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Analysis of tensile strength on ST.37 material with SMAW welding variations of SAE 10 oil and water cooling

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Tensile test

ABSTRACT

In welding work must pay attention to the suitability of the welding construction in order to achieve optimal results. For this reason, welding needs to pay attention to several important things including welding efficiency, energy savings, and of course low costs. The purpose of this study was to determine how the tensile strength of the ST 37 material welded by SMAW welding which was cooled with a variety of cooling media, oil and pure water. The research method used in this research is to use real experimental research methods (True Experimental Research). From the results of the study, it can be concluded that the highest Ultimate Stress (Tu) tensile strength value is when the material is cooled with oil media, where the highest value is 365.15 N/mm2, followed by water cooling media oil, where the highest value is of 347.75 N/mm2, and the lowest is without cooling media where the highest value is 343.35 N/mm2. This is due to the thermal cycle that affects the microstructure of the material, this is what causes the tensile strength of the material to increase when a cooling medium is applied to the ST 37 welding material.

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1. INTRODUCTION

In welding work must pay attention to the suitability of the welding construction in order to achieve optimal results. For this reason, welding needs to pay attention to several important things including welding efficiency, energy savings, energy savings, and of course low costs. In the need for high quality welding such as joints in pressure vessels such as heat exchangers, pressure pipes and bridge construction, other steel structures, welding must be planned properly. In this study the welding method used is Shielded Metal Arc Welding (SMAW) this is very closely related to electric current, toughness, weld defects, and cracks which generally have a fatal effect on the safety of the welded construction, the authors make variations in cooling welding results with SAE 10 oil and water to strengthen the welds produced, in this study the authors cooled by dipping the welded samples into each cooling medium.

2. RESEARCH METHOD

The research method used in this research is to use real experimental research methods (True Experimental Research).

Research Variables There are two variables in this research, namely the independent variable and the dependent variable. The independent variable is the variable determined by the researcher before conducting the research. The independent variables in this study are:
1. Variation of water-cooling media, SAE 10 oil and without cooling.
2. Welding current 70 A.
3. The cooling time is 2 minutes, 1 second or immersion and without cooling media for comparison.

The dependent variable is a variable whose magnitude is related to the independent variable used. The dependent variables in this study are:

1. Mechanical properties (tensile stress strength)
2. Lap Joint.

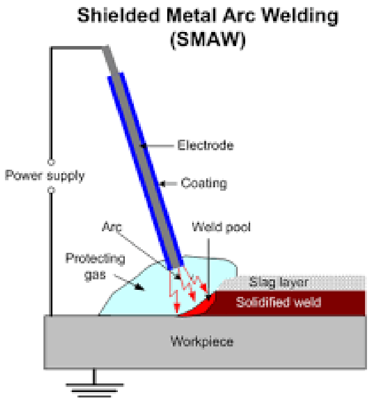

Figure 1. Shielded Metal Arc Welding

The appearance of the workpiece that has been welded is as shown in Figure 2 below,

Figure 2 workpiece after welding

The workpiece that has been welded is then shaped according to the shape of the specimen following the ASTM E8 standard as follows:

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Figure 3. Tensile test workpiece according to ASTM E8 standard

3. RESULTS AND ANALYSIS

The results of the test data were taken using the Tarnos test in accordance with the experimental design, the data is presented in table 3 below.

Table 3. Ultimate Tensile Strength Test Results (Tu) N/mm2

No	Treatment	**Strength Ultimate (Tu) N/mm^2**
1	Non-Treatment	330.55
2	Non-Treatment	325.9
3	Non-Treatment	335.15
4	Non-Treatment	343.35
5	Water	340.48
6	Water	339.23
7	Water	345.55
8	Water	347.75
9	Oil SAE 10	346.73
10	Oil SAE 10	352.19
11	Oil SAE 10	365.15
12	Oil SAE 10	355.3

From table 3 the results of the ultimate stress tensile strength test (tu) it can be presented a graph of the test results in Figure 3 below.

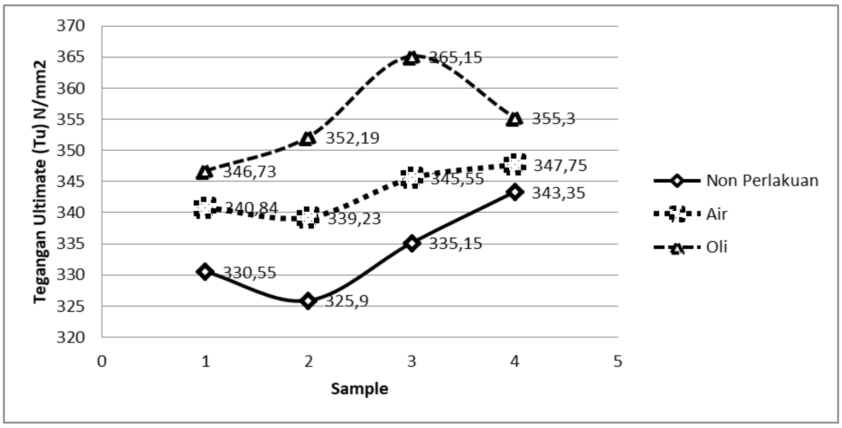

Figure 3. Graph of Ultimate Tensile Strength Stress (Tu) N/mm2

From Figure 3 the tensile strength test graph can be seen that there is a significant difference in the ultimate stress value (tu) N/mm2 in each type of treatment. Where the highest ultimate stress value was treated with cooling with SAE 10 oil on each weld sample, followed by cooling with water and the lowest ultimate stress was non-treated. This is because during the welding process, the ST 37 material will undergo a phase change that takes place. ST 37 welding material and the heat affected zone (HAZ) will undergo a thermal cycle, where the material is heated until it reaches the maximum temperature, followed by cooling. The thermal cycle will affect the microstructure of the weld material and the heat affected zone (HAZ), where the weld metal will undergo a series of phase transformations during the cooling process, this is what causes the tensile strength (tensile strength) to increase because in the tensile test the working load is axially opposite to the direction of the internal stress, so that with increasing hardness will increase the tensile strength of a material.

4. CONCLUSION

From the results of the study, it can be concluded that the highest Ultimate Stress (Tu) tensile strength value is when the material is cooled with oil media, where the highest value is 365.15 N/mm2, followed by water cooling media, where the highest value is of 347.75 N/mm2, and the lowest is without cooling media where the highest value is 343.35 N/mm2. This is due to the thermal cycle that affects the microstructure of the material, this is what causes the tensile strength of the material to increase when a cooling medium is applied to the ST 37 welding material.

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