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STUDY THE SHIELD GAS INFLUENCE ON IMPACT STRENGTH OF 5083AL-ALLOY JOINT

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Abstract:

Metal Active Gas (MAG) welding has high quality for joining two or more materials efficiently. 5083 Al grade is selected on the basis of important factors such as corrosion resistance, fabrication, heat treating good combination of toughness and formability. MAG is efficient welding utilized in aerospace, ship & marine industries. Determine the gas flow rate influence on impact strength of 5083 Al-alloy joints with size of 45 mm x 10 mm x 4 mm. In this, maximum impact strength of 17.1 Joule obtained at shielding gas flow *of 7 Lt/min with constant current 235 amps.*

Keywords - 5083 Al- alloy, Impact strength, Inert gas, MAG welding set up

1. INTRODUCTION

Aluminium is extracted from bauxite ore, is also called as hydrated Aluminium oxide. Aluminium metal is easily welded by MAG but most difficult to weld with other arc welding processes because spreading out from weld pool during the operation [1-2]. Metal Active Gas welding produces precise quality weld joint between two different or similar metal [3]. Shielding gases shield the weld zone from air and maintain an arc for welding [4-5]. The consumable electrode with highest melting temperature of 3422^{o} C that has main purpose to initiate and maintain the arc between electrode and work piece surface [6-8]. The power polarity (DCSP and DCRP) are differentiated on the basis of connections [9]. In case of DCSP, heat energy of 70 % occurs on work piece surface and 30 % energy occurs at electrode tip. But generate the heat energy of 70 % at electrode tip and 30 % energy occurs on work piece surface in DCRP. The depth of penetration becomes deep & narrow in DCSP and shallow & wide in DCRP [10-15]. The welder get electric shock, skin burn or death by contact with electric energy while working and scattered blue light causes the irritation of eyes, headache during the welding operations [16-23].

2. EXPERIMENTATION

Experimentation is to achieve desired goals by conducting experiments in a sequence with input and output factors discussed below as:

2.1 Experimental material

5083 Al with 4 mm thick welded by MIG machine set up. In this, (92.4- 95.6) % Al, (4.0 –4.9) % Mg, (0.40 – 1.0) % Mn, (0.4) % Si, (0.4) % Fe, (0.1) % Cu, (0.24) % Zn, (0.05-0.25) % Cr and (0.16) % Ti are the compositions of 5083 Al-alloy.

2.2 Experimental method

In this, Experiments are conducted by MAG process for joining 5083 Al- alloy efficiently with the variation range of shielding gas flow by keeping current constant ranges as 215 Ampere, 225 Ampere and 235 Ampere shown in table 1:

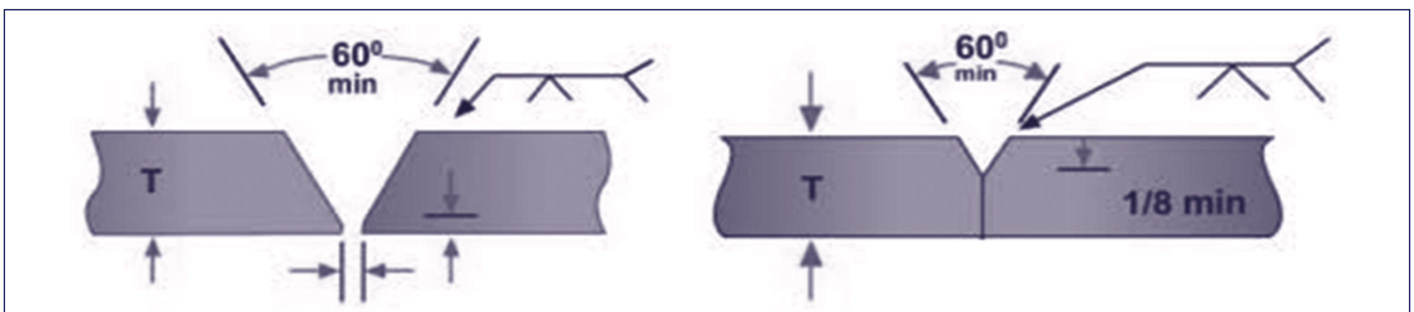
Table 1: Gas flow Rate input values

Welding Modes	Shielding gas flow (Lt/min.)
1	5
2	5.5
3	6
4	6.5
5	7

2.3 Specimen's preparation

In this research, fifteen numbers of samples are prepared final by welding for testing the impact strength with the help of charpy impact test machine. The configuration of prepared specimen is represented in figure 1.

