SYNTHESIS AND CHARACTERIZATION OF POLYANILINE NANOWIRES BY A NOVEL ELECTROCHEMICAL POLYMERIZATION TECHNIQUE.

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ABSTRACT

In the present work, we study the electrochemical behavior of polyaniline nanowires (PANINW) which is synthesized by two step galvanostatic technique on platinum as working electrode in three electrode system. During deposition of PANI, various process parameters Viz. concentration of dopant, applied current density and the time of deposition were optimized. The surface morphology was characterized by Scanning probe technique Viz. Atomic Force Microscopy (AFM). Polyaniline nanowire grown with diameter 130 nm and length 535 nm.

Keywords: Polyaniline nanowires, two step galvanostatic technique, surface modification.

I. INTRODUCTION

In the present day its important to monitor our environment which can produce adverse effect on flora and fauna. Therefore scientist were attracted towards the Conducting polymers due to its ease of synthesis, low power consumption, tunable conductivity [1 - 3]. Different polymerization techniques evolved in which conducting polymer synthesized by chemical oxidative polymerization which require large amount of times to carry out the reaction with the help of oxidizing agent but it is helpful to synthesize the thin film as well as an interfacial polymerization technique is utilize to produced composite film of polyaniline with the help of oxidizing agent which is quite tedious to carry out [4, 5] . Nanowires grown by template synthesis [6, 7]. PANINWs synthesize by three step electrochemical polymerization [8, 9] but Shirsat etal synthesize and bridge polyaniline nanowires between the gap of two gold microelectrodes, by simple tow step galvanostatic technique without using oxidant with less reaction time [10].

In present work, keeping the idea of two step electrochemical polymerization, PANINWs synthesize and grown on platinum working electrode (vs Ag/AgCl reference electrode). and topographical image PANINWs is recorded by Atomic Force Microscopy (Park XE 7). The electrochemical characterization performed by utilizing CH 600C electrochemical work station. A single compartment of three electrode cell containing platinum plates of dimensions 20 * 10 *0.5 mm3 were used as working & counter electrodes and saturated Ag/AgCl used as reference electrode. In electrolyte preparation aniline monomer prior to used distilled once and stored in cold environment were purchace from Sigma Aldrich. The reagent used as hydrochloric acid (HCl) of laboratory grade. In the electrolyte preparation 1 M of HCl is added drop wise with continuous stirring in 0.5 M of aniline for half an hour. This solution is used for electrochemical deposition and growth of PANINWs on platinum working electrode at room temperature.

II RESULT AND DISCUSSION:

PANINWs synthesized by two step electrochemical polymerization technique. In the first step appling constant current density of 0.9 mA/cm2 for 20 minutes to introduced PANI nuclei on to the platinum working electrode, at

this high current density effective potential at working electrode remains at 0.77 v (vs Ag/AgCl reference electrode) these PANI nuclei act as seeds for the growth of PANINWs in the second step [8]. After first step current density reduced to 0.2 mA/cm2 for 70 minutes where the effective potential drop to 0.57 v (vs Ag/AgCl reference electrode) as shown in fig. 1. during this step PANINWs are grown on the base of nuclei on the platinum working electrode which is confirmed by Atomic Force Microscopy (AFM).

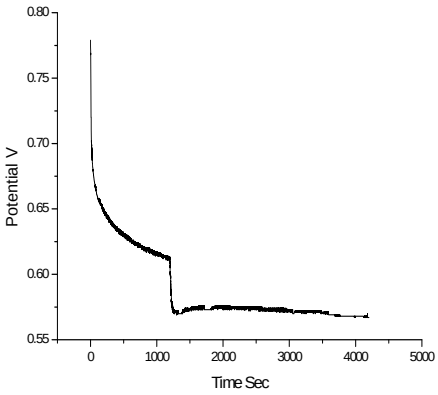


Fig.1: Plot of two step electrochemical polymerization of PANINWs.

The topography of PANINWs is obtained by using Atomic Force Microscopy shows in fig 2. Which confirms that PANINWs grown on platinum working electrode with diameter 130 nm and length of 535 nm.

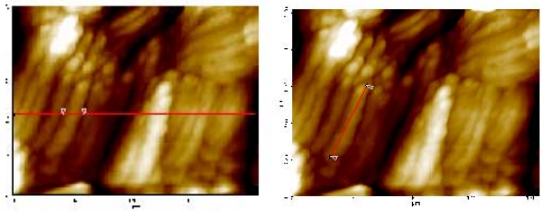
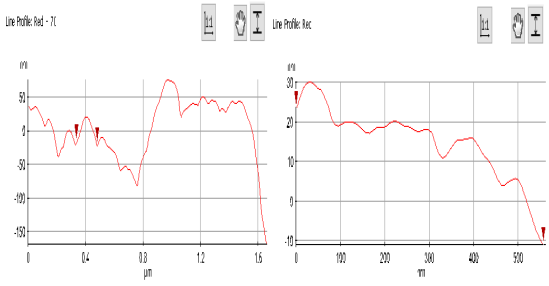
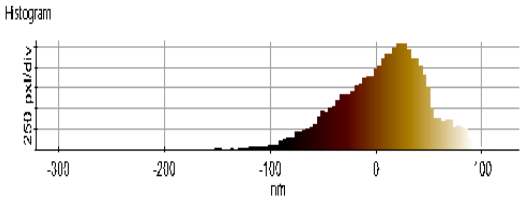


Fig. 2: Surface morphology of PANINWs by AFM



(a) (b)



(c)

Fig. 3: (a) diameter (b) Length line profile (c) Histogram shows the diameter of PANINWs by AFM.

III. CONCLUSION

Two step novel electrochemical polymerization technique is utilized to synthesis and grown of PANINWs on platinum working electrode at room temperature. This technique required less reaction time as well as do not require any oxidant compare to the chemical oxidative polymerization technique. Surface morphology of grown PANINWs studied by Atomic Force Microscopy, which confirms the growth of PANINWs of 180 nm in diameter with several micron in lengths.

IV. ACKNOWLEDGEMENT

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