

# The Preparing of Polyaniline- Silver Composites by Oxidation in Comparison with Polyaniline –Carbon Nanotube Composites Prepared by Electro-Oxidation for Hydrogen Sensors

Thamir A. A. Hassan , Mohammed A. Ajeel, Ali Jasim Mohammed\*

*Al-karikh university of science, Baghdad, Iraq*

\*Corresponding author: [spirijabier3@yahoo.com](mailto:spirijabier3@yahoo.com)

**Abstract.** The first series preparation of polyaniline (PANI) – silver composites by the oxidation of aniline with silver nitrate in the 0.2 and 1 mol L<sup>-1</sup> M aqueous solutions of acetic acid, the reaction condition produce a composite that have a conductivity of about 4000 S cm<sup>-1</sup> at 72 wt % (20 vol%) of silver (Ag). Scanning Electron Microscope (SEM) illustrates the formation of nanostructured Ag (nanowires) coated with polyaniline. In the second series, the preparation of polyaniline - multiwall Carbon nanotubes(MWCNTs) composites were included MWCNTs of 0.25wt %, 0.5wt % or 1wt % added to 0.1 M distilled aniline under reflex procedure with 0.3M H2SO4 (pH 4) investigated by cyclic voltammetry. A cyclic potential ranged from -100 mV to 1500 mV (scan rate of 30mV S<sup>-1</sup>) at room temperature for fabricating PANI/MWCNTs composite. Images of SEM showed that the PANI/MWCNTs Nanofiber structure with diameters has the range of 50nm-70 nm. Results of current-voltage (I-V) curves showed increase in electrical conductivity with increasing proportion of MWCNTs. PANI-silver composite which has been prepared in 1 mol L<sup>-1</sup> of acetic acid and PANI-1wt% MWCNTs composite as hydrogen sensor, the results have showed that PANI-MWCNTs sensor have more sensitivity compared to PANI-silver sensor.)

## INTRODUCTION

There are two common methods to prepare the solidified conducting polymer as (PANI) from aniline chemical direct oxidation and electro-oxidation. The composite preparation depends on the direct oxidation of aniline with silver nitrate [1,2]. Excluding one case where there is increase in reaction temperature that work as an external stimulus affecting the aniline oxidation [3]. Polyaniline (PANI)-metallic silver composites are resulted from the successful oxidation of aniline with silver ions. Figure 1 shows the structure of polyaniline-metallic silver composite. The use of nitric acid or water as a reaction medium for oxidation of aniline with silver nitrate has been reported in the literatures [1,4,5,6,7]. The development of PANI silver composites is crucial to the design of conducting patterns using the inkjet techniques [8]. The addition of metals as silver to PANI will increase the conducting of PANI [9]. Sensors based on conducting polymers for constructing it follow the same method [10]. Conducting polymers are widely used as porous catalyst supports for electro-oxidation of methanol [11]. The conducting polyaniline PANI has many advantages which made it more preferable over other conducting polymers due to high conductivity, environmental stability and relatively facile process ability [12]. The remarkable physical and mechanical properties of carbon nanotubes (CNTs) inspired interest in using it as the nano-fillers in polymer composites to enhance electrical, mechanical and optical characteristics of materials [13,14]. The formation of donor-acceptor complex can be used to dissolve the carbon nanotubes in aniline [15]. In this work, the preparation of (PANI/MWCNTs) composite has been made by electropolymerization of aniline containing well-dissolved MWCNTs. The present study reports on two different methods to obtain two types of nanocomposite materials Polyaniline- silver composites and polyaniline-carbon nanotube composites [16]. Such different methods give substantial understanding about the ability of composite structure when the composition is different especially with nanomaterials such as Ag and CNTs; the latter materials results in different structure and morphology and has direct effect on the surface area of the composite and sensitivity.