Figure 1: Specimen Prepared for making Joint



3. STUDY RESULTS AND ANALYSIS

Experimental Result reveals that the gas flow rate influence the impact strength of 5083 Al-Alloy welded joint for constant current ranges of 215 Ampere, 225 Ampere and 235 Ampere, are enlisted below in table 2, table 3 and table 4.

Table 2: Observation of Impact strength at constant current 215 Ampere

Specimen ID	Sample 1	Sample 2	Sample 3	Sample 4	Sample 5
Gas Flow Rate (Input) in Lt/min.	5	5.5	6	6.5	7
Impact Strength (Output) in Joule	13.3	13.5	14.2	14.7	15.3

Table 3: Observation of Impact strength at constant current 225 Ampere

Specimen ID	Sample 6	Sample 7	Sample 8	Sample 9	Sample 10
Gas Flow Rate (Input) in Lt/min.	5	5.5	6	6.5	7
Impact Strength (Output) in Joule	14.1	14.5	14.9	15.5	15.9

Table 4: Observation of Impact strength at constant current 235 Ampere

Specimen ID	Sample 11	Sample 12	Sample 13	Sample 14	Sample 15
Gas Flow Rate (Input) in Lt/min.	5	5.5	6	6.5	7
Impact Strength (Output) in Joule	14.9	15.3	15.8	16.4	17.1

The observations are noted clearly from all values of above tables that having maximum impact strength of 17.1 Joule obtained at shielding gas flow of 7 Lt/min with constant welding current 235 amps.

3.1 Shielding Gas influence the impact hardness of welded joint

As per Observation tables and Graphical chart, Impact strength is continuously increased by increasing the shielding gas flow at constant current ranges of 215 ampere, 225 Ampere and 235 Ampere.

Figure 2: Graph represents individual Shield gas flow effect on impact strength at 215 Ampere

