Morphology study of the electrodeposited platinum nanotube

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Abstract

Nanostructures applicability in different fields such as catalytic activities or sensor applications can be affected by their morphology and structure. Deposition potential as a driving force in electrochemical process can seriously influence the deposition mechanisms and consequently the morphology and the structure of the ultimate nanostructures. Hence, among various parameters which can affect the final morphology of the nanostructures, studying the deposition potential effect on the morphology and final application of the synthesized nanostructures can be a valuable exploit.

In this study, electrochemical methods were used in order to deposit platinum nanotubes inside the pores of the polycarbonate template (with the pore size of 200 nm). First of all, the templates were sputtered with a thin layer of gold and then soaked in anchor solution containing of 3-aminopropyltrimethoxysilane. Then, electrodeposition was carried out in a solution containing of 5 mM H_2PtCl_6 and 0.1 M H_2SO_4 solved in doubly distilled water. The process was controlled by the electrochemical techniques such as voltammetry (Fig. 1-a) and chronoamperometry (Fig. 1-b) and all the measurements were recorded with respect to the Saturated Calomel Electrode (SCE). Subsequently the templates were solved in a chloroform (CH_2Cl_2) solution and the synthesized nanotubes were characterized with Scanning Electron Microscopy (SEM), Tunneling Electron Microscopy (TEM), X-ray diffraction patterns and EDX analysis. Observations indicate that the potential can seriously affect the final morphology (Fig 2) due to its effect on the kinetic behavior of the platinum reduction reactions. Potential -0.35 V was found as an appropriate potential in order to obtain reasonable electro catalytic properties.

Keywords: Platinum, Nanotubes, Electrodeposition, Morphology

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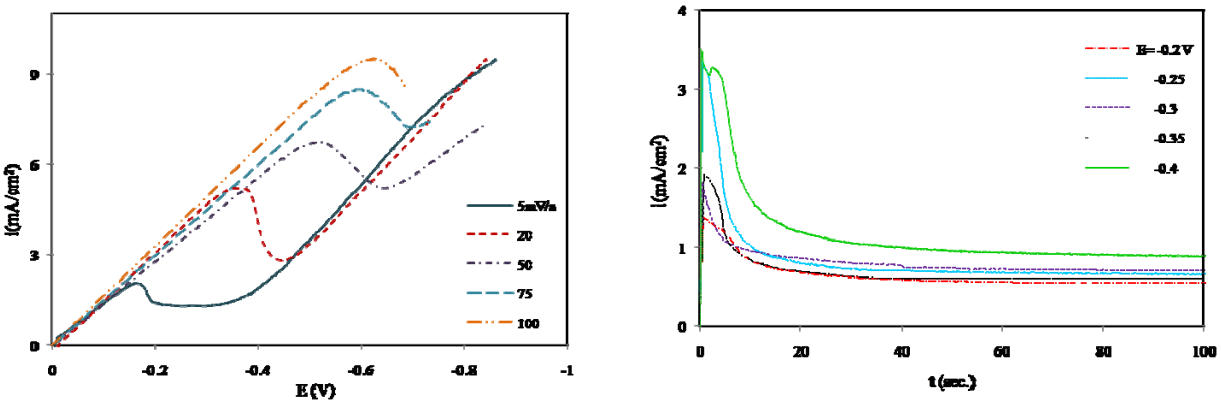
Figures



(a) (b)

Fig. 1: (a) Linear voltammograms of the platinum nanotubes in various scan rates,
(b) Chronoamperometry analysis for platinum reduction, potential from -0.2 to -0.4 V vs. SCE.

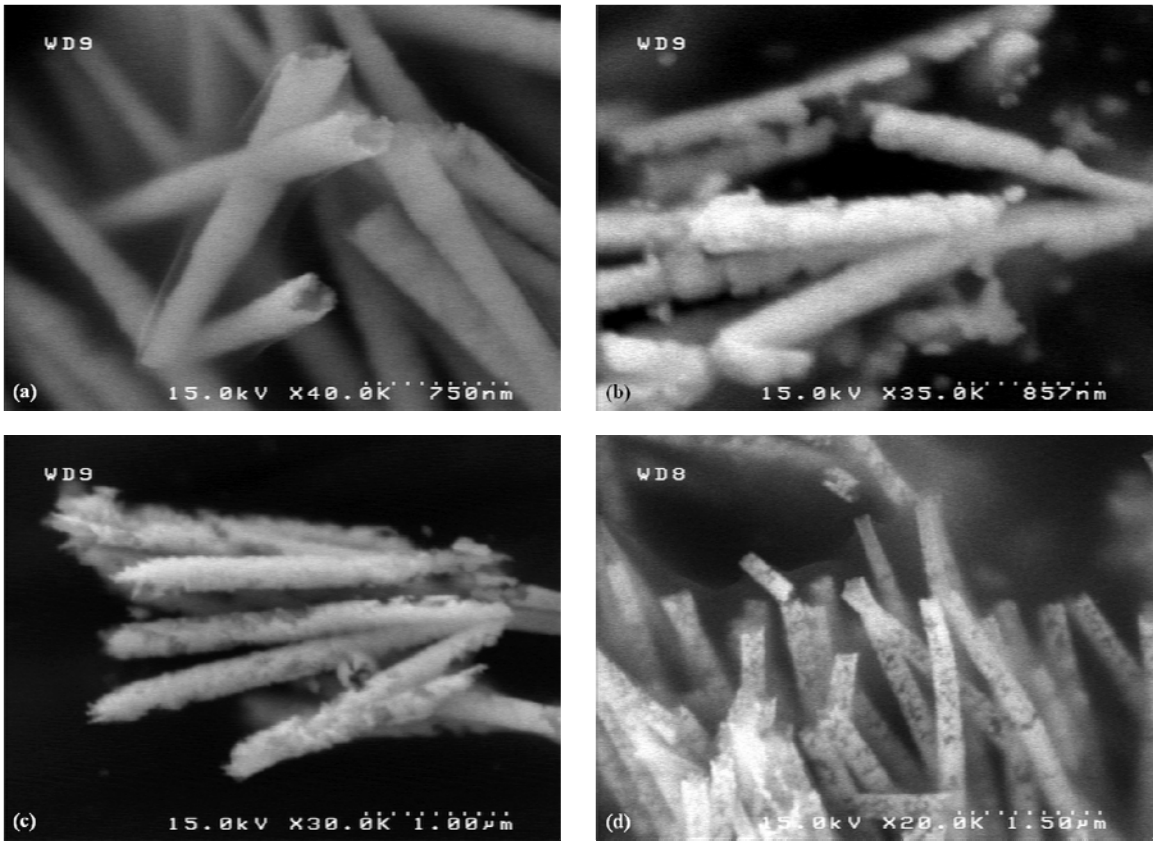


Fig. 2: FESEM results of the synthesized platinum nanotubes in various potentials vs. SCE,
(a) -0.2 V, (b) -0.25 V, (c) -0.3 V, (d) -0.35 V.