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Analysis of Welding Gases

[#1]Sushant Bhalerao, [#2]Audumbar Mukane, [#3]Bharat Khamkar, [#4]Akash kadam, [#5]Prof. Z.M. Athawale

[1]sushantbhalerao855@gmail.com

[#1234]Student, Department of Mechanical
[#5]Prof, Department of Mechanical

JSPM'S Bhivrabai Sawant Institute of Technology and Research Centre, Wagholi, Pune, India.

ABSTRACT

It is well established that welding fume contains toxic substances, which are hazardous to human health. The percentage of gases like Co2, CO, No2 are changes when the material changes. This research paper deals with study of different type of gases emitted from metal arc welding process for the different material type. This article is adopted by taking the readings of welding at constant atmospheric condition using gas analyzer by varying current for same material. The aim of the article is to find out the which material causes maximum emission of gases .the material used for welding are Mild steel, stainless steel and Cast iron.

Keywords - Arc welding, gases, material selection, physical properties.

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I. INTRODUCTION

Welding is process if joining two metal parts together by applying intense heat between them, which cause the parts to intermix with them. Welding process are widely used in fabrication, civil industry ,mining industry and metallurgy. The heat generated during welding contains minut particles called fumes. All welding process generate fumes but most fumes are produces during electric arc welding. The vulnerabilityof welding depends on following factors:

1. Type of welding process
2. material being welded
3. electrode material
4. presence of coating on the metal
5 .voltage and current used
6. type of ventilation

Most of the small and medium scale organization have poor working condition contribute to workers safety and health problem. Toxic gases like nitric oxide ,carbon monoxide, ozone and nitrogen dioxide are produced from welding process. These toxic gas can cause headache, pulmonary edma, and drowniness .

Nitrogen gases form when nitrogen and oxygen in the air react with hot arc and hot base metal, NO2 present in workplace where combustion process is in use, CO2 form during MAG welding as a result of atomization of carbon dioxide in shielding gas.

Type of gas	Source
Carbon monoxide	Formed in welding arc
Nitrogen oxide	Formed in welding arc
Oxygen deficiency	Welding in confined spaces, displacement of air by shielding gas
Ozone	Formed in welding arc
Hydrogen fluoride	Decomposition of electrode coating

Table 1: welding gases and sources

Problem statement:
The problem is that, to measure percentage of gases emitted during arc welding process for commonly used materials like MS, SS, CI in welding industry. And also measure the amount of gases changes while changing the current.

II. LITERATURE REVIEW

1.Supplement to the welding journal, june 2005 Sponsored by American welding society and welding research council Chemical Analysis Of welding Fume particles By N.T.JENKINS and T.W. EAGAR

The chemical composition of welding fume must be examined when considering fume toxicity. Various chemical analysis techniques are presented and their applicability to airborne particles is described knowledge of particle size is important because given characterization technique only provides accurate data for a specific size range. For the purpose of comparison and illustration this paper uses several characterization technique to analyze the chemistry of mild steel welding fume. In this paper they found Energy dispersive spectrometry (EDS) was found to be an effective method for evaluating result.

2. international journal of advance Research in mechanical engineering and technology (IJARMET) vo-1issue 1 (apr-jun.2015) Impact of welding processes on Environment and Health Pankaj Kumar.j. mistry Dept. of mechanical engineering, Rungta engineering college, Raipur, CG, india Environment consideration today tend to control, guide and develop engineering process affecting both men and environment, the melting of filler metal, base metal and the coating on base metal during welding processes and subsequently the gas formed release minute. This paper describes the information currently available on air pollutant effect in welders, to protect welders from welding fumes, the aim of this paper is to gather the potential toxic effect of welding fume documented by individual efforts and spread awareness about the environment and health hazards of welding fumes.

3. Scientific research and essays vol.6(15) 11 aug.2015 ISSN 1992-2248 C2011 ACEDEMICS JOURNAL Determination of welding parameters for shielded metal arc welding Ugur soy department of metallurgy and materials science engineering, sakarya university. Technology faculty, turkey Osman Lyibilgin Machine program, karasu vocational school, sakarya university. Technology faculty, turkey arc welding is type of welding that uses a welding power supply to create an electric arc between an electrode and base metal to melt the material to melt the welding point. In this paper arc welding parameter are determined for shielded metal arc welding method. Parameter selected depending on welding method and present study some parameter are included and some of them are excluded. to determine the welding parameter, the national and international welding standard and also welding experience are taken into consideration for shielded metal arc welding method.

III. METHODOLOGY

Material selection:
In the gases analysis selection of good material is very important parameter. The base material process, experimental procedure for the research work were chosen after a through literature survey and research methodology and parameter for proposed research work were evolved.

