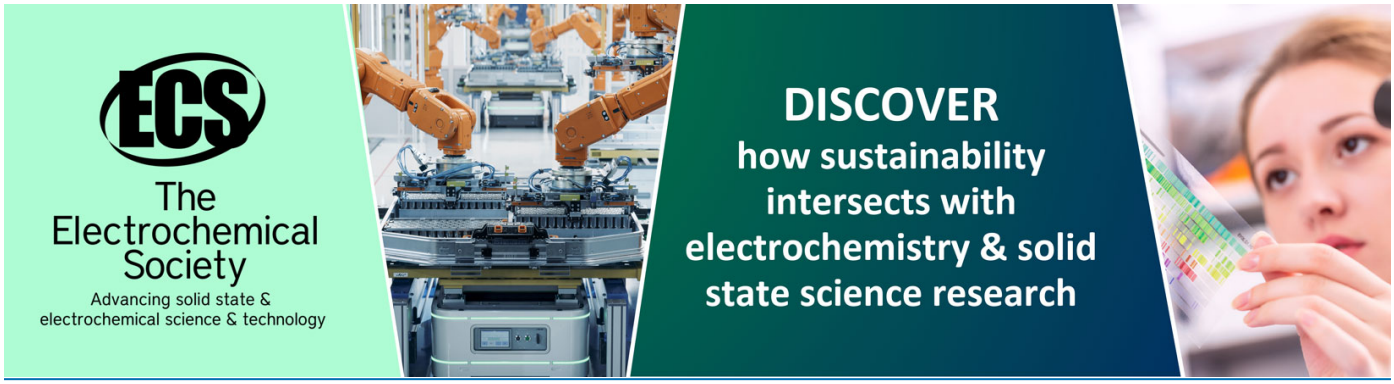
Advanced nano membrane for an alkaline Fuel Cell



Advanced nano membrane for an alkaline Fuel Cell

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Abstract. Structural and optical properties were studied as a function of Nano membrane after prepared, for tests. Nano membrane was deposited by the spray coating method on substrates (glass) of thickness 100 mm. The X-ray diffraction spectra of (CNTs, WO3) were studied. AFM tests are good information about the roughness, It had been designed electrolysis cell and fuel cell. Studies have been performed on electrochemical parameters.

Keywords. (WO3:CNTs) nano membrane, electrolysis cell, an alkaline fuel cell, X-ray diffraction, atomic force microscope.

1. Introduction

That the need for advanced alternative energy technologies in scientific and other applications, the main energy is indisputable. Among the available technologies are fuel cells, promising which are considered the best of the battery, that features high energy density, low volume, and low maintenance costs. This has helped increase demand during these years [1,2], Alkaline fuel cells (AFCs) are the oldest fuel cells developed using the KOH electrolyte solution to generate electricity from hydrogen. fuel cell technology is among the possible technologies and a promising alternative to its high efficiency and silent, modular and environmentally friendly operation because of its low emissions [3], It's also easy to manufacture and clean completely. Its emission is only water, and researchers are making efforts to improve it and reduce cost by using low cost and easy-to-make catalysts [41 Attempts to improve the performance of fuel cell nanocatalysts have prompted researchers to replace platinum catalyst because of its high cost. More work is needed to improve the activity and stability of fuel cell nanocatalysts. Low-cost tungsten oxide-based (WO3) catalysts[5], It is a wide bandgap semiconductor, in the range of Eg = 2.5-2.8eV at room temperature [6], As well as it has been studied carbon nanotubes attracted considerable attention because of their unique properties such as thermal and chemical stability, High surface area and electrical conductivity [5]. Ariyanfar Initial et al. Studied scientist electrochemical with UPS simulation engineering designs by studying electrical cooling rate parameters. Variable temperature and planned an alkaline Fuel Cells (AFCs), the cost to improve the performance of electrical power [7], Chong Luo et al Focus on the impact of carbon nanotubes on the fuel cell that is used while not requiring for noble metal and improve the performance of catalysts, as well as the synthesis of carbon nanotubes support catalyst [8]. The aim is paper to open new horizons among the field of electricity production to be a platform for the search for renewable energy sources and effective to the extent of the possibility of using these cells on a large scale and low cost. Also, because the possibility of resolving several problems related to the use of non-renewable resources.

