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Fabrication and Study of Nano catalysis for Alkaline Fuel Cell

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Abstract
In this paper the manufacture of an alkaline fuel cell electrodes made upfrom a Nano mesh (Pt:NiO) catalyst has been studying , made from a Nano mesh (Pt:NiO) catalyst. The general morphology of the samples is were imaged by using with the an Atomic Force Microscope (AFM) to determine the roughness of the prepared surface, it constructed from nanostructure with dimensions in order of 35 nm. The Structural characteristics were studied through the analysis of X-ray diffraction (XRD) of the prepared nanomaterial for determining the yielding phase;1. 72 volt was also obtained at 0.02 A/cm^2 current density for an alkaline fuel cell.

Keywords: Nano (Pt:Nio) Catalyst : Electrolysis Cell; Fuel Cell; X-Ray Diffraction; Atomic Force Microscope

تصنيع ودراسة الحفاز النانوي لخلية الوقود القلوية

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الخلاصة
في هذا البحث تم دراسة تصنيع أقطاب خلية وقود قلوية ، تم تصنيعها من محفز نانوي مؤلف من اوكسيد النيكل مع البلاتين .Nano (Pt: NiO) , تم توصيف طبوغرافية السطح للعينات باستخدام مجهر القوة الذرية (AFM) لتحديد خشونة السطح المحضر ، وان البنية النانوية كانت أبعادها في حدود 35 نانومتر. تمت دراسة الخصائص التركيبية من خلال تحليل حيود الأشعة السينية (XRD) للمادة النانوية المحضرة وتحديد الطور السائد , وقد تم الحصول على فولتيه 1.72 فولت و كثافة التيار عند 0.02 A / cm^2 لخلية الوقود القلوية,

1 Introduction

Fuel cells are electrochemical devices that convert chemical energy into electrical energy. Depending on the type of fuel cells used in electricity, are classified into different groups Each fuel cell has two electric electrodes the negative electrode and the positive electrode.An electrolyte membrane also, which carries the charge of molecules electrically from one electrode to the other and a catalyst [1]. Yu et al. studied the conditions of the electric energy of the cell and the fuel and its applications [2]. Karl Kordesch et. al. studied alkaline fuel cell applications [3]. [4] Researchers have made efforts to find cheaper metals replace platinum catalysts because of its high price [5]. Satheesh et al. studied photovoltaic composite nanoparticles Pt / C - TiO_2 for fuel cells, prepared in a non-homogeneous, interactive manner, using techniques such as cyclic voltammetry. This study confirms the superior stability of these materials against corrosion under polarization conditions [6] István et al. used a layer of nanoparticles to partially cover Ni thin film to provide the most effective use of the hydrogen oxidation reaction (HOR) catalyst. The Pd / Ni electrodes were prepared by spontaneous

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and electrolytic deposition of Pd on nickel-pure polycrystalline surfaces [7]. B. Escobar Morales et al. studied the electrochemical properties of carbon-supported nanoparticles of Pt by analyzing the catalytic response of the oxygen reduction reaction. Motivation parameters such as the charge transfer factor and the exchange current density of the catalyst were studied [8]. This paper aim is to prepare a catalyst of Nano (Pt:NiO) catalyst to synthesise the fuel cell. These cells are very reliable now for the production of clean, renewable and sustainable electrical energy.

2 Experimental

2.1. NiO Nanoparticles Preparation

2.512 g NiCl2.6H2O was dissolved in 250 ml deionized water as a solvent, then the solution was placed on magnetic stirrer for 50 minutes at 60 ° C. NaOH was added, then a green gel was obtained indicating the formation of NiO nanoparticles as shown in 'Figure 1'which was separated and washed with distilled water and ethanol to remove the byproducts which were formed during the reaction process and dried at 60 ° C for 14 hours. The Dried samples were then roasted at 400 ° C for two hours to obtain the black-colored nanoparticles.

