

APPLICATION OF METAL OXIDE NANO PARTICLES IN ELECTROLYSIS OF WATER FOR HYDROGEN PRODUCTION

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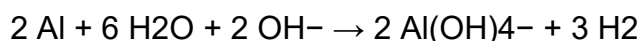
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Introduction:

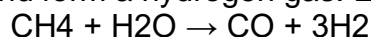
Global warming, pollution, increasing price of fuel and energy crisis are greatest challenges for mankind. Many organizations like government body, private institution, corporates are finding many other or alternatives ways to tackle this problem. Because of these problems there is a search for alternative fuels. Examples of alternative fuel are fuel from sun that is solar fuel, fuel from sea that is marine fuel, fuel from wind that is wind power and also tidal form of fuel etc. These alternative fuel which are yet to find should be clean, pure less harmful to the mother earth

Now there are various more way for hydrogen production. Mostly nowadays hydrogen is produced through the burning of hydrocarbon which contain carbon, oxygen, hydrogen molecule. Burning of these compounds produce hydrogen and other gas like carbon dioxide and carbon monoxide which are harmful to earth even though its efficiency is 80%.

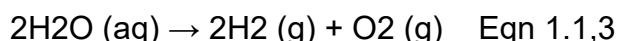
Aluminium is also used for production of hydrogen the equation is given below which show generation of hydrogen using aluminium metal.



Steam reforming is another method where the hydrogen can be generated. This includes conversion of methane to the hydrogen gas. Here water vapor is produced using steam which will react with the methane and form a hydrogen gas. Equation of steam reforming is given below.



Another method for production of hydrogen is by water. Water contains one oxygen and two hydrogens. This can be split to produce hydrogen. This method using electricity generally called as electrolysis. It is a clean and pure method without any harmful generation. Equation is given below.



For electrolysis electricity can be a renewable source which make its good for earth. These sources may be electricity from solar, hydrothermal etc.

Electrolysis needs two electrode and a battery to pass current. Electrodes are coated with Nanoparticle to increase the rate of reaction. These nanoparticles will act as catalytic agent to increase the production rate of hydrogen. The nanoparticle are of 1-100nanometer in size these are coated on electrode which will increase the surface area of electrode and increase rate of reaction.

Objective:

- To build electrode for separation of water to produce hydrogen gas through electrolysis.
- . To give an upper hand over existing procedures by solving the cost and time factor problems.
- To achieve better accuracy of results.

Methodology:

Part 1: Synthesis of Cobalt Oxide Nano particle

In the first step we took 11.89 grams of cobalt chloride hexahydrate and 50ml of water in a 50ml glass beaker. Then We stirred it in magnetic stirrer for 30min at 24°C and 360rpm. We prepared 15ml of 1M oxalic acid by dissolving 12.6g of oxalic acid pellet in the 100ml round bottom flask. We added 15ml of this oxalic acid to the beaker containing cobalt chloride hexahydrate and water by drop by drop. After 20min we added the 2g of urea to beaker which facilitate the combustion. It is kept at 80°C for 30min. Then the solution will turn into a purple colour gel.

After that the gel is taken into crucible and kept in the micro-oven at 550°C for around 3 hours. Here the left-out urea will be vaporised and we will get bluish powder which is nothing but Cobalt oxide nanoparticle.

Part 2: Characterization and Electrochemical Setup

The obtained Cobalt oxide nanoparticle (CoO) is sent to characterization. The characterization technique used is cyclic voltammetry which is use find potential capacity of nano particle.

We will then coat the cobalt oxide nanoparticle onto electrode by dip coating method We placed working electrode, counter electrode, reference electrode and connect battery to it. Then we will conduct experiment by varying electrolyte concentration, Ph, temperature and current.

As of now we have taken electrolyte NaOH of 1N and at 15V we conducted experiment. We got a small concentration of hydrogen. We will conduct more experiment to get more concentration of hydrogen.

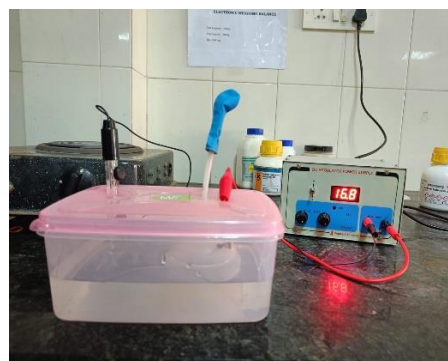
At last, we will find the amount of hydrogen produced through the gas chromatography technique. We will analyse the data obtained



CoO synthesis



Electrode preparation

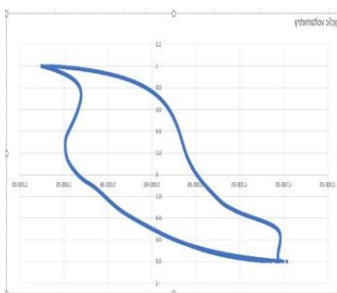


Electrolysis setup

Results:



CoO Nanoparticle



Cyclic Voltametric

CoO Nanoparticle shows the cobalt oxide nano particle powder which is obtained after keeping gel in micro-oven for around 3hour in 550°C. This nanoparticle powder is then crushed and we will get powdered Cobalt oxide Nanoparticle which is light blue in color.

Cyclic Voltametric shows the Cyclic Voltametric graph which is plotted against Current in X axis and Potential in Y axis. In this graph we can analysis the current and potential characteristic of our Nanoparticle powder.

We have fabricated electrolysis setup and did experiment using 5N NaOH and 15v voltage we got some amount of hydrogen and we are yet to analyses and then we will improve the process.

Conclusion:

Hydrogen fuel is one such field where we can produce hydrogen which is less harmful and does not affect nature. From the literature survey we have done we concluded that the production of hydrogen from steam reforming and gasification are harmful as they release carbon monoxide and other harmful gases. By this we concluded that electrolysis will produce a clean and pure hydrogen.

In this project we have researched about the production of hydrogen from water. We have come to conclusion that we can produce clean pure hydrogen through electrolysis of water, this will not produce any emission and not harmful to body. We have created the Cobalt oxide nanoparticle which will increase rate of reaction of electrolysis.

The electrolysis setup is fabricated and we have done the experiment and in future we are planning to do more experiment changing electrolyte, voltage and other parameter.

Future Work:

- We have fabricated the electrolysis setup. Next step is to do experimentation.
- We will prepare electrolyte solution containing NaOH, KOH and KCl.
- After preparing electrolyte solution we will conduct experiment at different voltage and current.
- At last, we will analyze the data of hydrogen produced and compare the result with other research paper.