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Fabricating and Study Effect of the Concentrations Electrolyte for An alkaline Electrolysis Cell

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Abstract. This work studies the fabrication of an alkaline electrolysis cell with type 314 stainless-steel plates. The plates are coated with nano nickel-monoxide and immersed in the electrolyte solution, The Structural characteristics were studied through X-ray diffraction (XRD) or prepare for determining the yielding phase, Also the sample will test using an atomic force microscope to find the roughness of the prepared surface, as well as a study of the results of the various concentrations' electrolyte solution ranging from 0.07 M to 0.32 M KOH, info thus showed that the KOH concentrations were responsible for the conductivity changes, as well as the study of the volume of gas, voltages with change time and current When the voltage increases the amount of lost mass also increases. The resulting increase in the percentage mass lost due to the increase in the voltage is attributed to the increase in electrical current.

INTRODUCTION

Start interest in renewable energy has spurred researchers to develop energy sources, principally due to growing considerations about warming and environmental pollution. Chiefly because of increased carbon dioxide emissions [1] Hydrogen production is also a method of using renewable sources of energy to directly contribute to the reduction of greenhouse gases. Hydrogen is produced by electrolysis, Photocatalytic [2,3]. Electrolysis of water is an electrochemical process, Which splitting the water into its basic constituents, Hydrogen, and oxygen, Through the use of continuous electricity, either solution is also acidic or alkaline [4,5] ,Water is used as a main source within the electrolysis cell and desires little energy to produce it [6] . Stainless-steel is characterized by a high resistance to corrosion, and mechanical properties are smart, so it's one in every of the simplest electrodes of the electrolytic cell [7] , B. Laoun studied a theoretical study describing the assembly of hydrogen by increasing the pressure and decreasing the temperature of the electrolyte polymer within the electrolytic cell [8]. Walt Pyle et al used solar power within the electrolysis cell to provide gas [9] Yasuhiro Mizukoshi et al evaluating the electrochemical properties of NiO / Au. High-velocity electrochemical changes were obtained within one second by improvements in penis length and thickness of the new film [10]. Nanomaterials have wide applications in technologies that are advanced because of their characteristic properties [11], One in each of the foremost promising trends in nanotechnology is the use of electrolysis because of its obvious benefits. Nanomaterials obtained during this fashion are incredibly promising as optical selective coatings, and will greatly increase corrosion resistance and protection capability. The strategy of electrolysis permits the acquisition of compound materials on complex oxides of molybdenum oxides, cobalt, manganese, nickel, iron, vanadium [12]. And tungsten , Nanomaterials characterized by sensible electrical, magnetic and mechanical properties, high thermal stability and high corrosion resistance [11, 13.14.]. This work is aimed to design an electrolyser cell , Additionally, Study the impact of the concentration of solution answer KOH on producing hydrogen from the cell.

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MATERIAL AND MATHODE

The stainless-steel of type 314 was cleaned with is up and water, before immersion in HCl solution (10-15%) for 10 minutes, then washed with acetone, ethanol and at last in ultrapure water via an ultrasonic treatment for 10 min then dried.

The prepared stainless-steel was cut into 10 cm long. One ends of stainless-steel of type 314 were connected to a cathode. The plating resolution has consisted of sodium acetate, nickel sulfate, and sodium sulfate mixture of temperature. Nickel sheet was used as an anode. The nanoporous nickel oxide film was deposited on the surface of the stainless. The deposited film is very porous as a shown figure (1a). Once deposited, the deposited stainless-steel was rinsed many times with deionized water, then dried with drying device as shown figure (1b).

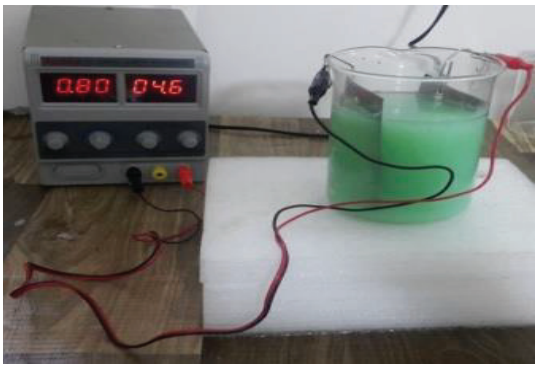

FIGURE 1. a. Electroplating process

FIGURE 1.b: drying device

DESIGN OF ELECTROLYSER CELL

For the aim of fixing all components of the cell, organic glass was cut and pierced. The external structure of the cell is 114 cm2 and thickness 10 mm, holes (2 for every plate) within the center to enter and exit the gases, the glass plate diameter 8 mm, and fix all the elements of the cell. 2 items of stainless-steel of a kind 314 were cut with an area of 80 cm^2 and thickness 2 mm, add a 3 mm thick insulated sheet in an exceedingly hollow box form to be used between cell plates placed between the outer dish. To prevent leaks of gases from the cell. .And so connect this cell with a free energy source consists of an electric cell voltage of 12 volts as a supply of electricity shown in Figure (2). The water has terribly high electrical resistance and can't be splitting directly into hydrogen and oxygen, it should tend terribly high currently and this can be impractical. The addition of the electrolytic resolution KOH powder is employed to increase water delivery, additionally, these materials increase reduces the energy needed to start out the reaction and so helps to split of water, ionic conduction. Wherever potassium hydroxide was added to the distilled water with

totally different concentrations of potassium hydroxide and change current with voltage constant to review of volume hydrogen.

