
Calculation of Elongation in Media Use Backing Ceramic against Steel ASTM A36 by SMAW Process

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Abstract

Process Welding is usually done back and forth to get maximum results; of course, this will save time and increase costs. A medium backing ceramic is used to minimize the time a welder uses and the costs used. In the welding process, it will only partially get good results. Therefore, researchers will look for solutions to problems to maximize better welding. Therefore this research made to know the effect value of useBacking ceramic and not useBacking ceramic against ASTM A36 steel using SMAW welding using elongation calculations. Influence of media use backing ceramic on the strength of the tensile test on ASTM A36 steel using SMAW welding using elongation calculation is known that the highest elongation values were found in specimens that did not use Backing ceramic by 8.80%. At the same time, the lowest elongation value is found in the specimen that uses Backing ceramic by 7.30%.

Keywords: welding; ASTM A36 steel; elongation; backing ceramics.

1. Introduction

Technological developments in construction have developed rapidly, and metal raw materials cannot be separated from welding technology. Many construction fields, such as the transportation industry, civil construction, power plants, and others, use steel materials to strengthen construction. *Steel* is a metal alloy consisting of iron and carbon, in which iron is the more dominant element than carbon. Steel differs from pure metals such as iron, aluminium, zinc, copper and titanium. Steel is an important component in building a better civilization, and the use of steel in construction cannot be separated from welding technology because it has an important role in metal methods and revisions.

Welding is a metal joining technique in which parts of the base metal and filler metal are melted to form a continuous joint, with or without pressure and with or without filler metal. Many types of welding can be used according to the needs of certain industries. For example, Shielded Metal Arc Welding (SMAW) is a welding type often used in the power generation and transportation industries.

However, welding is usually done back and forth to get the most out of it, which requires a lot of time and money. To overcome this, then media-backing ceramics can be used to reduce the time and cost required. MediaBacking ceramic is a barrier to increase weld penetration and produce a better weld joint.

However, welding results are only sometimes good. Therefore, this research was conducted to determine the effect of backing ceramic on the elongation of ASTM A36 steel welded by the SMAW process. Elongation measures a material's ability to resist plastic deformation before failure occurs. Knowing the influence of backing ceramics on the elongation of steel ASTM A36 is expected to provide useful information to improve the quality of welded joints.

The results of this study can provide useful information for developing welding technology in the future. Knowing ways to improve the quality of welded joints is expected to increase efficiency and effectiveness in construction using steel materials.

2. Materials and Methods

2.1 ASTM A36 Steel

The material used in this research is ASTM A36 steel. It is a low-carbon, high-strength steel that can be machined and welded. To improve corrosion resistance, then A36 steel can be galvanized or coated. The chemical composition of these materials is shown in Table 1.

Table 1. ASTM A36 Steel Chemical Composition

Element	Content
Copper	0.20%
Sulfur (S)	0,050 %
Carbon (C)	0.25 - 0.290 % (Depending on thickness)
Silicon (Si)	0,280 % (max 0,4 %)
Iron (Fe)	98 %
Phosphorous (P)	0,040 %
Manganese (Mn)	1,03 %

2.2 Welding Machine

The welding machine used for the ASTM A36 steel welding process is SMAW or gas-shielded arc welding machine. This process generates heat energy for welding through an arc between a closed metal electrode and the workpiece. The filler metal inside the electrode is covered with slag, which protects the weld metal during welding. SMAW welding is also known as manual metal arc welding. The SMAW welding process diagram is shown in the figure below.

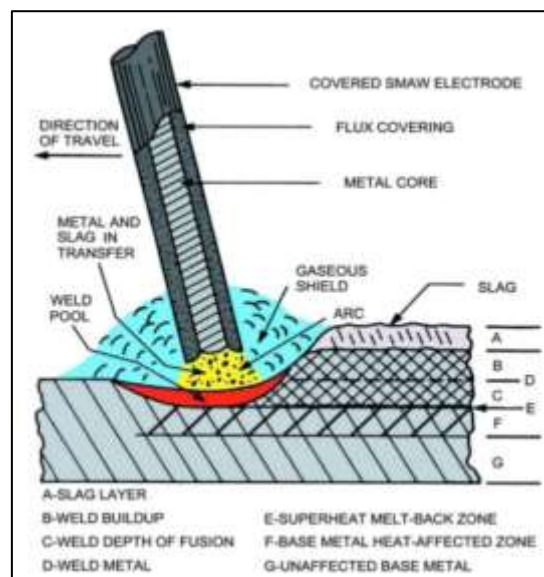


Figure 1 SMAW Welding Machine

2.3 Backing ceramics

Equipment backing ceramics is the equipment used to support the welding process. Backing ceramics are made of high-temperature resistant and sealed ceramics made from a mixture of different minerals (e.g. Al_2O_3 , SiO_2 , Fe_2O_3 , TiO_2).

