

Abstract: Metal matrix composite layers reinforced by in situ WC particles were formed by laser cladding using pre-pasted (1.2%Zr+40%WC)/FeSiBRE alloy powder on the medium carbon steel substrate. The morphologies, microstructures, interface structure and the distribution of the WC particles in the clad layers were observed with optical microscope, scanning electron microscope with EDAX. The microstructure characteristics of metal matrix composites are the typical γ austenite dendrite distributed on the eutectic substrate. In situ WC particles can not only be trapped by the advanced solid/liquid interface and distribute within dendrites but also be pushed away by the interface into interdendritic regions together with the eutectics. The martensite transformation is observed after the rapid cooling processes also. There is good metallurgical bonding between the layer and substrate. The microhardness varies between 500 ~ 600 HV 0.2.

Key words: laser pre-coated cladding; in situ; hypoeutectic; microhardness

Large-Sized CTOD Test for Welded Joints of Offshore Petroleum Platform

YANG Xin-qi (School of Material Science and Engineering, Tianjin University, Tianjin 300072, China), WANG Dong-po, HUO Li-xing, ZHANG Yu-feng. p48 ~ 52

Abstract: The measuring and testing technique of large-sized crack tip opening displacement (CTOD) tests for welded joints used in the construction of offshore petroleum platform under low environmental temperature (-18°C) were performed in accordance with the BS 7448 standard (Part. 2, 1997). The CTOD tests on the weld metal and heat affected zone (HAZ) regions were conducted for the welded joints with a thickness of 2.5 in (63.5 mm) welded by SMAW and SAW technology respectively. The testing results and some technique problems during the test procedure were discussed in details. Except for two specimens of HAZ, it is shown that the CTOD values of all specimens meet the requirement of minimum CTOD 0.15 mm proposed by the Phillips. The experimental results provided the basis to estimate the effect of heat treatment procedures after welding on the welded joints with large-sized thickness.

Key words: large sized welded joint; crack tip opening displacement; measuring and testing

Analysis of Dynamic Fracture Toughness of Welded Joint with High

Loading Rate GONG Shui-li (Key Laboratory For High Energy Density Beam Processing Technology, Beijing Aeronautical Manufacturing

Technology Research Institute, Beijing 100024, China) ZHANG Jian-xun, p53 ~ 56

Abstract: In this paper, by means of the test method that combining the Hopkinson device of gas gun loading model with the measuring technique of Charpy V-notch specimen in gas gun device of split Hopkinson pressure bar, the dynamic toughness of welded joint and several factors affecting with high loading rate were studied. The results showed that the impact specimen has a special fracture appearance and the size of ductile fracture zone expressed the value of plastic deformation of crack. The value of parameters of fracture toughness of welded joint were affected seriously by some factors such as loading rate, matching strength and ambient humidity. The value of fracture toughness of heat-affected zone represented the dynamic toughness of welded joint.

Key words: welded joint; high loading rate; dynamic fracture toughness; affected factors

Design of Electric Eddy Sensor for Detecting Temperature of Back Side of Weld Pool LIAO Ping (Jiamusi University, Heilongjiang Jiamusi 154007, China), YANG Wen-jie, LI Fu-jin, p57 ~ 60

Abstract: According to the measure principle of electric eddy sensor, the basic principle of detecting weld pool temperature with the electric eddy sensor is studied. It is found by investigating on the welding that the relationship between the weld pool temperature and output voltage of the sensor is single valued. The electricity parameters and the structure parameters of the sensor are calculated theoretically, and an electric eddy sensor with a cooling system, which can solve the problem caused by the heat radiation, is designed. The sensor can detect true voltage signal about the changing temperature of the back side of weld pool when using the step traveling pulse TIG welding on mild steel. A new studying method for penetration control is proposed in this paper. The advantages of the sensor are that it doesn't adopt contact measure that can disturb the heat radiation and arc, it is strongly anti-jamming, its structure is simple and its cost is low.

