REVIEW OF EXPERIMENTAL ANALYSIS OF WELDING BEHAVIOUR ON DISSIMILAR METALS AND THEIR TESTING METHODS

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Abstract-— Efficient welding of dissimilar materials imposed a major obstruction due to the non-uniformity in thermal mechanical and chemical properties of the materials to be welded under common welding conditions. Microstructures of the welded materials may be affected by welding parameters like change in materials, weld current, weld angle, weld position, hold time and other parameters which cause a sudden change of the thermal, mechanical and chemical properties along the weld. Different defects come up in dissimilar materials welding like surface defects, residual stresses during welding causing stress concentrated on one side of the weld, tensile and compressive thermal stresses, corrosion cracking, etc. The current research includes experimental investigation for the welding of dissimilar materials with different parameters (i.e. materials, weld current, hold time and weld position) to improve microstructure and thermal, mechanical and chemical properties of welded joints. Non destructive testing and Scanning Electron Microscopy (SEM) will be carried out for the analysis of the welded materials and their microstructures.

Keywords—dissimilar materials, microstructures, welding parameters, residual stresses, scnning electron microscopy;

I. INTRODUCTION

In manufacturing industry welding of dissimilar metals typically plays an important role. Applications of welding dissimilar metals and alloys are wide found in automobile machinery, pressure vessels etc. The chemical compositions of the metals create their dissimilarities of the metals. notably weldability and alternative mechanical properties are much affected by the chemical composition of the dissimilar steel alloys. During the manufacturing of structural steels some parts are particularly added to enhance the properties, however some inevitable parts could also be gift,added from the scrap materials throughout the production of steel. Individual dissimilar metals properties vary with different alloy dissimilar metals, due to the variation of the alloying parts. Hence welding of dissimilar metals might totally compose different properties of the metals. In order to improve the performance with minimum cost an appropriate welding procedure is to be identified.

The project is to investigate welding behaviour of dissimilar materials. The different properties which plays a crucial role in their weld ability are to be optimize. Particularly affected are their thermal mechanical and chemical properties, welding parameters like . materials, weld current, hold time and weld position and ect.

The identify the dissimilar materials to be welded in help of thermal mechanical and chemical properties of the materials to be welded under common welding conditions. the different dissimilar materials using suitable welding parameters and welding techniques.

the dissimilar welded joints is done by using Non Destructive testing (NDT) for checking the defects and analyse them. and the behaviours of welded materials with respect to stresses and their strength using destructive testing methods. To make the welding of dissimilar materials cost effective. To check the microstructures of welded materials using the SEM.

Than making the Welding Procedure Specification (WPS). It is most important documents in regards to welding is the WPS (Welding Procedure Specification) and many people working with WPS look at them like they are just an issue, or something that only the engineers and quality control technicians.

A WPS is supported by a Procedure Qualification Record (PQR or WPQR). A PQR is a record of a test weld performed and tested (more rigorously) to ensure that the procedure will produce a good weld.

II. LITERATURE REVIEW

Radha Raman, Visnu Kumar Tiwari et al. and Rajesha stainless steel of grades 202, 304, 310 and 316 were welded with mild steel by TIG and MIG welding processes.calculated the tensile strength of dissimilar metal joints was investigated. TIG is more suitable then mig. TIG welding process provides better strength.

Tayyab Islam et al. [2] Analysis of Dissimilar Metal Welding of 1020 Mild Steel and 304 Stainless SteelTaking 302 stainless-steel because the filler metal. the weldedjoint to fret corrosion cracking are studied. A302 steel is replaced by Inconel 625 the developed peak stress falls by15-30% stress corrosion cracking ar reduced by 17%.

Farzeen Shahid, Abid Ali Khan & M.Saqib Hameed .[3] MECHANICAL AND MICROSTUCTURAL ANALYSIS OF DISSIMILAR METAL WELDS. Work done on mechanical characterization, microstructure properties of welded joints. The mechanical properties of the weld is very important dissimilar metal weld Improve the strength of the dissimilar metals weld intermediate layers at the interface is used.

Rutash Mittala et al.[4] METALLURGI-CAL ASPECTS OF DISSIMILAR METAL WELDMENTS. Discuss metallurgical variations along the Weldment Microstructural and mechanical properties change in the dissimilar weldments studied. Paper provides a dissimilar metal weldments, mechanical and physical joint properties, microchemistry and property variation across the dissimilar weldments.

K. Kalaiselvan et al.[5] Comparative Studies on Dissimilar Metals thin Sheets Using Laser Beam Welding . laser beam welding of dissimilar materials focusing on aluminum to other materials has been studied. There were large differences in melting point between the sheets of Ti and Al welding. There was a vicinity at intervals the lower freezing point sheet that had melted however not mixed with the most weld pool.

M. Bala Chennaiah et al.[6] Influence of Heat Input and PWHT on the Microstructure and Mechanical Properties in Dissimilar (IS2062-EN8) Welded joints. Dissimilar metal joints of Mild steel and EN8 are arrange by using a MIG welding process. Tensile strength, impact, hardness was tested and Microstructure was check . Then the result is heat input should be approved when welding joints Similar and Dissimilar (IS 2062&EN8) joints using MIG process. That besides giving good tensile strength, impact strength, hardness.

