SUMMARY

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Traditional non-renewable energy suffers the accelerating consumption and the world is in an ever-urgent need for innovative solutions for a green power source. Glucose based fuel cells are a promising solution. However, the electrooxidation of glucose is a sluggish one and obtained only at a considerable overpotential at precious metals. In addition, the electrode suffers poisoning from the oxidation products. Thus, replacing the precious metal with a cheap one and/or decreasing the cost using deposition of nanoparticles with exceptional catalytic properties might be a good solution.

Catalytic properties of metal and metal oxides nanoparticles depend extensively on the morphology and the crystallographic orientation of such catalyst, in addition to the underlying substrate which could enlarges the useful use of the deposited nanoparticles and enhances the adsorption properties of glucose. In this work the fabrication of a metal nanoparticles and/or metal oxides nanoparticles on a suitable underlying substrate aiming at a superior electrocatalytic oxidation of glucose at those modified electrodes are introduced. A suitable underlying substrate, like glassy carbon electrodes, with its extraordinary high conductivity, specific surface area and chemical inertness could serve as an optimum underlying substrate for metal and metal oxides nanoparticles, especially if it is specifically functionalized with some groups that

could control the interphase properties enlarging the useful use of the deposited tailored nanoparticles.

The present thesis includes four chapters ; brief outlines of these chapters are given below;

***Chapter I*:** is the "Introduction and literature survey " part. It outlines Scope of electrochemistry of the work presented in this thesis. In addition, some applications of electrochemistry paying attention to glucose electrooxidation. Also, the literature survey of the electrocatalytic oxidation of glucose, enzymatically and non-enzymatically, on various electrocatalyst either mono, binary or ternary catalysts along with the underlying substrates commonly used is outlined.

***Chapter II*:** Experimental details including fabrication and characterization of modified electrodes, working procedures and apparatus used are given.

***Chapter III*:** Results and discussion section, it includes three parts III1, III2and III3. It presents the results regarding;

1- Fabrication of nickel oxide (NiO_x) nanoparticles catalyst modified gold (Au) electrode for the electro-oxidation of glucose in alkaline medium. The modified electrodes were morphologically and electrochemically characterized. It has been found that the electrocatalytic activity critically depends on the additive (glucose) in deposition bath.

2- A nickel oxide (NiO_x) nanoparticles modified glassy carbon (GC) electrode, designated as GC_{ox}/NiO_x (Glu), were fabricated from a nickel bath (0.02 M $NiSO_4$ + 0.03 M $NiCl_2$ + 0.03M H_3BO_3) containing a suitable additive, typically glucose, and then applied for the electrocatalytic oxidation of glucose.

3- The glassy carbon (GC) electrode casted by graphene (Gr) and then modified with (NiOx) nanoparticles is also applied for glucose oxidation.