2.4 Electrode

Electrodes are equipment used in the welding process to conduct electric current to the workpiece. Electrodes can be permanent or consumable, depending on the welding process.

2.5 Tensile Test

Tensile test equipment is used to test a material's tensile properties. This equipment usually consists of a force gauge, an elongation gauge, and a clamping device to hold the test specimen.

3. Results

This chapter describes the information generated from the testing process according to research procedures. This information is analyzed and processed to obtain results from physical and mechanical material testing from the SMAW welding process with and without backing ceramics. The results obtained include the results of tensile testing.

3.1 Tensile Testing

Tensile testing is a method of measuring the ductility of material under applied stress and tension. This test is one way to check material properties. By pulling on a material directly, we can see how it responds to pulling forces and how far it stretches. This study focused on knowing the level of stress in each sample. The following formula is used to determine the elongation value of the tensile test object:

$$\varepsilon = \frac{L_1 - L_0}{L_0} \times 100\% \quad (1)$$

3.1.1 Elongation Value of Tensile Test Specimens

The elongation value is measured to determine the characteristics of the test specimen. From the elongation value, calculations can be made based on the data from the tensile test results. The elongation value data can be seen in Table 2.

Table 2. Elongation value from the Tensile test

No	Variation	Code Material	L ₀ (mm)	L ₁ (mm)	ε (mm)
1	Non Backing Ceramics	A1	288	313	8.68
		A2	287	312	8.71
		A3	288	314	9.03
		Average	287	313	8.8
2	With Backing Ceramics	B1	288	308	6.94
		B2	287	310	8.01
		B3	288	308	6.94
		Average	287	308	7.3

From Table 2, it can be seen that in the tensile test, the elongation value varies for each specimen. The average elongation value is 8.80% on the variation without backing ceramics. While the variation with backing ceramics, the average elongation value is 7.30%. From these values, the strain values on the graph shown in Figure 2 can be seen.

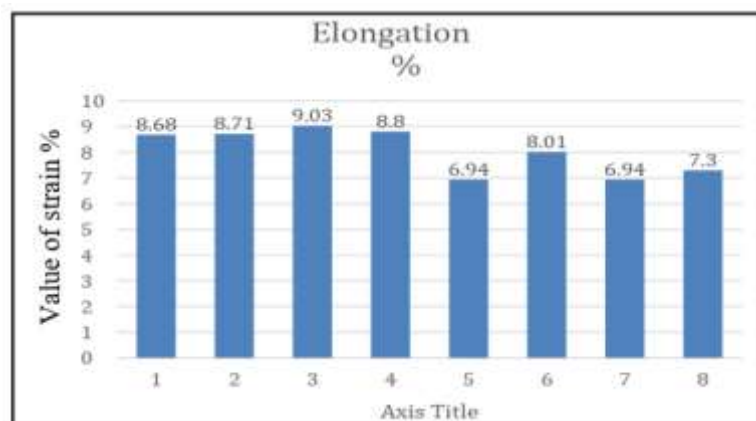


Figure 2. Elongation Graph

Based on Figure 2 above, it can be seen that the highest elongation values are found in specimens that do not use backing ceramics, which is equal to 8.80%. At the same time, the lowest elongation values are found in specimens that use backing ceramics, which is equal to 7.30%.

4. Discussion

From the discussion above, we already know that the use of backing ceramics in the SMAW welding process can affect the elongation value of the tensile test specimen. The elongation value measures a material's ability to stretch before breaking when stretched. The test results show that specimens not using backing ceramics have the highest elongation value of 8.80%. In comparison, the specimens using backing ceramics have the lowest elongation value of 7.30%.

This indicates that using backing ceramics can affect the mechanical properties of the welded material. Backing ceramic is the equipment used to support welding by holding molten metal on the back of the weld joint. Backing ceramics can reduce the time and cost required in the welding process, but test results show that this can also affect the elongation value of the welded material.

However, further research is needed to know exactly how backing Ceramics affects the mechanical properties of materials and how these can be utilized in the welding process. Other factors that may affect the test results, such as welding parameters, the type of material used, and the environmental conditions during the test, must also be considered in further analysis.

5. Conclusions

From the discussion above, using backing ceramics in the SMAW welding process can affect the elongation value of the tensile test specimen. The test results show that specimens not using backing ceramics have the highest elongation value of 8.80%. In comparison, the specimens using backing ceramics have the lowest elongation value of 7.30%. This indicates that using backing ceramics can affect the mechanical properties of the welded material. However, further research is needed to know exactly how backing Ceramics affects the mechanical properties of materials and how these can be utilized in the welding process.

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