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# Effect of Filler Rod on Microstructure and Mechanical Properties of Bimetallic Weld Joint

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**Abstract- Bimetallic weld joint is used in boiler reactor and pressurized water reactor design, where low carbon steel alloy components are welded to stainless steel piping system. There are various problems which need to be addressed while welding the bimetallic metals due to the variation in the properties of the base metal.The analysis confirms the well mixing of stainless steel and mild steel with filler rods inside the weld pool. The mechanical properties in terms of ultimate tensile strength found to be high as 467.54 N/mm2 with filler rod SS316L and micro hardness value at the center of the welded zone was found maximum (294 HV) with filler material SS316L, the fracture of the tensile test specimen were obtained outside the weld zone.**

**Keywords- Bimetallic, Filler Road, SS202, HAZ, stainless steel.**

## I. INTRODUCTION

The welding process can be carried out on the same or unequal metal. It is possible to weld metals of various kinds and chemical compositions together. The welding current, unlike welding current, holding time, welding force, etc., can be affected by the inclusion of various mechanical properties during the welding process and in two different metal microstructures. Metals have a remarkable chemical makeup.

Metal chemical composition may differ due to ageing, oxidation, and other circumstances. Since the welded structure can be positioned in potentially hazardous locations, research into welding's mechanical qualities is critical. There is a risk of intermetallic compound formation, which might have a negative impact on the weld quality. To combine various materials [1] under various conditions, welding is now widely employed in many sorts of industries. It is often considered as a part of design and innovation. [2] This type of stainless steel is ideal for gas metal arc welding (GMAW). A copper-covered wire with a consistent thickness is used in GMA welding as a joining method. MIG-welding has a number of advantages over traditional welding [2].

There are numerous industries that use hardened steel, such as the compound and petrochemical sectors as well as biomedicine and atomic reactors, because of its high elasticity [3, 4]. One of the welding-boundaries that affect the qualities of the welding connection as well as the shape and infiltration design in welding measurements is the protection of gas stream rate [5, 6].

During the welding process, it is beneficial to take precautionary measures to ensure that the welded junction will be strong, durable, and resistant to erosion [7]. Protecting the gas shields the liquid metal pool from any climatic defilement, as well as settling the bend and promoting uniform metal exchange in welding [8].

## II. RELATED WORK

**A. Joseph et al., (2005) [21],** Failure examination and writing examinations of dissemination welded joints have indicated that countless disappointments have happened in the warmth influenced zone (HAZ) locale of the consumed steel side of such unique welded joints. The leftover pressure presented in the welded joints is one of the principle parameter prompting disappointment of the welded joints. To encourage margarine to avoid or reduce the residual pressure disappointment of the entryway weld, this research reveals that Inconel-82 buttering layers for unique welded connections can be used.

According to **Changheui Jang et.al (2008),** Welds constructed from low composite steel, Inconel 82/182, and treated steel were examined. Welds made from protected metal circular segments were also investigated. An optical and electron magnifying lens was used to see the microstructure. The Inconel 82/182 weld has a distinctive dendritic pattern. The weld thickness and cross-strength of the welds were measured using standard and small size tests, as well as miniature hardness tests. Moreover, the example toward the finish of the break was taken to the base, center, and top of the weld and tried to survey the spatial variety in thickness. It was discovered that albeit the strength of the highest point of the weld was around 50-70 MPa, the break morsel at the highest point of the weld was about 70% higher than the lower part of the weld.

**John F. Harvey et al., (1969) and Dennis R. Greenery et al., (2004), [28-29],** Metallic joints bet$^{n}$ hardened steels

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& least carbon-steel are frequently dissected in high temperature applications of energy change frameworks. Financial considerations force steam power plants to operate with modest temperatures on the kettle's many components grounds that the essential heater cylinders and warmth exchangers are made of trivalent steel. In different segments, for example, super warmers and the last strides of repeaters working at high temperatures, for example, expanded downer force and oxidation obstruction, hardened steel treated steel is required. Along these lines, a progress weld is needed between the two pieces of the material.

**R. Chhibber et al., (2006) and R. L. Klueh et al., (82) [30-31],** a few examinations had being directed on carbon-steel welding & tempered steel since they may fall flat in bimetallic joints prior to arriving at their plan life. There is the greatest hazard zone in this joint at the interfacial location between the weld metal and carbon steel, according to studies by A. M. Clayton et al. (1983) and J. W. Elmer et al. (1982) [32-33]. Dissatisfaction in the austentic ferritic divergent compound welds disappointment.

