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OXY-HYDROGEN GAS WELDING PROCESS BY USING DRY CELL (GAS GENERATOR)

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Abstract:

The main aim of this paper is to generate oxy-hydrogen gas (brown's gas) for welding, Brazing and IC engine running techniques. The proposed HHO gas generator which is something that is small conveniently shaped and its cost is also very low compared to other welding techniques. Although people use HHO generator in practice which installed in IC engine fuel purpose, welding & cutting. In this research we focused on finding an efficient and less costly gas. An efficient system is supposed to produce a large volume of Hydrogen gas using a very little power. As the hydrogen gas is eco-friendly and it has no carbon deposition. Gasoline fuel emits greenhouse gases such as methane, CO2, etc. Making fuel from water is very revolutionary idea because water is available in anywhere also in cheap cost.HHO gas generator is composed of two basic components, tube generator and a power source. Tube generator consists of a tube, a pair of electrodes and electrolyte, while the power source such as a battery. This generator works on the principle of water electrolysis. HHO gas generators are classified into two types as follows. those are (i) Dry cell type generator and (ii) wet cell type generator. But here we are using dry cell technique for consumption of liquid (electrolyte solution) and power is low, and cell potential will also increase and it reduces heat losses efficiently compared to wet cell technique.

Keywords: HHO gas, electrolysis process, Dry cell, electrolyte, welding.

1. Introduction

Now a days the continuous increase of fuel prices and reducing the fossil fuels are one of the main driving forces behind these efforts to more efficiently utilize the various sources of renewable energy resources. Generally, peoples are believed that by using the welding process lot of greenhouse gases were released but, in this paper, we are discussed about by using HHO Gas generator we will generate the gas by using that gas we will do the eco-friendly welding process. By using this type of welding through dry cell type of generator, it will not release any type of CO_2, NO_2, SO_2, CO, HC etc... will be reduced. Later, numerous experiments show that hydrogen gas mixture under high pressure storage conditions only in case of fire or electrostatic and flame gun nozzle design unreasonable result when supply will not keep pace with the speed tempering combustion, are safe under normal circumstances a. Professor YULL BROWN'S, Brown gas generator is water welder prototype.

1.1 Definition:

Oxy-hydrogen is a mixture of hydrogen (H_2) and oxygen (O_2) gases. This gaseous mixture is used for torches to process refractory materials and was the

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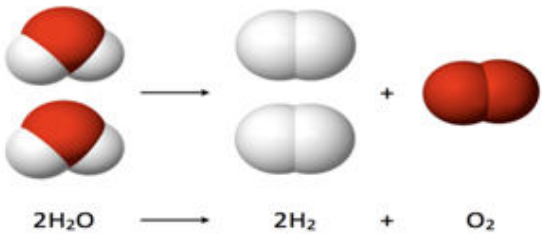
first gaseous mixture used for welding. Theoretically, a ratio of 2:1 hydrogen: oxygen is enough to achieve maximum efficiency; in practice a ratio 4:1 or 5:1 is needed to avoid an oxidizing flame**.**



1.2. Electrolysis

Electrolysis is a technique that uses a direct current (DC) to drive an otherwise non-spontaneous chemical reaction. Electrolysis is commercially important as a stage in the separation of elements from naturally occurring sources such as ores using an electrolytic cell. The voltage that is needed for electrolysis to occur is called the decomposition potential**.**

During the time of Maxwell and Faraday, concerns came about for electropositive and electronegative activities. Electrolysis is the passing of a direct electric current through an ionic substance that is either molten or dissolved in a suitable solvent, producing chemical reactions at the electrodes and decomposition of the materials.

The main components required to achieve electrolysis are:

An electrolyte: a substance, frequently an ion-conducting polymer that contains free ions, which carry electric current in the electrolyte. If the ions are not mobile, as in most solid salts, then electrolysis cannot occur.

A direct current (DC) electrical supply: provides the energy necessary to create or discharge the ions in the electrolyte. Electric current is carried by electrons in the external circuit.