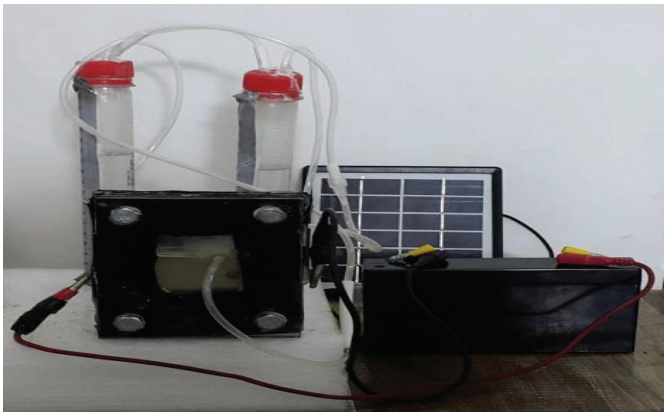

FIGURE 2. The electrolysis cell

RESULTS AND DISCUSION

The XRD patterns indicate that the nano composite is well Figure (3) the obtained patterns are conferred, XRD analysis showed a series of diffraction peaks at 2θ of 27.21°, 42.08°, 61.82°, and 75.94° ° are often assigned to (111), (200), (220), (219) and (2 11) planes, The diffraction peaks show sensible crystalline nano particles and match o.k. with ideal lattice constants, this paper, The XRD pattern shows that the samples are single phase and distinct diffraction peak was detected. This result shows that the physical phases of the NiO nano particles have higher purity prepared [15]

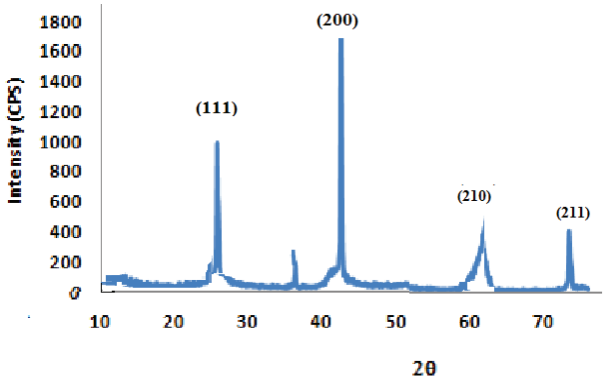

FIGURE 3.X-ray diffraction analysis of NiO nano particles

The optical microscope was carried out after the coating process was done by taking the sections of the sample and the grinding was done on it and then washed with soap and dried water and then Etching which consists of (HNO3) 2% and pure alcohol 98%, as shown in a figure (4). This figure shows that NiO thin films on the stainless steel substrate surface appear with a stainless steel direction while the AFM image as shown Figure (5 a and b) inside the small area shows the growth of NiO particles in a particular direction with their interfaces. Where the same decay layer is narrow and covered the substrate area with a higher concentration and the particle size distribution and the average particle size around 42.15 nm. The particle size, distribution, and morphology are closely related to the preparation techniques [16]