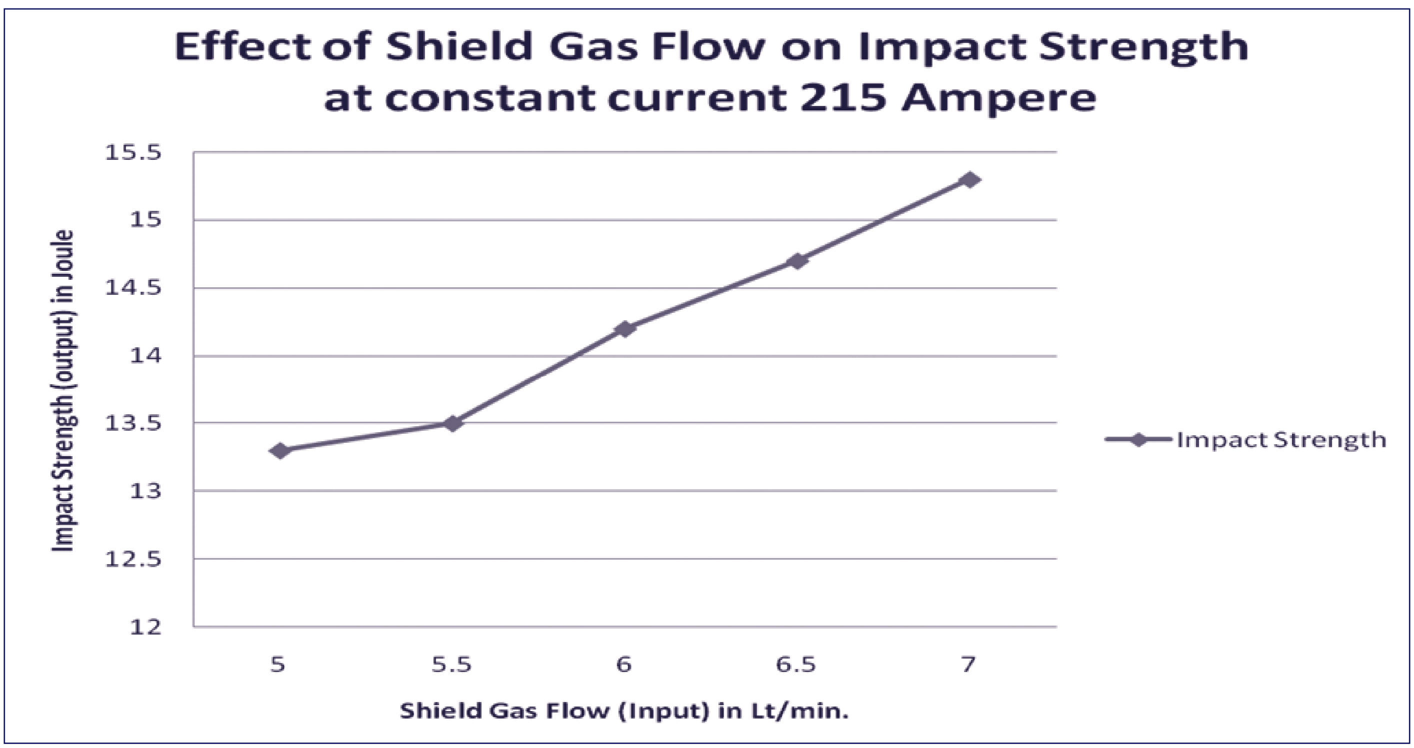


Figure 3: Graph represents individual Shield gas flow effect on impact strength at 225 Ampere

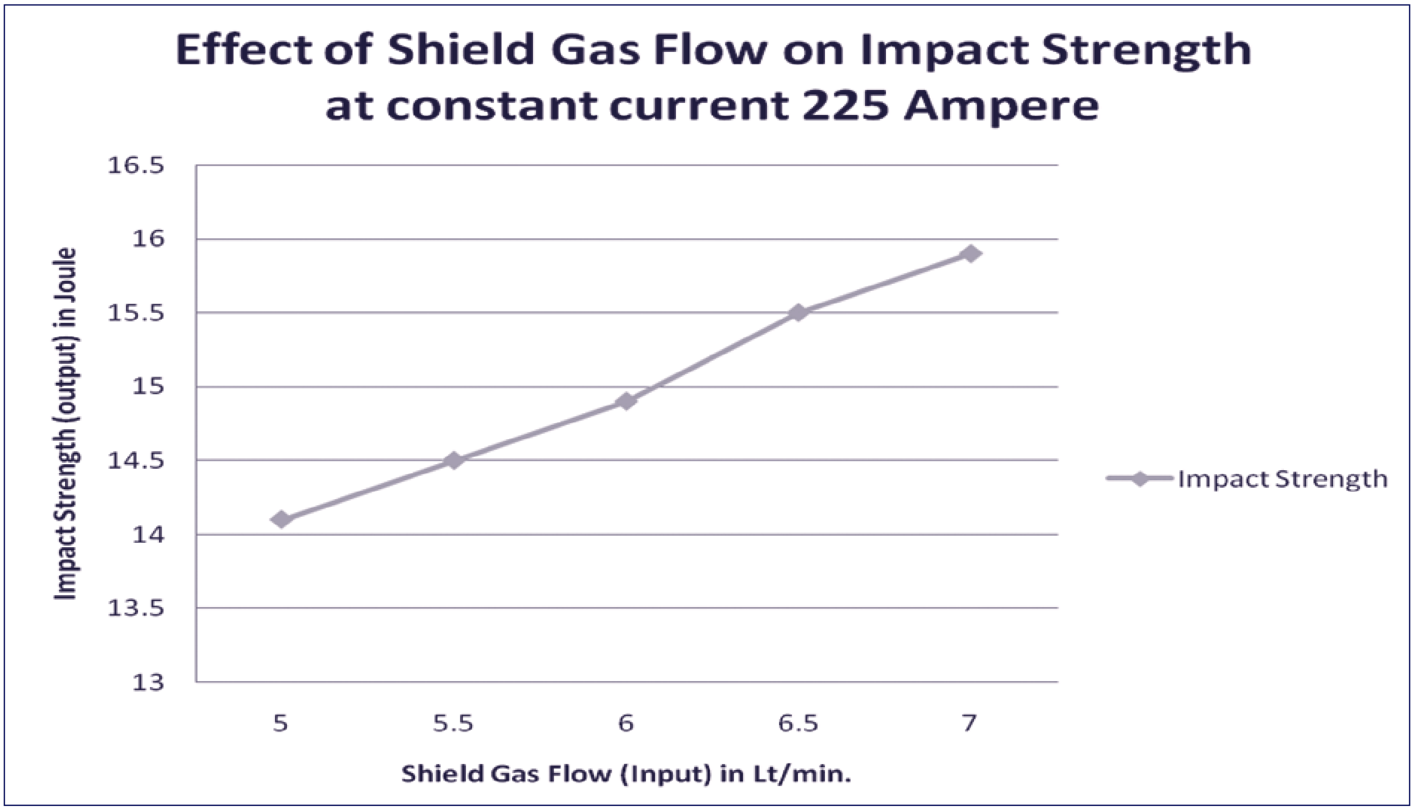


Figure 4: Graph represents individual Shield gas flow effect on impact strength at 235 Ampere

