



MEMORY 2016



GENERAL INDEX

- 1 .- *Platinum nanoparticles supported on different substrates for ORR: electrolyte medium effect*
- 2 .- *DFT calculations to determine the interaction energy of a Pt cluster with sp² and sp³ carbon surfaces*
- 3 .- *Synthesis and Characterization of NiPdPt Alloy Nanoparticles for the Oxygen Reduction Reaction*
- 4 .- *Optimization operation of a parabolic through collector using artificial neural networks*
- 5 .- *Catalyst screening for photocatalytic hydrogen production using copper, nickel and titanium oxides core-shell nanostructures*
- 6 .- *Synthesis and Characterization of Pt₃Fe Alloy Nanoparticles for the Oxygen Reduction Reaction*
- 7 .- *Electrocatalysis of NiCu@Pt core-shell nanoparticles for ORR.*
- 8 .- *3D CFD modeling and experimental validation of a 10-Cell PEM fuel cell stack.*
- 9 .- *Preparation and properties of polypropylene-carbon nanotubes nanocomposites for application in bipolar plates*
- 10 .- *Hydrogen National Technologies Laboratory: Advances on design*
- 11 .- *REDUCING TIME AND COST OF THE MANUFACTURING PROCESS OF MEMBRANE ELECTRODE ASSEMBLIES*
- 12 .- *Enhance Photoactivity of Hydrogen production with mixed oxide: TiO₂-NiO as semiconductor*
- 13 .- *Hydrogen production improved mixed oxide TiO₂-ZrO₂ photocatalyst as semiconductor*
- 14 .- *STUDY OF THE DYNAMICS OF A FOUR-MODULE FUEL CELL STACK TO BE INTEGRATED IN A HYBRID ELECTRIC POWER PLANT OF A UTILITY VEHICLE*





GENERAL INDEX

- 15 .- *Computational analysis of the machining and design parameters in the flow conditions of the electrodes in the PEM Cells*
- 16 .- *Microwave-assisted green synthesis of Ag-Pd and Fe-Pd nanoparticles supported on SiC and Al₂O₃ for zinc sulfate decomposition.*
- 17 .- *Synthesis and sulfonation of graphene oxide as catalyst support for fuel cell electrodes*
- 18 .- *Evaluation of an internal combustion engine enriched by Oxyhydrogen gas generated by an Alkaline electrolyzer*
- 19 .- *Hydrogen storage in Ca-coated Nanotorus: A DFT Theoretical study*
- 20 .- *Precursor effect on graphene oxide properties for fuel cell applications*
- 21 .- *Effect of functionalization of ordered mesoporous carbon as support in cathodes for fuel cells*
- 22 .- *Catalytic activity of Pt/GO-Fe₃O₄ for oxygen reduction reaction*
- 23 .- *Hydrogen adsorption and storage in modified nano-toroidal carbon C-120 structures with boron and nitrogen elements through computational molecular simulation analysis*
- 24 .- *Effect of protective agent in the formation of palladium nanoparticles synthesized by sonochemistry*
- 25 .- *Biohydrogen production by anaerobic digestion of corn cob and stem of faba bean hydrolysates*
- 26 .- *Biohydrogen photo-heterotrophic production using dark fermentation effluents from cheese whey*
- 27 .- *Design, manufacture and validation of an alkaline hydrogen enrichment reactor for internal combustion engines*
- 28 .- *Gamma irradiation of polystyrene-co-acrylic acid copolymers to use them as membranes in fuel cells*





GENERAL INDEX

- 29 .- *Estimation of a modular control design for applications in a photovoltaic hydrogen system*
- 30 .- *Sulfonated polystyrene-co-acrylic acid membranes modified by Transmembrane Reduction of platinum*
- 31 .- *Performance Analysis of an Electrochemical Hydrogen Compressor/ Purificator*
- 32 .- *Electrochemical evaluation of Pt/GMC and Pt/rGO for the electro-oxidation of methanol*
- 33 .- *Design of a control system for an oxyhydrogen reactor*
- 34 .- *Spent battery graphite rod as electrode materials for microbial fuel cell application*
- 35 .- *Pilot-scale study on novel microbial fuel cell design for wastewater treatment*
- 36 .- *Cantarito (clay cup) modified air cathodic Microbial fuel cell for wastewater treatment*
- 37 .- *Bio-hydrogen production by SSF of paper industry wastes using anaerobic biofilms: A comparison of the use of wastes with/without pretreatment*
- 38 .- *Dehydrogenation of LiBH_4+Al as a hydrogen storage reactive hydride composite*
- 39 .- *From the can to the tank, NaAlH_4 from recycled aluminum.*
- 40 .- *Development of a PEMFC plant for a hybrid electric utility vehicle: design and construction*
- 41 .- *Ni-Pt based nanopolyhedral catalyst to the ORR and PEM single fuel cell performance*
- 42 .- *Design of a Production Line for Alkaline Electrolyzer model ECH-001 used for Marine Vessels*