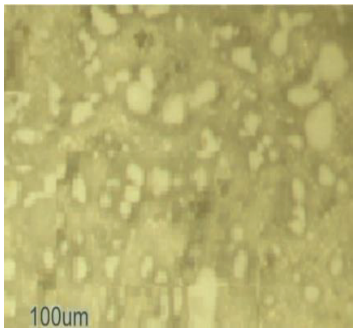

FIGURE 4. Show the surface images of Nano NiO / stainless steel substrate

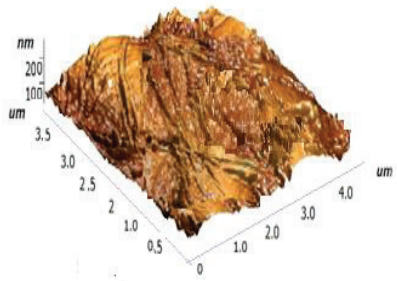

FIGURE 5a .AFM image of NiO nanoparticles applied on stainless steel

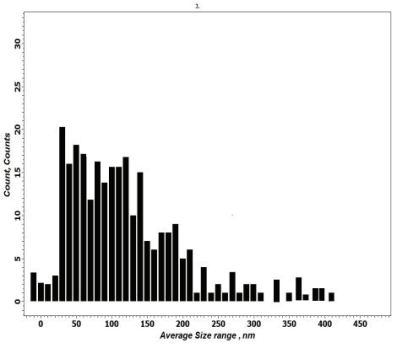

FIGURE5b. View of granularity normal distribution chart of NiO

Study the size of the hydrogen produced by the electrolytic cell with the current relationship and the stability of time as well as the relationship of voltages with time is significantly useful so that this gas, different amount of voltages were applied and then the volume of hydrogen produced in each time was measured. It is obvious that when the voltage increases, the amount increases of hydrogen produced for a specific period, the measurements of the volume of hydrogen were taken having voltage for 5 minutes as shown in the table (1). And Figure (6). The most important role in the process of electrolysis is the electrical conduction of the electrolyte solution. It is clear that the increase in electrolyte concentration leads to an increase in the number of power supply vectors. Increasing input voltages increases electrical conductivity, which in turn leads to more hydrogen production. It is worth mentioning that the optimum conductivity and corrosion resistance of stainless steel occurred at 0.32 M KOH, which correspond to the data for these papers [17,18]

TABLE 1. Shows the relationship between the concentration KOH with Volume of hydrogen and Voltage

Concentra n ion KOH (M)	Voltage (V)	Time (min)	Volume of H (ml)
0.07	2.3	5	1.6
0.14	3	5	2.3
0.18	4.2	5	3.9
0.22	5	5	5.3
0.25	6	5	8.2
0.28	7	5	9.6
0.32	8	5	10.2

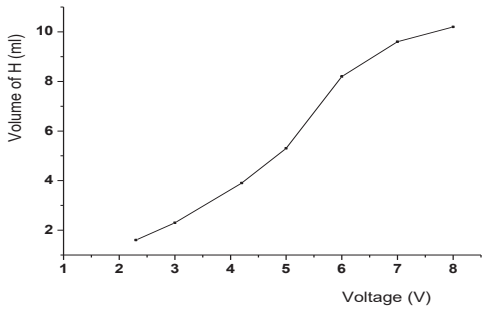

FIGURE 6. Shows the relationship between Volume – Voltage

The electrolyte concentration varied systematically from 0.07M to 0.32M. The study revealed that hydrogen production is gradually increasing with an increase in the concentration of electrolysis. This may be due to the amount of current going through that depends on the conduction of the electrodes and electrolyte concentration. In another perspective, the increase in hydrogen evolution in the increasing electrical concentration is due to more effective ion collisions per unit of time [19]. One of the most commonly used methods to protect metals from corrosion. Metal oxidation is in this case, an oxide film is formed, mainly due to the oxidation of substrate material during the anodic polarization. However, the electrochemical composition of the oxide materials by precipitation of mixed water solutions for salts minerals are of great benefit [4] , As shown in a table (2) and Figure. (7,8)

TABLE 2..Shows the relationship between the Concentration KOH with Current density and Volume of hydrogen

Concentratio KOH (M)	Current (A)	Current density (A/cm^2)	Voltage (V)	Time (min)	Volume o H (ml)
0.07	0.08	0.001	6	5	0.2
0.14	0.7	0.009	6	5	1.4
0.18	1.2	0.015	6	5	2.5
0.22	1.48	0.019	6	5	4.2
0.25	1.82	0.023	6	5	5.7
0.28	2.1	0.026	6	5	7.2
0.32	2.3	0.028	6	5	7.9

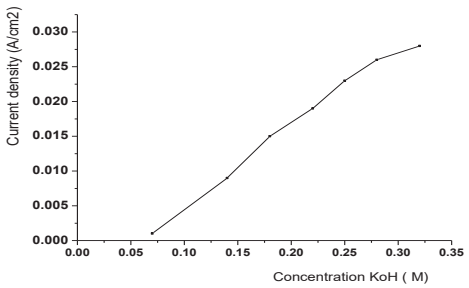

FIGURE 7. Shows the relationship between Current density – Concentration KOH

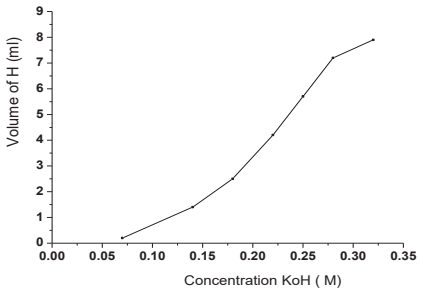

FIGURE 8 Shows the relationship between Volume of hydrogen – Concentration KOH

CONCLUSION

Adopting nanotechnology to work in the field of sustainable energy This cell was made of raw materials are available in the local market, The process of producing hydrogen during this method is that the most economical and easy, Through this study, found that the concentration electrolyte will increase with an increase within the voltage. Also, as increasing with the volume of hydrogen, Concentration electrolyte will increase with a rise within the current density of the same time

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