Key words: electric eddy sensor; temperature of back side of weld pool; detection

Effects of Tilting Mirror Parameters on Powder Feeding Laser Cladding Processing ZHAO Hong-yun (Jilin Institute of Technology, Changchun 130012, China), FAN Wei-guang, LI Dong-qing, ZHANG Zhong-dian, ZHAO Yu, p61 ~ 63, 68

Abstract: The formation principle of laser cladding source and effect of tilting mirror parameter on the distribution of source energy are analyzed in theory, and the results show that: when the other conditions keep constant, the length of laser cladding source decreases with the add of number of laser prismatic face (m); and the higher rotation rate of tilting mirror (n), the more uniform distribution source will be gotten. The different specimens which had been gotten under different rotation rates were analyzed and measured about the microscopic structures, the sizes of laser cladding and the hardness of cladding layer, and the results show that: the microscopic structure varied with the change of rotation rate of tilting mirror in different area of cladding layer; the width and thickness are increased by the increase of rotation rate of tilting mirror; the hard-

ness of cladding layer is decreased slightly by the increase of rotation rate of tilting mirror.

Key words: tilting mirror parameter; laser cladding; powder feeding structure

Research on Technology of Detecting Welding Seam Based on Gauss Wavelet QU Wen-tai (College of Electrical Engineering, Zhejiang University, Hangzhou 310027, China), ZHU Jing, p64 ~ 68

Abstract: Based on the technology of edge detection by wavelet transform, a new method of detecting seam of welding pipe using Gauss wavelet is proposed. As Gauss wavelet has local characteristics on the time and frequency domain, it is suitably used to detect the local shape of a signal as welding seam. The paper mainly relates to the pretreatment of the seam image, the Gauss wavelet transform and its application on the detecting welding seam, and the correlation analysis on the ultimate results. The scale parameter has outstanding effects on the transform results. By the analysis and the simulation on computer, the method shows higher estimated precision and better capability of anti-disturb. In the other hand, its complication is not high. So it can be used into real-time control system.

Key words: Gauss wavelet; edge detection; welding seam; correlation analysis

Restraint Length and Out-of-Plane Restraint of T Joint Under Restrained Welding LIN Hai-rong (School of Civil Engineering, Shandong University, Jinan 250061, China), WEI Xing, FENG Wei-ming, p69 ~ 71, 76

Abstract: It can remove residual welding deformation effectively to use technology of restraint welding and reverse deformation. But it is very difficult to calculate values of restraint, restraint length and reverse deformation accurately, because of the complication of stress fields in welded structure. Study showed that angle deformation of T joint is changed along the welded seam length. In the case of a short welded seam, it is approximate constant. Under restraint welding, the material is plastic in the place of welded seam and nearness. But in the distance the material is elastic. By theory of elasto-plastic bend, this paper provides the model to calculate out-of-plane restraint to remove angle deformation in T joint. The values of the critical restraint length, limit restraint and reverse deformation have been calculated. The results of tests show that the calculation method is effective. The method can be generalized for the case of a long welded seam.

Key words: T joint; angle deformation; restraint; elasto-plastic bend theory

Role of CuS in Formation Nucleation of Acicular Ferrite YU Sheng-fu (Huazhong University of Science and Technology, Wuhan 430074, China), ZHANG Yuan-qin, LI Wei-wen, XIE Ming-li, WANG Chang-hong, p72 ~ 76

Abstract: The physical simulation test method for researching on the role of inclusions in formation nucleation of acicular ferrite was designed and the roles of CuS, Al_2O_3 and $Al_2O_3 \cdot CuS$ in nucleation of acicular ferrite were studied. The metallurgical microstructures of the micro-zone adjacent to the inclusions were observed with digital metallurgical microscope and

the chemical compositions of the micro-zone adjacent to the inclusions were analysed with electron probe microanalyzer. The results show that CuS and $\text{Al}_2\text{O}_3 \cdot \text{CuS}$ can make depleted Mn zones be formed in the metal micro-zone adjacent to the inclusions formed. CuS and $\text{Al}_2\text{O}_3 \cdot \text{CuS}$ have an ability to induce the nucleation of acicular ferrite; Al_2O_3 can not make the chemical composition of the metal micro-zone adjacent to the inclusions change and depleted Mn zones can not be formed, and Al_2O_3 is not potent in nucleating acicular ferrite during thermal cycle. The CuS on inclusion surface plays an important role on the nucleation and growth of acicular ferrite.