GENERAL INDEX

- 43 .- *Performance of Ni-Pd-Pt catalyst in membrane-electrode assemblies for PEM single fuel cell*
- 44 .- *Ni and Ni-Cu core-shell nanoparticles: structural and electrochemical study for ORR*
- 45 .- *STARCH-DERIVED MATERIALS USED AS POTENTIAL CATALYST SUPPORT IN FUEL CELLS - A SULFUR-DOPED APPROACH*
- 46 .- *Characterization of metal hydrides tanks of a hydrogen-based energy storage system*
- 47 .- *Green synthesis of nickel nanoparticles using extract of Sargassum ssp. and supported onto carbon for the oxygen reduction reaction*
- 48 .- *Synthesis and functionalization of Ordered Mesoporous Carbon (OMC) for Microbial Fuel Cells applications.*
- 49 .- *Development of fuel cell electrodes containing Pt-Sn/C electrocatalyst deposited by the electrophoretic method*
- 50 .- *Effects of the chemical composition on the catalytic activity of Pt-Sn/C alloys for the EO*
- 51 .- *The oxygen reduction reaction on nitrogen-doped carbon supported CoSe₂*
- 52 .- *Organometallic functionalization of graphene: Novel route to form Pt-Ru alloys as electrocatalyst for Methanol Oxidation Reaction*
- 53 .- *MCFC technology for clean energy generation, carbon capture and CO₂ valorization.*
- 54 .- *Sonochemical synthesis of graphene by liquid exfoliation and its electrochemical performance for oxygen reduction reaction.*
- 55 .- *Design, manufacture and experimental validation of a miniaturized air breathing PEMFC for portable applications*
- 56 .- *Hydrogenolysis of glycerol to produce valuable chemicals: A review*





GENERAL INDEX

- 57 .- *Synthesis of graphene and nitrogen-doped graphene with electrocatalytic activity towards Oxygen Reduction Reaction*
- 58 .- *Effect of the scaling-up the reactions synthesis of the poly(styrene-co-acrylic acid) polyelectrolyte at laboratory level*
- 59 .- *Thermodynamic Analysis and Process Simulation of Syngas Production from Methane using CoWO₄ as Oxygen Carrier*
- 60 .- *Synthesis and characterization of Graphene-supported Pt-CoTiO₃ catalyst for the ORR in alkaline media*
- 61 .- *Electroless Nickel Plating Process in Electrodes for Use in Oxi-hydrogen Reactors*
- 62 .- *ALD processed ceria-based layers for SOFC and micro SOFC applications*
- 63 .- *Location of hydrogen refueling stations methodology*
- 64 .- *New low-Pt loading electrocatalysts using N-doped carbon nanotubes as support*
- 65 .- *BINDING ENERGY OF H₂ MOLECULE ON Mg_xM_{1-x} ALLOYS (M= Al, Ni, Zn; 1.0 \leq x \leq 0.8)*
- 66 .- *Electrical conductivity and performance in SPEWE single cell of Ir-Sn-Sb-O (40) mixed oxide powder catalyst*
- 67 .- *Electrochemical water oxidation by Cobalt-Iron Cyanide effect of Mix Valance State*
- 68 .- *INFLUENCE OF THE S CONTENT IN FORMATION OF SULFUR-DOPED CARBON NANOMATERIALS*
- 69 .- *Diseño de un fotobiorreactor para la producción de hidrógeno a partir de microalgas*
- 70 .- *Design and Preparation of Electrodes by Alkaline Water Electrolyser for Production of Hydrogen and Oxygen*