According to M. Sireesha et al. (2002) and A.K. Bhaduri et al. (1999) [34-35], the joint's service life can be prolonged by reducing the cycle warm pressure by enhancement the coefficient of warm extension of the composition-portion. Using a filler material with a warm extension coefficient (CTE) between carbon steel and treated steel is one way to get there. Due to differences in warm development coefficients, these joints have been shown to induce significant warm anxiety during temperature changes [36].

**According to Mitchell et al. (1978) and Christoffel et al.** [37-38], carbon moves from high temperatures to low temperatures. As a result, carbon relocation bimetal weld junctions have failed.

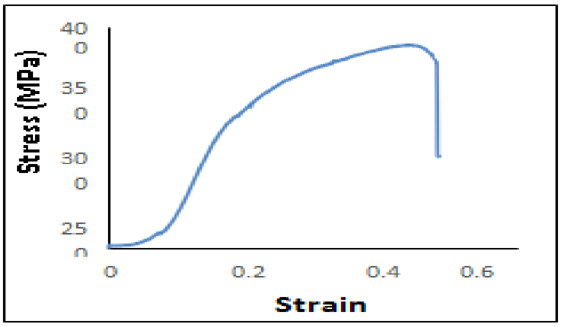
## III. SELECTION OF MATERIALS

To begin with, the most pressing issue was figuring out what kind of material we'd need to use to carry out the exercise. A mild steel plate (SS202) measuring 200x100x22mm has been selected, as given in fig 1.

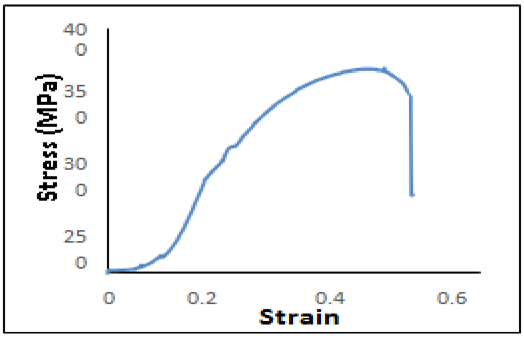

Fig 1. Stainless Steel 202.

**1. Tensile-test:**
The ASTM E8 standard dictated that a ductile test example be set up to test the elastic properties of the test sample at room temperature. For each scenario, three examples were tried and the average value was used.

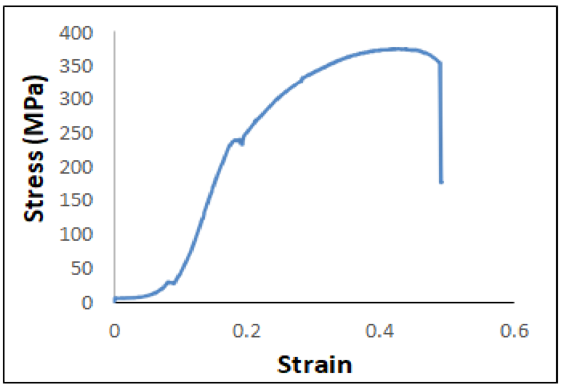
Welded samples filled with a mixture of mild steel and stainless steel-202 &S.S-316L have elastic pressure estimations exceeding 465MPa, It is a step forward from the original material. There are some welds that fail in the weld area, whereas others fail outside of the weld zone. Example 2 has a larger estimate of weldment pressure compared to the previous examples. Significant voids suggest a break may have happened in the area affected by heat (HAZ).




(a)




(b)




(c)

Fig 2. Stress-Strain diagram of Mild Steel, (a) Specimen-1, (b) Specimen-2, (c) Specimen-3.

## IV. CONCLUSION

TIG welding has been used to test the mechanical characteristics and microstructure of welding-joints between tempered-steel S.S-202 and mild-steel using various filling materials, including SS308L and SS316L.

Mechanical characteristics & micro-structured of welding joints between tempered steel S.S-202 & mild-steel using various filling materials, including SS308L and SS316L. Welding The SS202 welded joints' strength or stiffness is depending on the quality of the boundary and filling-material.

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