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Thin film nanostructured lead dioxide (NLD) electrodeposition in the presence of PVP: phase, morphology, and electrochemical study

Gh. Darabizad^a, M. F. Mousavi^{a*}, M. S. Rahmanifar^b

^a Department of Chemistry, Faculty of Science, Tarbiat Modares University P.O. Box 14115-175, Tehran, Iran

^b Faculty of Basic Sciences, Shahed University, Tehran, Iran
mousavim@modares.ac.ir or mfmousavi@yahoo.com

Several studies have been done on synthesis of lead dioxide which shows tremendous effect of morphology on different applications [1, 2]. The morphology of lead dioxide synthesized depend on various factors such as kind of substrates[3], the electrochemical method used[4] and deposition conditions including use of additives such as surfactants[5]. The different morphologies of NLD were investigated by means of variation in polyvinylpyrrolidone (PVP) concentration and the relationship between the morphology of the lead dioxide and performance of lead acid battery was investigated. The synthesis of lead dioxide was done under constant current density on Ti substrate from solutions containing Pb(NO₃)₂, NaF and HClO₄ at different percents of PVP. Cyclic voltammetry (CV), charge-discharge tests was used for evaluation of electrochemical behavior of system. Atomic force microscopy (AFM), Scanning electron microscopy (SEM), and X-ray diffraction (XRD) was used for characterization of morphology and roughness and phase composition. XRD results showed that all samples were composed of β -PbO₂ and α -PbO₂. According to the galvanostatic charge-discharge tests, synthesized sample in the presence of 3% PVP showed good result. Based on SEM images, electrodeposited PbO₂ at the presence of 3% PVP has uniform shape and size of the particles is between 20-60 nm. Roughness of the optimized sample is obtained 22 nm. The voltamograms of the samples show two anodic peaks that relate to β -PbO₂ and α -PbO₂.

Reference

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