NiCl2.6H2 O + H2 O+ 2NaOH ⟶ NiO+ 8H 2O +2NaCl (1)

Figure 1-Green gel of NiO nanoparticles

2.2. Pt Nanoparticles Preparation

100 mg H_2PtCl_6 was dissolved in deionized water. The solution was then stirred by a magnetic stirrer as well as a hydrazine solution was added as a reducing agent. The platinum deposit was separated after washing the precipitate several times using deionized water. Add acetone and evaporate with water in the liquid phase. When placed in the oven at 120 ^oC.

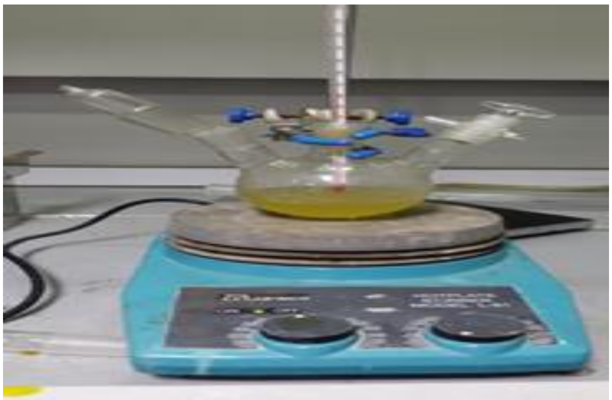

Figure 2-Preparation of nano Pt

2.3. Synthesis of catalysts

The nano platinum was mixed with nano nickel oxide and acetone of the ratios 2: 2: 1, respectively These materials were mixed by with a Sonicators (Qsonica.LLC). The samples were then pressed with a special press to form two electrodes for the alkaline fuel cell (as shown in Figure-3).

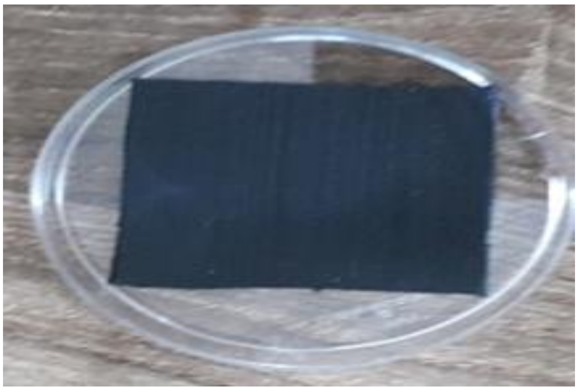

Figure 3-nano (Pt:NiO) catalyst electrodes

2.4 The electrolysis cell consists of stainless steel plates of type 314 No. 2 isolated from each other, for the purpose of isolating each gas separately (hydrogen and oxygen), including a plate of organic glass. These electrodes are immersed in an electrolyte solution, prepared from distilled water and 28% gm potassium hydroxide. The outer wall consists of organic glass (14.5x12) cm^2 to prevent leakage of gases from the cell , 0.1 cm thick of electrode , and these electrodes were connected to a solar cell operating at 10 volts and a current of up to 3 amp ,as shown in Figure-4.

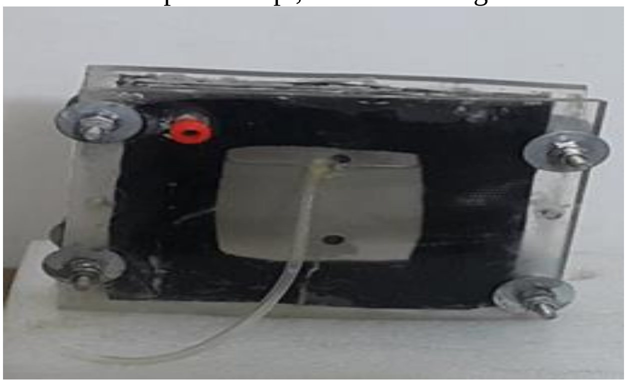

Figure 4-The electrolysis cell

2.5. A fuel alkaline cell alkaline consists of nano (Pt:NiO) catalyst anode and cathode, with t These two electrodes are separated by an electrolyte (KOH). An oxidant is fed to the cathode to supply hydrogen while a fuel is fed in to the anode to supply hydrogen. The outer wall of the cell consists of organic glass sheets.