Require properties of material

- It should have standard grade and should widely use in industrial application
- It should have the good characteristics like machinability, weldability, strength, and elongation.
- Matching the base metal
- Tensile strength, welding position
- Cleanness of base metal

According to these characteristics select three material for analysis,
1.MS-IS20602
2.SS-304
3.CI-80-55-06
1.MS-IS20602

Mild steel has a high resistance to breakage. Mild steel, as opposed to higher carbon steels, is quite malleable, even when cold. This means it has high tensile and impact strength. Higher carbon steels usually shatter or crack under stress, while mild steel bends or deforms.

Chemical Composition:

Carbon	0.16 to 0.18 %
Manganese	0.70 to 0.90 %
Silicon maximum	0.40%
Maximum	0.04%
Phosphorous maximum	0.04%
Melting point	510 degrees

physical properties:

Tensile Strength, Yield	370 MPa
Elongation at Break (In 50 mm)	15.0 %
Reduction of Area	40.0 %
Modulus of Elasticity (Typical for **steel**)	205 GPa

2. SS-304
Chemical composition

Carbon	0 .08
Manganese	2.00
Silicon	1.00
Chromium	18/20
Nickel	8.0/12
Phosphorous	0.045
Sulphur	0.03

Physical Properties	Metric
Tensile Strength, Ultimate	505 MPa
Tensile Strength, Yield	215 MPa
Elongation at Break	70 %
Modulus of Elasticity	193 - 200 GPa

3. CI-80-55-06
Chemical composition

Carbon 3.4
Manganese 0.4
Silicon 2.35
Chromium 0.08
Nickel 0.5
Copper 0.6
Magnesium 0.055

Physical properties:

UTS	80000
TS	55000
%Elongation	6%
Hardness	>190
Density lb/in^3 (g/cm^3)	0.256(7.1)
Thermal Conductivity Btu/hr·ft·F (W/m·K)	250(36) for Ferritic grades, will change with an increase in pearlite, approx. 20% less
Specific Heat at 70F Btu/lb·F (J/Kg·k)	0.110(461)
Coefficient of Thermal Expansion Ɛ/F(Ɛ/C)X10^6 average between 68-212F	6.4 (11.5)
Melting Temperature (F)	2100 F
Compressive Strength Ksi (MPa)	429 (2960)

Welding process selection:
Arc welding process:
Arc welding is a process that uses an electric arc to join the metals being welded. A distinct advantage of arc welding over gas welding is the concentration of heat.

- These are most generally available processes in most of the industries and hence do not need separate investment for equipment.
- Cost – equipment for arc welding is well-priced and affordable, and the process often requires less equipment in the first place because of the lack of gas
- Portability – these materials are very easy to transport
- Works on dirty metal

IV. EXPERIMENTAL SETUP

Equipment's used for experiment:

1. **arc welding machine- Thyroluxe 600**

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TEST:
as mention above we choose three material for the gas analysis according to their properties, we are taking readings by varying current.

Procedure of test: The test procedure for gas analysers is as follows:

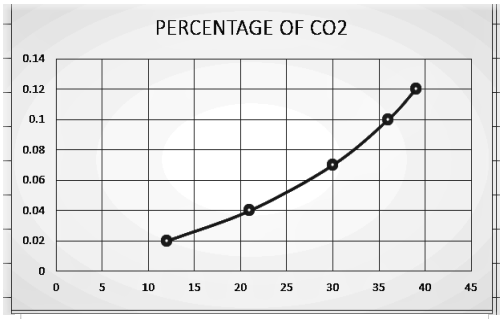
1. Check that the power supply is as per specifications of the manufacturer and electrical earthing is proper.
2. Check that all the accessories as per manufacturer are available and are functioning properly.
3. Check the span and zero calibration using sample gas of suitable value for CO as well as HC.
4. Check the electrical calibration.
5. Check that the sampling system is leak proof.
6. take MS material for testing.
7. take a standard electrode for MS material.
8. start welding machine, and weld the material.
9. during welding, the gas sensitive probe will placed in the welding fume to take reading. the gas readings displayed on analog screen in percentage, Write down the readings,
10. now for the same material repeating the procedure by varying welding current and write down the values of gases for five different currents.
11. repeat this procedure for testing SS and CI material.

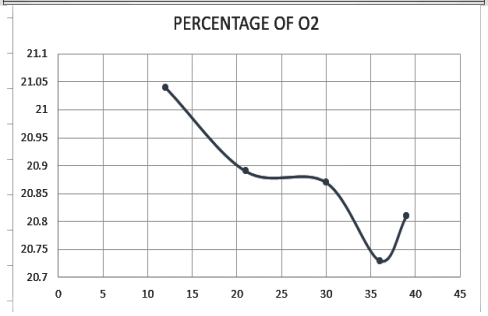
V. RESULT

From above test we draw a graph of current v percentage of gas. For the three materials.