2. Experimental work

2.1. The prepared nano (WO3) catalyst electrode

Preparation of the nano WO3. The solution was prepared by reacting tungstic acid powder with hydrogen peroxide (30%,) with 5% out of WO3. Polyethylene glycol and added into the solution. The solution was stirred for 24 hours using rod stirrer. After stirring, the solution was aged for another day and PEG (polyethylene glycol) was added into the solution for Polyethylene glycol: WO3 and mixed in 7 hours, As shown figure(1).

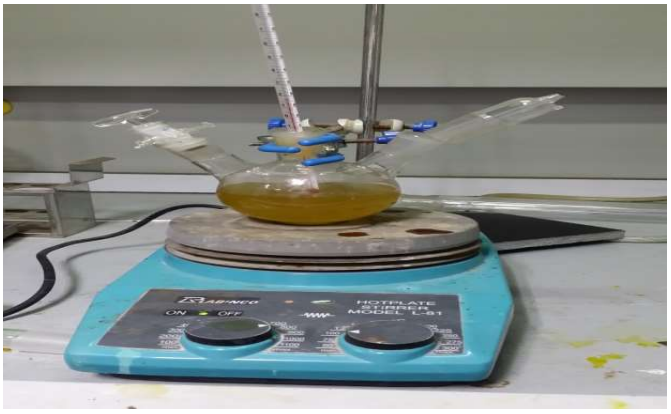

Figure 1. Preparation of nano WO_3.

2.2. The prepared nano (CNTs)

Note: I did not touch on the preparation of carbon nanotubes(CNTs) and so for publication in The 1st International Scientific Conference on Pure Science, IOP Conf. Series: Journal of Physics: Conf. Series 1234 (2019) 01200. IOP Publishing.

2.3. The prepared nano (WO3:CNTs) catalysts electrode

First, WO3 and CNTs are mixed (1: 1) by device Qsonica. LLC Sonicators for 15 minutes .in addition the mesh has been cleaned and then cut with an area of (3 x 3). pouring into a measuring mold (3 x 3) and dried.

2.4. Design of electrolyser cell

The electrolytic cell designed from two electrodes of stainless steel. Those electrodes immersed in an electrolyte solution, as shown figure (2).

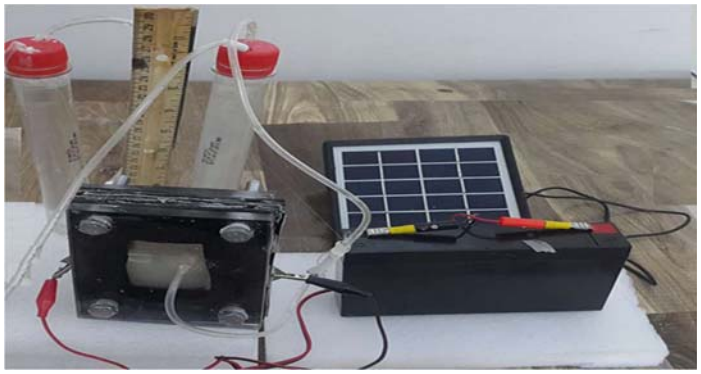

Figure 2. electrolyser cell.

2.5. An alkaline fuel cell

After prepared fuel cell nanomembrane, the fuel cell designed from two electrodes coated from these prepared materials.

3. Results and discussion

3.1. Structural properties

Membrane structures studied by X-ray diffraction (XRD) technique. It is a noncontact and nondestructive technique used to identify the crystalline phases present in materials and to measure the structural properties of these phases. X-ray diffraction measurement has been done, using Shimadzu XRD 6000, show nano membrane with a high degree of crystallite orientation. showed of obtained diffraction peaks at planes (002), (111), (211), (110),(202),(113) and (222),The diffraction peaks show good crystalline nanoparticles and match very well with ideal lattice constants .These are consistent with previous studies [9,10]**.as** shown figure (3).