3. Results and discussion

XRD XRD patterns indicate that the nano composite is well 'Figure-5'the obtained patterns are presented , -6000 Shimadzu Japan was used for the purpose of measuring crystallinity of samples .The XRD analysis showed a series of obtained diffraction peaks at planes (200), (111), (101), (110),(211), and (220),The diffraction peaks show good crystalline nanoparticles and match very well with ideal lattice constants . The XRD pattern shows that the samples have phase and distinct diffraction peak except for the characteristic peaks of FCC phase catalyst was detected. This result shows that the physical phases of the catalyst nanoparticles have higher purity prepared [9, 10]

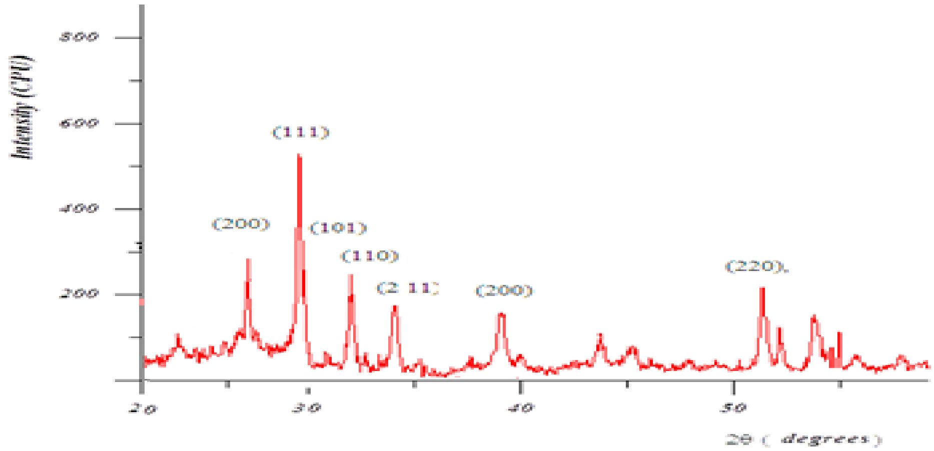

Figure 5-X-ray diffraction of nano (Pt:NiO) catalyst

The surface morphology of the catalyst has been verified using AFM analysis that isfocuses fully focused on the nano scale characterization. Surface morphology of the catalytic layers revealed the formation of a sponge-like structure when the current density increases, where nano crystalline can be seen distributed throughout the entire surface, as well as analysis of the morphology of the catalyst porous under varying current density conditions. The network obtained was very highly spaced, randomly oriented and highly correlated of pores. However, the increase in the current density of small pores requires showing forms, leading to an increased catalyst porosity. It was found that the particle size was 35nm as shown in Figure 6 a and b. Particle size, distribution, and morphology are closely related to the preparation techniques [11, 12].