1. MS

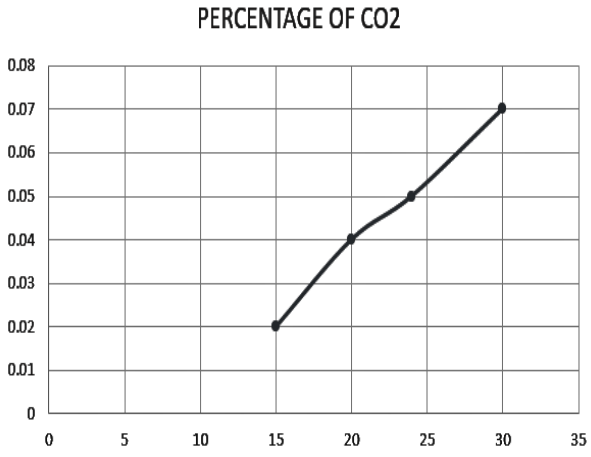
Current(AMP)	Co2 %	O2 %
12	0.02	21.04
21	0.04	20.89
30	0.07	20.87
36	0.10	20.73
39	0.12	20.81

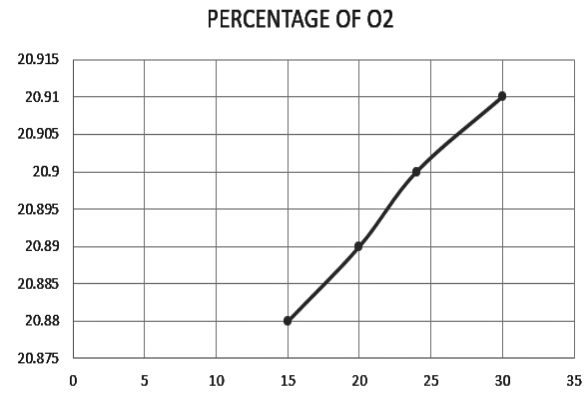




2. SS

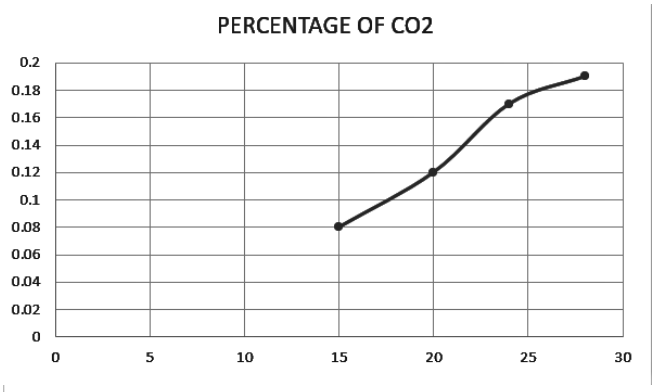
Current(AMP)	CO2 %	O2 %
15	0.02	20.88
20	0.04	20.89
24	0.04	20.90
30	0.07	20.91

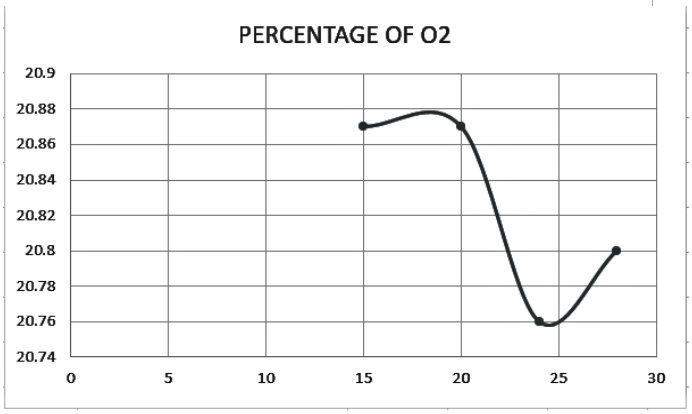




3. CI

Current (AMP)	CO2 %	O2 %
20	0.12	20.77
15	0.08	20.82
24	0.17	20.76
28	0.19	20.50





VI. CONCLUSION

From the above result is concluded that,

1. if current varies then amount of gases also varies that means percentage of gases emitted also depends on current supplied to machine
2. for co2 gas of any material if current increases the percentage of co2 also increases proportionally.
3. But for oxygen deficiency it also varies with current but it does not vary in specific proportion. Some time increase in current may decreases o2 percentage.

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