Electrodes of metal, graphite and semiconductor material are widely used. Choice of suitable electrode depends on chemical reactivity between the electrode and electrolyte and manufacturing cost. Historically, when non-reactive anodes were desired for electrolysis, graphite (called plumbago in Faraday's time) or platinum were chosen. They were found to be some of the least reactive materials for anodes. Platinum erodes very slowly compared to other materials, and graphite crumbles and can produce carbon dioxide in aqueous solutions but otherwise does not participate in the reaction. Cathodes may be made of the same material, or they may be made from a more reactive one since anode wear is greater due to oxidation at the anode.

Cathodic process: $4K^+ + 4e^- \rightarrow 4K$

Anodic process: $4OH^- + 4e^- \rightarrow O_2 + 2H_2O$

$4KOH \pm 4e^- \rightarrow 4K + O_2 + 2H_2O$

A liquid containing electrolyte is produced by:

Solvation or reaction of an ionic compound with a solvent (such as water) to produce mobile ions. An ionic compound is melted by heating an electrical potential is applied across a pair of electrodes immersed in the electrolyte. Each electrode attracts ions that are of the opposite charge. Positively charged ions (cations) move towards the electron-providing (negative) cathode. Negatively charged ions (anions) move towards the electron-extracting (positive) anode.

1.3 Catalyst:

Catalysis is the process of increasing the rate of a chemical reaction by adding a substance known as a catalyst, which is

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not consumed in the catalysed reaction and can continue to act repeatedly.

2. Construction and working:

The gas generator shown in belowFigure 1.3it is based on the common-duct series-cell generator has total efficiency is about 80-90%. when all things are considered (ambient temperature, ambient pressure, accurate measurement of gas volume and current) when powered by straight DC. The generator with a target input voltage of about 12.9-14.1V DC depending on Temperature.

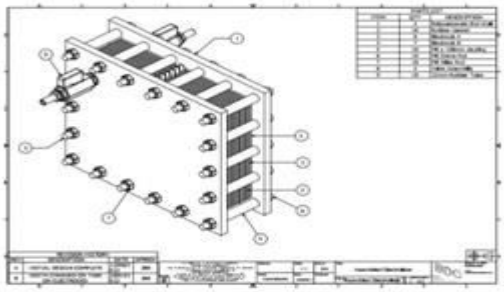

Figure:2.(a) Gas Generator setup

Here using thirty plates which are having thickness of 1 mm and area of 250 mm x 250 mm. The material for plates usedis stainless steel (304 grade). here using 30 plates for this generator out of 36 plates 24 are acts as neutral plates remaining 6 are acts as electrode plates.The six electrode plates have a small extra strip for electrical contact. The extra strip is 1mm thick 100mm×20mm stainless steel (304 grade). Each plate consists of two holes, one hole is for solution inlet and another hole is for gas outlet. Holes drilled with a diameter 12mm.

Figure:2. (b) drilled sheet

The small rubber gaskets square blocks were meant to keep proper distance between SS plate centres, but they turned out to be unnecessary and were not used.

2.1 Gasket:

The gasket used here which is made with rubber mixing with small-molecule compounds called isoprene, and having thickness of 2mm and the outer dimensions were 250mm×250mm.

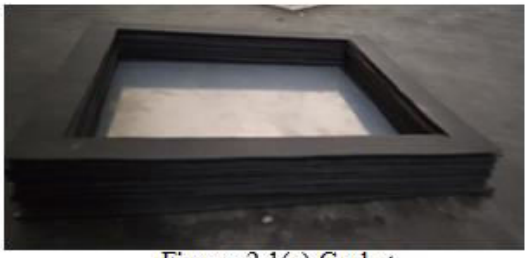

Figure: 2.1(a) Gasket

and inner dimensions 250mm×250mm it used for electrical insulations and water leakage insulation.