T. Ramkumar et al.[7] Studies on the structural property, mechanical relationships and corrosion behaviour of Inconel 718 and SS 316L dissimilar joints by TIG welding without using activated flux . the successful connection of SS 316L similar, Inconel 718 Similar and SS316L & Inconel 718 dissimilar weldmentsusing TIG welding . There was no solidification or HAZ liquid cracking during the multi-pass welding of these joints. Laves section was completely controlled in the weld zone , Tensile studies disclosed the weldments were better to that of the parent metals.

Praveen Kumar Yadav et al.[8] Analysis of heat affected zone of mild steel specimen developed due to MIG welding. the mechanical properties mild steel (0.134% carbon) was selected as a specimen having thickness 5, 8,16mm were prepared for experiment. Specimens were welded in the range of 20-24 Volt, 130-150Amp and test pieces out of theses for test of tension, impact and hardness and micro structure have been extracted. there is increase in penetration and there is slight increase in HAZ hardness with respect to increase In Current.

Ravindra V. Taiwade et al.[9] This paper a systematic comparison of effect of single, double and triple pass welding on heat affected zone and tensile strength of AISI 304 stainless steel and chrome-manganese austenitic stainless steel. the passes of welding AISI 304 SS did not show any significant carbide precipitation and grain coarsening. the severity of carbide attack was more in Cr–Mn ASS, although the width of sensitized region was less as compared to AISI 304 SS .and the minimumCr-concentration value at grain boundary attributed to detrimental attack of IGC in HAZ in case of Cr–Mn ASSafter third pass of welding.

RD Ramdan et al.[10] Metallurgy and mechanical properties variation with heat input,during dissimilar metal welding between stainless andn carbon steel, in the present research, voltage, current and the welding speed has been varied in order to observe the effect of heat input on the metallurgical and mechanical aspect of both welded metals. Welding was conducted by Gas Metal Arc Welding (GMAW) on stainless and carbon steel with filler metal of ER 309. Than the present resulted, these structure both HAZ of carbon steel and stainless steel show higher hardness than their based metals. the HAZ of stainless steel is more difficult than martensitic transformation in the HAZ of carbon steel.

Cheng Ma et al.[11] Microstructure of the heat affected zone of a 308L-316L stain-less steel weld joint and its corrosion behavior in high temperaturewater were studied, The higher level of the residualstrain in the root area of the HAZ is in correspondence with ahigher density of dislocations having a tangled structure. And also the 316L SS shows a lower corrosionresistance in high temperature water than the top and middleareas of the HAZ.

Wei Wang et al.[12] Failure analysis of dissimilar steel welded joints in a 3033t/h USC boiler, The cracking is along the circumferential direction of tube, initiated in the CGHAZ and terminated at the FGHAZ of the outer wall. And also The high hardness and unstable microstructure in the HAZ are responsible for the cracking failure.

P. Mithilesh et al.[13] the investigates the weldability, metallurgical and mechanical properties of the dissimilar joints of Inconel 625 and AISI 304. Dissimilar joints were obtained by gas tungsten arc welding process employing ERNiCrMo-3. The conclude that weld microstructure was fully austenitic; Segregation effects have been witnessed at the interface of AISI 304, Hot cracking tendency was totally avoided on using Mo rich filler wire, and the result of tensile tests, the GTA weldments undergo ductile fracture with considerable amounts of plastic deformation.

Mohammed Al Hajri et al.[14] Dissimilar metal weld (DMW) joint between alloyed steel (AS) and stainless steel (SS) failed at one of intermediate temperature superheater (ITSH) tube in steam/power generation plant boiler, And Apart from physical examination, microstructural studies based on optical microscopy, SEM and EDX analysis were performed. EDX analysis show the precipitation of carbide at the weld/ metal interface which is a strong evidence of creep stage I process involvement and also Bending stresses and/or improper welding operation appears to play some role crack formation in the weld structure.

P.G. Ahire et al.[15] Genetic algorithm based optimization of the process parameters for manual Metal arc welding of dissimilar metal joint. The experimental result shows the optimum value of weld strength as 773.8Mpa and weld deposition rate as 2.1gms which can be controlled, according to demand by setting the input value by using GA . and also the manual metal arc welding parameters leads to improved application of the process in industries like pharmaceutical, chemical, dairies, and process industries

Anna Ericson Oberg , Erik Astrand [16] : Variation in welding procedure specification approach and its effect on productivity. The variation in chosen parameter values at each site as well as to identify any differences in weld result when welding

according to the pWPSs. The parameter variation between the sites and also a large variation in output from the same PWPS. This indicates a large potential for productivity improvements as well as the fact that an approved WPS does not guarantee high and even quality.

III. RESEARCH GAP

From the review of the published work related to the dissimilar materials welding for various materials approaches it is observed the thermal mechanical and chemical properties of the materials to be welded under common welding conditions. The study about properties and identify the right materials and process for welding. And the help of welding parameters like change in materials, weld current, weld angle, weld position, hold time and other parameters making the Welding Procedure Specification (WPS) documents. And it is supported by a Procedure Qualification Record (PQR or WPQR). A PQR is a record of a check weld performed and tested (more rigorously) to comfirm that the procedure will produce a good weld. The document amd record improve the weldability and welding quality.

IV. CONCLUSION

The following major conclusions are drawn from the review of dissimilar metal welding and their testing methods to reduce defects. And study about the how to material properties are behave the after welding. and the Techniques like Welding Procedure Specification (WPS) documents and Procedure Qualification Record (PQR) can help improve the welding quality and weldabilty.

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