Key words inclusion; acicular ferrite; physical simulation; CuS

Study of Effect of Ions Bombardment on Al Coating Beryllium Substrate

LI Rui-wen (China Academy of Engineering Physics, Sichuan Mianyang 919 # 621900, China) ZOU Jue-sheng, XIAN Xiao-bin, p77 ~ 80

Abstract Magnetron sputtering ion plating has been used to make aluminium coating on beryllium substrate. Effect of ions bombardment on morphology, crystallographic orientation and interface layer were studied. The results show that during initial stages of plating, energetic ions bombardment and circle bombardment-plating can increase the width of interface layer consisting of Be and Al atom. Al coating grows largely in (111) crystallographic orientation and the grain size is much larger when ions bombardment is none; Al coating begins to grow in crystallographic randomness and the grain size decreases with ions energy increasing, if ions energy is up to a certain value Al coating grows again largely in (111) crystallographic orientation and grain size increases again with ions energy increasing.

Key words ions bombardment; beryllium; interface layer; Al coating; microstructure

Emulation Study About CO_2 Arc Welding Transition

FAN Wei (Jiamusi University, Heilongjiang Jiamusi 154007, China), p81 ~ 83, 96

Abstract In this paper, CO_2 arc welding transition is studied deeply and the parameters are analysed quantitatively. The mathematical models of welding source and arc length are simplified and the relative function of inductance and arc is determined by welding-wire diameter and feed-in velocity. The relation of inductance and short-circuit current is approached to the mathematical model of multizone function. A practical mathematical model is deduced by numerical value imitation, the suitable simplification is done and boundary condition is defined. The model is translated computer software by computer high language. The change of output waveform can be observed by simulated oscillograph. The results of emulation and practice are very close.

Key words computer emulation; CO_2 arc welding; numerical value imitation

Advances in TiAl Intermetallics and Its Joining Technology (I) —

Advances in TiAl Intermetallics HE Peng (National Key Laboratory

of Advanced Welding Production Technology, Harbin Institute of Technology, Harbin 150001, China), FENG Ji-cai, HAN Jie-cai, QIAN Yi-yu, p84 ~ 86

Abstract In recent years, considerable interest has developed in TiAl intermetallics because of unique properties such as low density, good stiffness, high elevated-temperature strength, and excellent oxidation resistance. TiAl intermetallics has been considered as ideal new high temperature structure materials with potential applications in spacecraft and aircraft for both military and civil purposes. The research status of TiAl intermetallics in the world is introduced. It is necessary to research on the joining technology of TiAl intermetallics for its application. Solid-state bonding is very effective treatment for the joining of TiAl intermetallics. The research status of the joining technology of TiAl intermetallics is reviewed with emphasis on the solid-state bonding technology status. Topics need further investigation are also pointed out.

Key words TiAl intermetallics; solid-state bonding; self-propagation high-temperature synthesis reaction welding

Development of Research on Rapid Propagation and Arrest of Cracks in Polyethylene Pressurized Pipelines

LIU Hou-jun (College of Material Science and Engineering, Tianjin University, Tianjin 300072, China), ZHANG Yu-feng HUO Li-xing, p87 ~ 90

Abstract There are many instances where fluid pressure acting on the structure caused the structure to cracking and the cracks could be propagated rapidly or arrested, which is regarded as the most advanced research field in dynamic fracture. The information and development which are related to polyethylene pipes estimation methods of resistance to crack propagation are described, including the principle and apparatus of test. Several dynamic analysis issues relating to rapid propagation and arrest in gas pipelines are presented in this paper. Some developments have been implemented into this finite element code to simulate the behavior of the fractured pipes. For the calculation of crack driving force the numerical approaches using the nodal force release and energy balance methods are described.

Key words rapid crack propagation; plastic pipe; critical pressure; arrest

Progress of Heat Transfer and Fluid Flow Simulation in the Weld Pool

LI Qiang (Institute of Metal Research, Chinese Academy of Science, Shenyang 110016, China), QIAN Bai-nian, LI Dian-zhong, p91 ~ 96

Abstract Heat transfer and fluid flow simulations in the weld pool are an important aspect in welding simulation. At present most of heat transfer and fluid flow model in the weld pool were mainly based on the Navier-Stokes equation. In this paper, some progress attained in recent years on heat transfer and fluid flow in weld pool was summarized, then generalized the factors that influenced heat transfer and fluid flow greatly. Finally, the developing direction of heat transfer and fluid flow simulation in weld pool is presented.

Key words simulation; weld pool; fluid flow; heat transfer