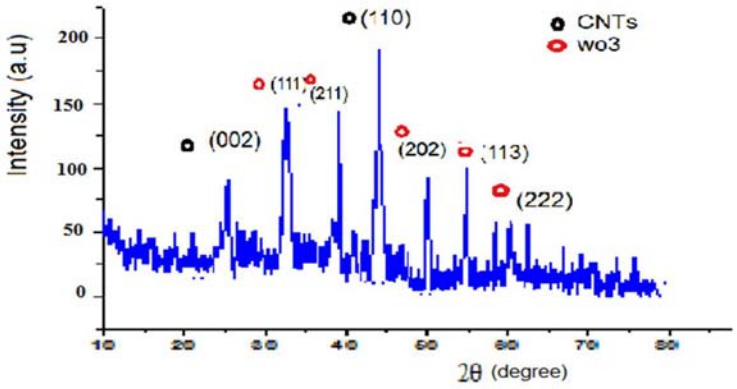

Figure 3. X-ray diffraction of nano (WO3:CNTs) membrane.

3.2. Morphological properties

The surface morphology of nano membrane were examined by AFM to show a smooth surface structure. It was found that the average particle size was changed and to be 40 nm. As shown figure (4) a, b.

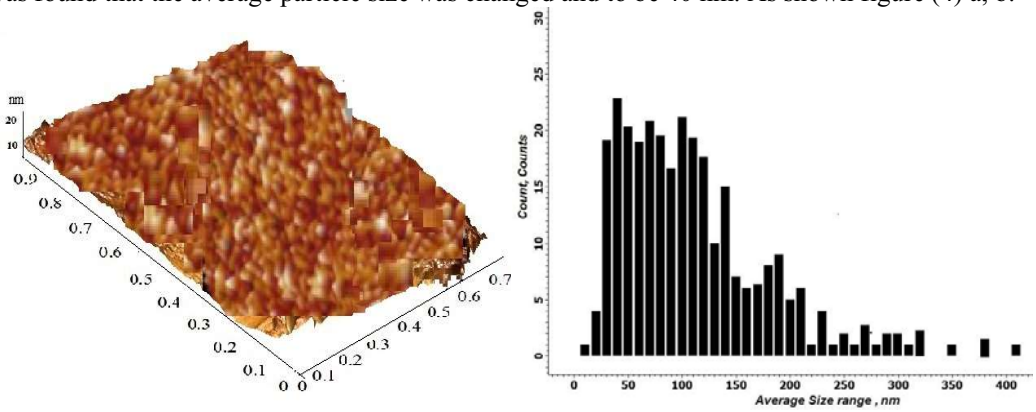

Figure 4. Atomic force microscope nano (WO3:CNTs) membrane.

3.3. absorbance for nano (WO3:CNTs) membrane

The study of absorptivity serves to know the suitable spectral range to use the material (within the studied range). The figures (5) note that the membrane peak absorbance (WO3: CNTs) appears at about 360 nm, which is closer to 340 and 400nm for reporting WO3 and CNTs. The spectra clearly showed increased absorbance with wavelength confirmation and observed the absorption of carbon greater than Tungsten oxide to permeable the high-transition Tungsten oxide material so that one can see that the membrane absorbance was less than the carbon absorption difference in absorbance ranges could be attributed to different methods of preparation of nanoparticles. The absorbance at 340 nm was changed to (WO3: CNTs) to low absorbance range: CNTs at about 400 nm in the presence of WO3 indicating a successful formation of (WO3:CNTs) nanocomposite.

