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Template-free synthesis of mesoporous ZnCo_2O_4 nanosheets and quasi-cubes via a simple solvothermal route

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Abstract: Porous ZnCo_2O_4 nanosheets (NSs) were synthesized via a solvothermal method in ethylene glycol (EG) and water combined solvent, and followed by calcination in air at 400 °C for 2 h. No surfactant or template was employed during the entire synthetic process. The ZnCo_2O_4 NSs have a thickness of about 100-150 nm, and possess a BET surface area and pore size of $54.4 \text{ m}^2 \text{ g}^{-1}$ and 7.8 nm, respectively. Such porous NSs would gradually stack into quasi-cube-like microstructures with reaction time prolonging. Quasi-cubes with edge length ranging from 10 to 30 μm were produced, and NSs almost disappeared after 15 h of solvothermal treatment. It was found that the volume ratio of EG to water played important role for the final shapes of ZnCo_2O_4 . Some irregular and broken NSs were formed if less amount of EG was used, while quasi-microcubes stacked by NSs were dominant in the product as the ratio of EG to water increased to 4:1. The current approach is simple and low cost, and can be extended for preparation of other transition metal oxides in nanoscaled size and porous structure.

Keywords: Electronic materials; Semiconductors; Microstructures; ZnCo_2O_4 .

1. Introduction

In recent years, nanoscaled transition metal oxides (NiO [1], ZnO [2], Co_3O_4 [3], and etc) have received increasing attention because of their unique properties and potential applications [1, 4, 5]. However, the industrialized application of Co_3O_4 is limited because cobalt is toxic and high-cost. Therefore, several studies have been made to substitute one cobalt ion of Co_3O_4 with eco-friendly and low-cost alternative metals such as Fe, Zn, Mn, and Cu, which can also enhance some of the physical and chemical properties of the cobalt oxide.

Spinel structural ZnCo_2O_4 can be widely used in gas sensors, electrocatalysis, supercapacitors owing to their high electrochemical, rich redox reactions, low cost and environment-friendliness [6-8]. The bivalent Zn-ions

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