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DISSIMILAR WELDING OF ALLOY STEEL AND STAINLESS STEEL BY USING VARIOUS PARAMETERS AND TO EVALUATE THE CRYOGENIC ENVIRONMENT

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Abstract - *The use of cryogenic treatment (CT) to improve mechanical properties of materials has been developed from the end of the Sixties. At the present time, the initial mistrust about CT has been cleared up and many papers about different materials reporting laboratory tests results, microstructural investigations and hypothesis on CT strengthening mechanisms have been published. In present scenario modernization of machine tools is on prime consideration that is an optimization of desired properties in machine tool parts means alternation of properties for that previously we employed heat treatment of steel, thus we have some improved properties but does not achieved correct solution for the problem. In modern age a new technology is comes on the front line, recognize by Acronyms C.T.P. or Cryogenic treatment of steel which has been done in cooling Atmosphere below Atmospheric tem. About – 1960C or- 3100F. During this temp. Range conversion of Austenite to marten site takes place. Thus we have got increased some desirable properties like reduced wear & Tear. Increased Hardness Micro- structure improved, Stress relieving properties also improved. In this paper alloy Steel and stainless stel is used for cryogenic treatment & study is performed regarding Micro- structure and Hardness, after Cryogenic treatment comparison is also made with un-treated test specimen.*

***Key Words*: Alloy steel, stainless steel, Cryogenic Treatment, Phase Transformation, Hardness, Micro-Structure**

1. INTRODUCTION

Welding is a manufacturing process of creating a permanent joint obtained by the fusion of the surface of the parts to be joined together, with or without the application of pressure and a filler material. The materials to be joined may be similar or dissimilar to each other. The heat required for the fusion of the material may be obtained by burning of gas or by an electric arc. The latter method is more extensively used because of greater welding speed. Advance welding techniques like Plasma Arc Welding, Laser Beam Welding, Electron Beam Welding, Electro-Magnetic Pulse welding, Ultrasonic Welding, etc. are now being extensively used in electronic and high precision industrial applications.

1.1 Dissimillar Welding

Joining of dissimilar metals has found its use extensively in power generation, electronic, nuclear reactors, petrochemical and chemical industries mainly to get tailor-made properties in a component and reduction in weight. However efficient welding of dissimilar metals has posed a major challenge due to difference in thermo mechanical and chemical properties of the materials to be joined under a common welding condition. This causes a steep gradient of the thermo-mechanical properties along the weld.

1.2 Welding Process

1) Welding processes that use heat alone i.e. Fusion welding.

2) Welding processes that use a combination of heat and pressure i.e. Forge Welding.

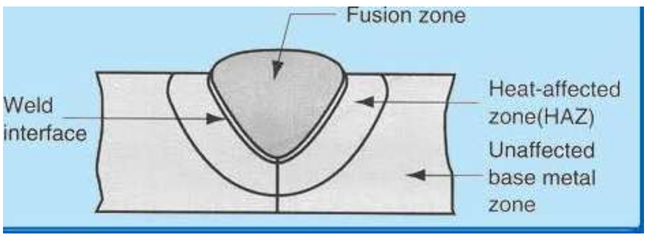

Figure 1 : welding process

2. MATERIALS

1) Alloy steel SS335 G12. 2) SS 316 stainless steel.

3. CRYOGENIC EQUIPMENT

Figure 2 : cryogenic equipment

In the cryogenic treatment, to optimize the metallurgical aspects by material to be treated under very cold low temperature for a predetermined period of time to obtain the metallurgical crystalline structure of the material to improve the hardness, strength, ductility, toughness, were resistance etc. and to reduction in residual stresses, which improves the stability during the machining. The cryogenic treatment consists of slow cooling of conventionally hardened steel samples to a prescribed temperature, soaking for certain duration, followed by slow heating back to the room temperature for subsequent tempering. It is already patented the rate of cooling for some steels by the investigators. The liquid nitrogen as generated from the Nitrogen plant is stored in storage vessels with the help of transfer line. It is directed to a closed vaccum evacuated chamber called Cryo Freezer through the Nozzles the supply of liquid nitrogen into the Cryo- Freezer is operated with the help of soleniod valves. Inside the chamber gradual cooling occurs at a predefined rate/ min from the room temp of -1960C. Once the Sub Zero temp is reached specimen are transferred to the Nitrogen Chamber where they are stored 24 Hours with continuous supply of Liquid Nitrogen. To fulfill the required purpose AISI-D2 specimen about (6mm Dia & Length 45mm) whose Cryo-treatment is being performed. A Ray Diagram is very helpful to get the proper sequence and procedure.

4. TESTING PROCESS

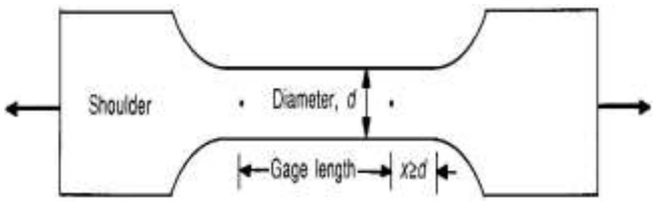

Figure 3: Tesing speciman

4.1 Hardness test Its is test to determine the resistance a material exhibits to permanent deformation by penetration of another harder material.

Figure 3: Hardness test machine

4.2 Impact test

Metals is performed to determine the impact resistance or toughness of materials by calculating the amount of energy absorbed during fractures. The impact test is performed @ various temperatures to uncover any effects on energy.

Figure 4: Impact test machine

4.3 Tensile test

It is a test of fundamental material science & Engineering test which a sample is subjected to a controlled tensile until failure. Its commonly used for obtaining the mechanical characteristics of materials.

Figure 5: Tensile test machine

5 . RESULTS & DISCUSSION

5.1 Hardness test

Identification	Impression(hardness value in HRB)
1	149,151

Table 1: Hardness result

5.2 Impact test

Identification	Impact values in joules
1	82

Table 2 : impact result

5.3 Tensile test

ID	Thickness (mm)	Width (mm)	CSA (mm2)	YL kN	YS N/mm2
1	6	30	180	52.5	374.54

Table 3: tensile result

TL KN	TS N/mm2	IGL Mm	FGL mm	%E
72.23	496.46	102.82	109.83	7.01

Table 4: tensile result

6. CONCLUSIONS

- Cryogenic can further change structure and properties of metals.
- Cryogenic can improve mechanical properties and reduce production costs.
- Cryogenic & practical testing have proven the process in many cases.
- Next steps in the cryogenic science shall include but not be limited to
- Understand phase changes down to 0ºK (absolute Zero).
- Determine the best processing parameters for each material) metallic and non-metallic).

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