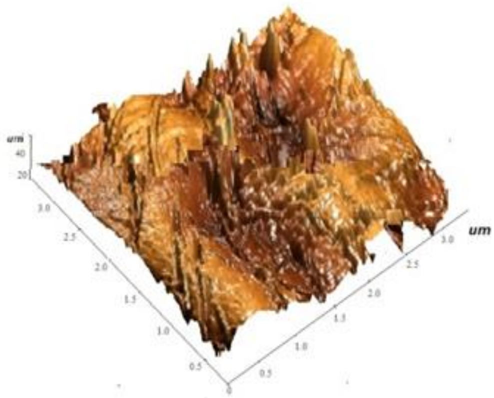

Figure 6 (a)-Atomic force microscope of nano (Pt:NiO) catalyst

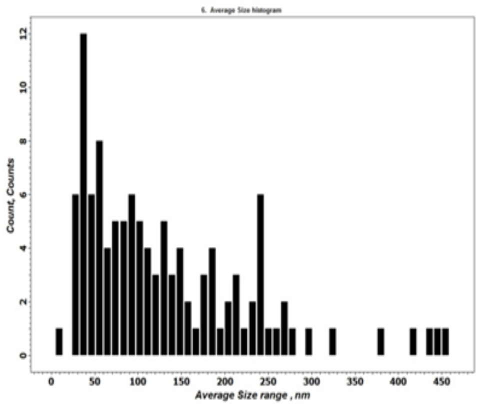

Figure 6 (b) H-istogram of size distribution of nano (Pt:NiO) catalyst.

Organic glass plates were used on the outer surface of this cell and electrodes were attached to the nano (Pt:NiO) catalyst plated Mesh (2). Hydrogen gas was released from the dissolution of water molecules in electrolysis to water to the cell through anode electrode touch a layer of the nano (Pt:NiO) catalyst, which in turn separates the hydrogen molecules into atoms, and then the protons and electrons pass through an external load cycle accompanied by the movement of hydroxide ions (OH^{-1}) from the negative electrode through the electrolyte solution of the anode electrode, oxygen molecules at the cathode, the electrode merges with the electrons that travel through the outer load circuit to form the water molecule again at the anode electrode, accompanied by an increase in the valiant cell temperature to more than 70 ° C, to obtain a power of 1.72 volts and a current density of $0.02A/cm^2$, as shown in figure7a and b .The amount of energy produced by the alkaline cell depends on the thickness and quantity of the plates. The atoms are the nano (Pt: NiO) catalyst that stimulates the hydrogen molecules and converts them into electrons in the form of energy, as well as the purity and amount of hydrogen provided to the alkaline cell. The higher the purity, the higher the energy, and the oxygen the cathode. This increases the energy and efficiency of the cell. In this paper, cell operation using oxygen from the electrolysis system was tested [13, 14].

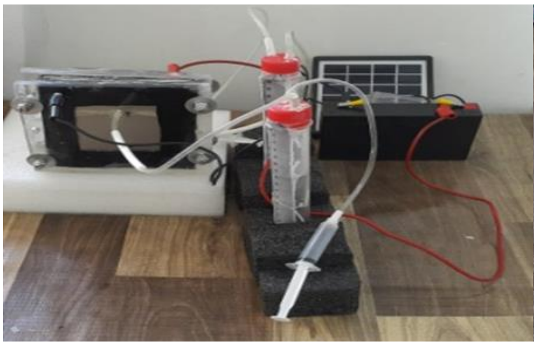

Figure 7(a)-The electrolysis method set up

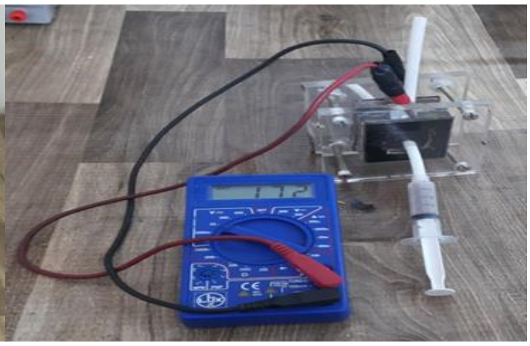

Figure 7(b)-The fuel cell

4 Conclusions

In this research, nano nickel oxide catalysts were synthesized successfully for membrane for fuel cell application. A simple chemical method was presented for producing nano (Pt:NiO) catalyst in liquid solution. Through this study it was found that the voltage of the fuel cell decreased with current for the same flow rate. While electrical conductivity increases with increasing the current but decreased with the voltage foe the same flow rate

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