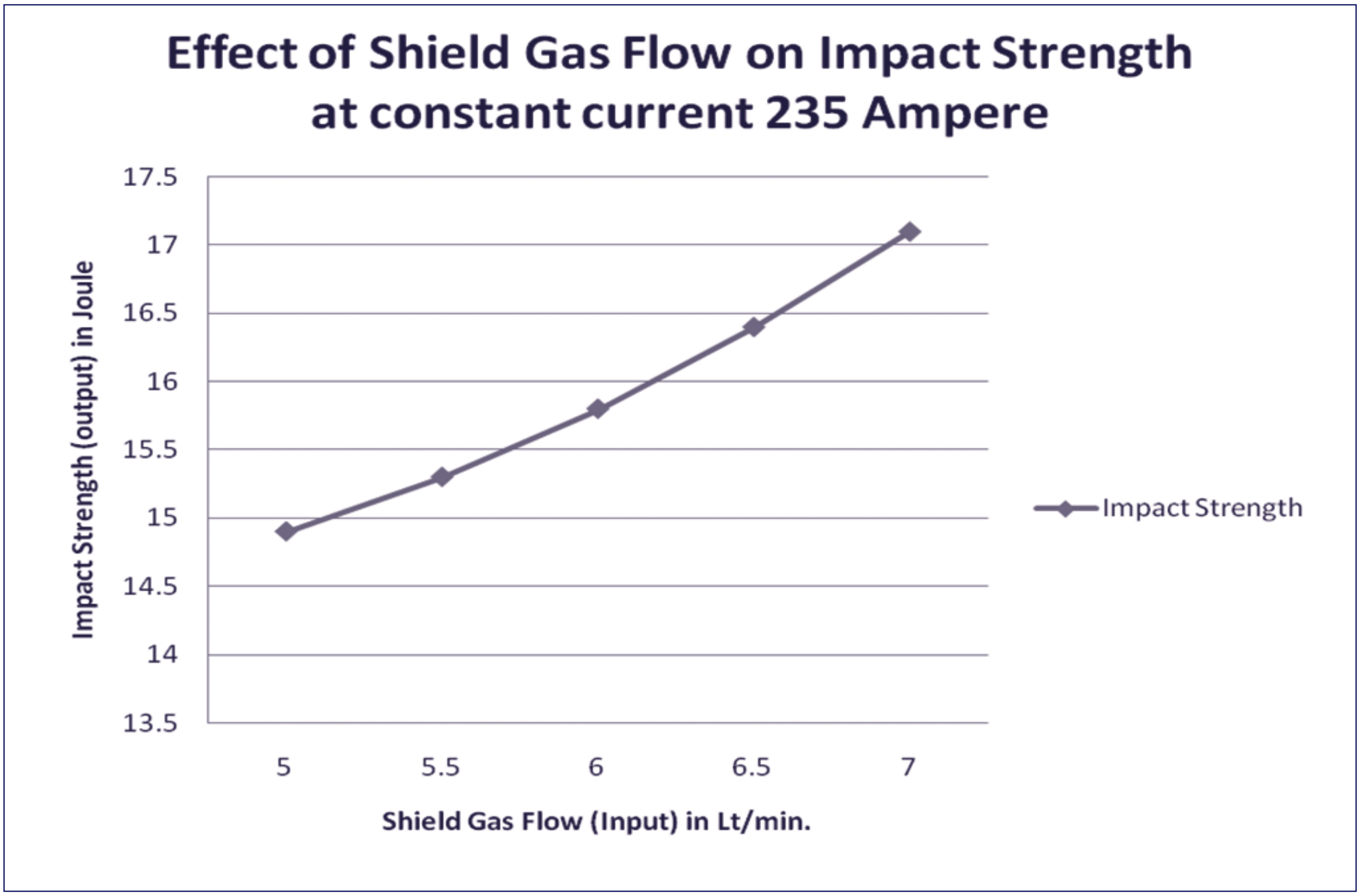
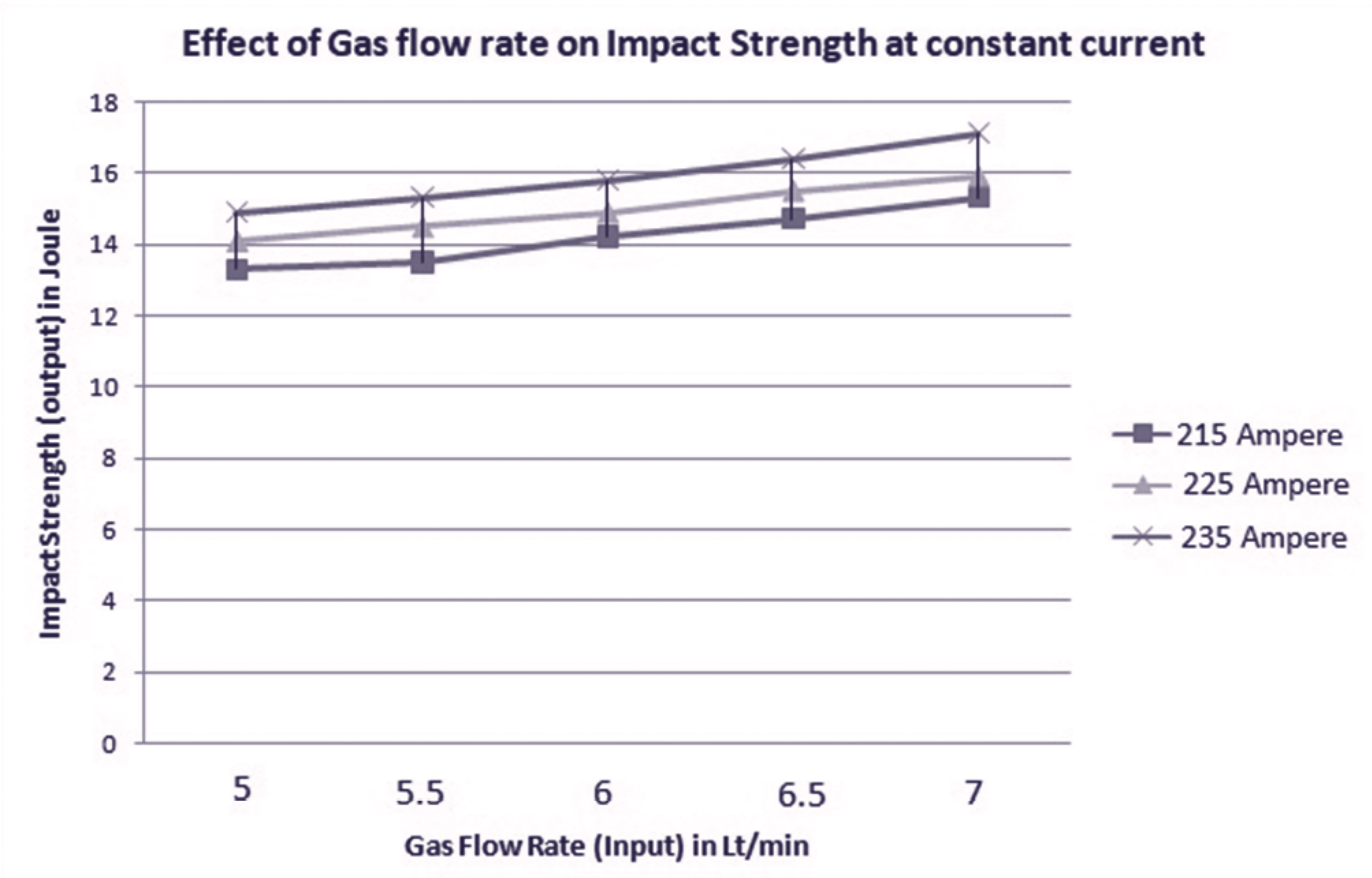


Figure 5: Graph represents combined Shield gas flow effect on impact strength



4. CONCLUSION AND IMPLICATIONS

With the help of results analysis, it concludes that the weld joint will have efficient & maximum impact strength of 17.1 joule for shielding gas flow of 7 Lt/min at constant current 235 ampere. And impact strength linearly increased by increasing the gas flow rate seen in figure 2. We can achieve better results by using Post weld heat treatment process which refines the grain size to create bonding strong.

This article would be useful for industrial organization in various aspects which discussed below:

1. To create the high strengthen joint which can bear the impact load with 17.1 joule of energy.
2. Industrial employee/worker would make efficient joint under controlled conditions of shielding gas flow.
3. 5083 Al alloy would be used in manufacturing the interior floor and roof of rail coach with anti corrosion properties.
4. To manufacture the aero plane body parts with efficient joint which provide long life.

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