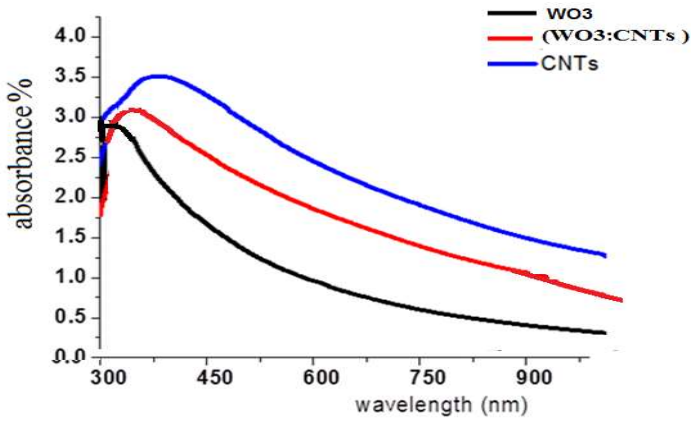

Figure 5. The absorbance spectra of nano (WO3:CNTs) membrane.

3.4. Study the parameters for an alkaline fuel cell

Hydrogen gas has been prepared by manufacturing a simple cell to analyze water electrically by adopting a small solar cell which is direct and free energy, as well as obtaining hydrogen gas with very high purity. The measurements of the volume of hydrogen have used the voltage. As the shown table (1) and figure (6).

Table 1. Show the relationship between Volume of hydrogen and Current

Volume hydrogen (ml)	**Time (min)**	***Voltage (Volts)***	**Current (A)**
0	5	6	0
1	10	6	1.2
1.4	15	6	1.6
1.9	20	6	2.2
2.7	25	6	2.5
3.9	30	6	2.9
5.5	35	6	3.1
7	40	6	3.5

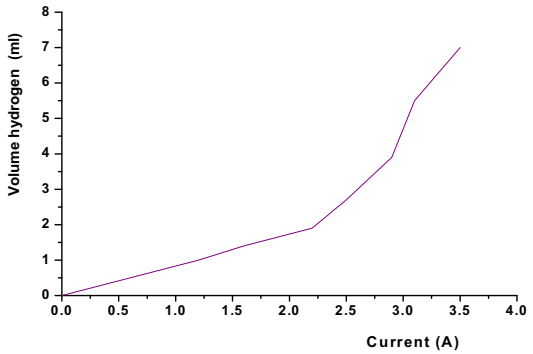

Figure 6. The relationship betweenVolume of hydrogen and Current.

The fuel cell has been assembled and manufactured from two stainless steel mesh electrodes coated with a layer of carbon nanotubes with tungsten oxide nanoparticles, in addition potassium hydroxide solution was prepared. Internal cell (3x3) while the external cell (9x9) from the organic glass with a thickness of 10 mm with three openings, one for entering hydrogen and the other for oxygen. Voltages were obtained of 1.8 volt. As shown figure (7).

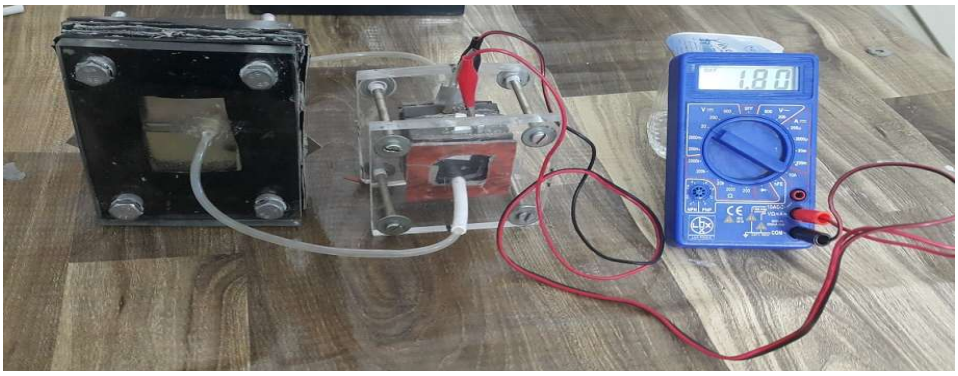

Figure 7. An alkaline fuel cell of electricity production.

4. Conclusions

1- Adopting nanotechnology to work in the field of renewable energy ,the nano catalyst was made of raw materials are available in the local market.
2- The absorbance spectrum shows the Higher absorbance and shifted toward in long wavelength CNTs.
3- All the materials involved in the manufacture of the cells are simple primary materials and cheaply available in the local market.

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