The end plates were cut out of 10 mm thick Nylon sheet. The size of the sheet was 300 mm x 300 mm. Eight 12 mm holes were drilled for M6 size stainless steel through-bolts. A ¼" pipe thread was tapped in a 12 mm gas vent hole. A valve and gas hose connector with epoxy glued to the ¼" tapped hole in both plates. Other thread sealants may not be compatible with the electrolyte so it's best to use epoxy or Teflon tape. The nipple valve was lined up with gas vent hole in SS plates. When the electrolyser stack is tightened up the gasket end plates tend to bend and bulge. Some form of metallic bracing should be used to prevent bending or the end plates made out of thick Nylon sheet.

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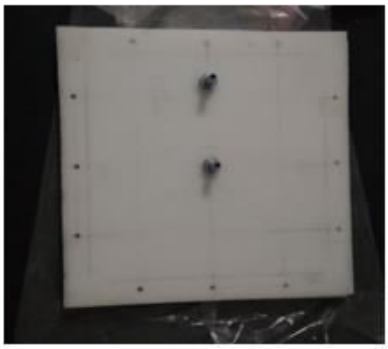
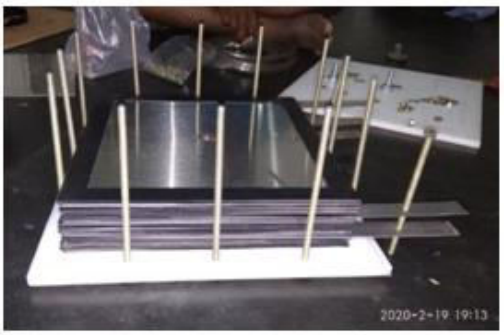


Figure: 2.1 (b) Nylon plates clamping together with S.S bolts.

The first stainless steel plate and one gasket spacer ring are shown in above Figure. There is a gasket spacer ring also between the gasket end plate and first SS plate. A 90
mm piece of 8 mm ID 10 mm OD rubber hose is slid over the bolts to isolate the bolts from the plates and hold the plates in place. It would have made more sense to drill the gas vent hole to the upper middle and centre of the plate, so that draining all of the electrolyte out of the generator would have been easier. A side view of the cell stack with several SS plates and gasket spacer rings in place is shown.

The finished generator is shown in below Figure. The two Nylon end plates are clamped together with 150mm long M6 stainless steel bolts with nuts. After initial Figure: 2.1 (c) nylon plates arrangement in series
tightening the electrolyser was submerged in hot tap water (about 60^{o}C) with the gas vent valves closed. This softened the PVC gaskets and allowed the stack to be tightened up even further to provide an excellent seal.



stainless steel bolts with nuts. After initial Figure: 2.1 (c) nylon plates arrangement in

series

Figure:2.1(d) After tightening of pates using bolts

The finished generator is shown in Figure. The bubbler is absolutely essential to prevent backfires from blowing up the electrolyser. The electrolyser may be filled with slightly acidic water (use vinegar) to neutralize the solution if any residual NaOH or KOH vapours in the output gas. It would be wise to use a non-return valve between the electrolyser and bubbler to prevent bubbler water being pushed back into the electrolyser in case of backfire.

2.2 Electrolyser solution tank:

This tank is filled with water which is mixed with catalyst. The capacity of this tank is two and half litre i.e. out of this up to half litre we can fill water mixed with catalyst into electrolyser solution tank. For its construction 2 Nylon sheets,1 acrylic tube,4 threaded rods and enough nut and

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bolts are used. The dimensions of Nylon sheets are150mm*150mm*10mm. Acrylic tube of inner diameter 90 mm, outer dia 100 mm and length of 300mm is used.The dimensions of threaded rods are 600 mm length and M6 diameter.

Figure:3. Electrolyser solution tank capacity of 2.5liters

Electrolyser solution tank consists of four holes. Two holes on the top of the tank and another two holes are at bottom of the tank. One Upper hole is used to send solution and another upper hole is used as outlet of the gas at which the entire process is aimed at. one Bottom hole is used to send solution into generator and another bottom hole is used to send the generated gas from generator to the electrolyser tank. Vinyl tube is used to connect electrolyser and generator.