GENERAL INDEX

- 71 .- *ANOSTRUCTURED A-ZEOLITE CONTAINING Rb⁺ AND Cs⁺ CATIONS FOR CO₂/H₂ SEPARATION: DFT CALCULATIONS*
- 72 .- *Effect of operational perturbations on H₂ production in a microbial electrolysis cell: voltage and concentration variations*
- 73 .- *Influence of the irradiance intensity on a biofilm photobioreactor for hydrogen production*
- 74 .- *Mechanistic models for hydrogen production by photo-fermentation using an immobilized consortium of photobacteria*
- 75 .- *Biohydrogen production from wine vinasses by dark fermentation: effect of substrate concentration and pH*
- 76 .- *W₁-XM_oxO₃·0.33H₂O semiconductor oxides for photocatalytic H₂ production: A physical approach*
- 77 .- *Excited States of Cyanidin as Dye Sensitizer on Small TiO₂ Nanoclusters Used as Photocatalyst in Hydrogen Production: A DFT Study*
- 78 .- *A Photocatalyst Based in Pelargonidin 3-Glucoside as Dye Sensitizer on Small TiO₂ Nanoclusters*
- 79 .- *TiO₂ Nanostructures with Sulfur Substitution and Sensitization with Pelargonidin for Hydrogen Generation Employing DFT*
- 80 .- *Photocatalytic Properties of TiO₂ Nanostructures Sensitized with Delphinidin 3-Glucoside for Hydrogen Generation: A DFT Study*
- 81 .- *Photocatalytic Properties of TiO₂ Nanostructures with Sulfur Substitution and Sensitized with Delphinidin 3-Glucoside for Hydrogen Generation: A DFT Study*
- 82 .- *Hydrogen Production by a Fe-based Oxygen Carrier and Methane-Steam Redox Process: Thermodynamic Analysis*
- 83 .- *Water effect in the stability of a non-aqueous vanadium flow battery for energy storage applications*
- 84 .- *Photocatalytic H₂ generation by oxide based nanostructures*



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Enhance Photoactivity of Hydrogen production with mixed oxide: $\text{TiO}_2\text{-NiO}$ as semiconductor

Alejandro Pérez-Larios^{1,2,3*}, R. Gomez², R. Zanella³, J. Bedia⁴, C. Belver⁴.

¹Universidad de Guadalajara, Centro Universitario de los Altos, Depto. Ciencias Biologicas, Carretera a Yahualica km. 7.5, Tepatitlán de Morelos, Jalisco, México. 47600.

²Universidad Autónoma Metropolitana-Iztapalapa, Depto. de Química, Área de Catálisis, Grupo ECOCATAL, Av. San Rafael Atlixco No 189, D.F., México 09340.

³Centro de Ciencias Aplicadas y Desarrollo Tecnológico, Universidad Nacional Autónoma de México (UNAM), 04510, Ciudad Universitaria, D.F. México.

⁴Seccion de Ingenieria Quimica, Facultad de Ciencias, Universidad Autónoma de Madrid, Campus Cantoblanco, E-28049 Madrid, Spain.

(* alarios@cualtos.udg.mx)

ABSTRACT

The most studied processes at the present for the hydrogen production are electrochemical, steam reforming of alcohols or hydrocarbons and water splitting. Thus, the water splitting using semiconductor materials had recently acquired great relevance because of the low cost for the hydrogen production. The principle of this technique is based on the photoexcitation of the semiconductor using a UV or visible light sources.

The alternative method of photocatalytic water splitting is promising since it involves the absorption of light to produce hydrogen by irradiating oxide semiconductors. Photocatalytic systems for water splitting may contain sacrificial reagents, as methanol, commonly used in the photocatalytic evolution of H_2 from water, since its hydroxyl group captures photogenerated holes and minimizes the probability of e^-/h^+ .

In this study, Titanium dioxide doped with Nickel (1.0, 3.0, 5.0 and 10.0 % wt) by sol-gel method were obtained. The solids were characterized by nitrogen adsorption using adsorption isotherm (BET) and porosity (BJH) method, XRD patterns and UV-Vis spectroscopy. The photoactivity was evaluated using a Pyrex reactor of 200 ml using a solution Methanol-Water (1:1) and 0.1 g of catalyst. A high pressure Hg lamp (with a $\lambda=254$ nm, $I_0 = 2.2$ mW/cm²) encapsulated in a quartz tube was used as source of energy.

The results showed materials with specific surface area among 100 to 180 m²/g and mesoporosity characteristics. The XRD patterns show the formation of the crystalline anatase phase. The band gap energy (E_g) for the materials were obtained with UV-Vis spectroscopy, the E_g values were lower than 3.2 eV. In the water splitting evaluation a maximum in the efficiency was found at Ni at 10 wt.%. The hydrogen produced was 3000 μmol .

Keywords: Photocatalysis; hydrogen production; sol-gel; Titanium dioxide.