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Co-synthesis of CuO-ZnO nanoflowers by low voltage liquid plasma discharge with brass electrode

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Abstract

Transition metal oxides CuO-ZnO nano-flowers have been simultaneously synthesized by the low voltage liquid plasma discharge method using brass cathode. The effects of discharge statue (normal and abnormal glow discharge) on the nanostructures were investigated. It was found that a lower discharge voltage 52 V in the normal glow discharge period is beneficial to produce homogeneous nano-flower structures while a higher voltage tend to result in inhomogeneous products including larger particles. The obtained products were characterized by SEM, XRD, high-resolution TEM, Raman and XPS. Moreover, the nano-flowers exhibit a favorable electrocatalytic activity of glucose oxidation.

Keywords: Liquid plasma discharge; Electrochemical discharge; CuO-ZnO; Synthesis; Nano-flowers.

1. Introduction

Transition metal oxide nanoparticles have attracted increased attention due to their novel and complex properties [1, 2]. Nano-crystalline CuO have been used in a broad range of areas [3, 4], such as micro-electro mechanical system (MEMS) [5] and catalysis [6] owing to their specific morphology, high surface-to-volume ratio and narrow band gap of 1.2 eV as a p-type semiconductor [7, 8]. In contrast, ZnO nanoparticles have a wide direct band gap of 3.37 eV and a large exciton binding energy of 60 eV, which make them important materials in electronic and photonic semiconductor [9, 10]. Due to the matched energy-band structure between CuO and ZnO, CuO-ZnO composite system has attracted much attention and has been proposed for various application, including catalysis [11, 12] and sensors [13, 14],