2.3 Bubbler unit:

This bubbler unit is next setup to the electrolyser tank. It is filled with distilled-water.HHO gas coming from the electrolyser tank is sent to the bubbler unit. Total Dissolved particles in the HHO gas are removed by allowing HHO gas to pass through distilled water. This tank consists of one inlet valve and one outlet valve. The gas coming from the outlet can be used for welding purpose. For the construction of this tank 2 Nylon sheets,1 acrylic tube ,4 threaded rods and nut and bolts are used. The construction of bubbler unit is similar to the electrolyser tank. The gas coming from one tank (electrolyser tank) can be sent to another tank (bubbler unit) by using a vinyl tube. The pipe used at gas outlet and pipe used in welding are same. We fix the flash back arrestor at the end of the pipe is used to prevent the reverse fire and it is a safety device. it is fire extinguishing device.

3. Results and Discussion:

A. Total active surface area which is equal to 210*210*112mm surface area.

Cell temperature= 120^0C

B. Water temperature = 111^0C

Voltage = 12V, Current = 18Amp

12V*18Amp = 216Watts

1lit/min of HHO= 5.02mmW

volts	Amps	watts	Time for produce 10ml	W*sec to produce 10ml HHO
4	0.09	0.36	610	219.6
8	0.26	2.08	179	372.32
12	0.58	6.96	83	577.63
16	0.72	11.52	73	840.96
20	0.86	17.2	67	1152.4
24	1.02	24.48	42	1028.16

C. At 4volts, 8V, 12V, 16V, 20V, 24V the resistance values are generally 44.4Ω, 30.769Ω, 20.68Ω, 22.22Ω, 23.0Ω, respectively.

As compared to the above resistances and tabular chart we are getting low resistance at 12V.

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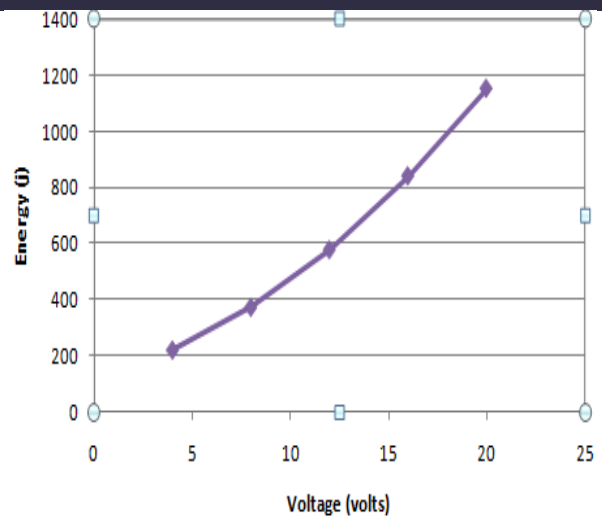

As per above the total exposed surface area results we concluded that if the number of plates to be increased the total exposed surface area will be increasing which tends to give more HHO Gas.

4. Conclusion:

The successive experimental set up done. HHO welding & cutting which results shows that:

- The flame of HHO gas does not deposit carbon hence cleaning is easier, and also resist corrosion.
- The gas is more efficient as a fuel either we use in industry or use in automobile.
- If we use this gas the health of instrument is increases and also reduces the process time.
- The HHO gas is less in cost and also eco-friendly.
- The HHO gas is colourless, odourless.
- The production of gas is a simple electrolysis process and the generator is also simple in construction.

5. Future Scope:

The future scope of this project is using hydrogen fuel cell in place of fossil fuel, as the fossil fuel is lacking day by day and it creates too much carbon, whereas it is carbon free and eco-friendly to the environment. It can be used for various purposes like cooking, welding, cutting etc. presently many companies are making use of it in vehicles like Hyundai and BMW have recently made such cars which can run on hydrogen fuel cell. Many developing countries have been researching on this project to use for electricity by the help of PEM (PROTON EXCHANGE MEMBRANE) it is a fuel cell used for making electricity by hydrogen fuel cell, so the basic scope of this project is to give larger efficiency at low cost.

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