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Synthesis of α-Mo_2C by Carburization of α-MoO_3 Nanowires and Its Electrocatalytic Activity towards Tri-iodide Reduction for Dye-Sensitized Solar Cells

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Nanowire-shaped α-MoO_3 was synthesized on a large scale by hydrothermal route. Nanocrystalline α-Mo_2C phase was obtained by the carburization of α-MoO_3 nanowires with urea as a carbon source precursor. The phase purity and crystalline size of the synthesized materials were ascertained by using powder X-ray diffraction. The shape and morphology of synthesized materials were characterized by field-emission scanning electron microscopy (FE-SEM) and high resolution transmission electron microscopy (HR-TEM). The electrocatalytic activity of α-Mo_2C for I^-/I_3^- redox couple was investigated by the cyclic voltammetry. The synthesized α-Mo_2C was subsequently applied as counter electrode in dye-sensitized solar cells to replace the expensive platinum.

Key words: Counter electrode; Dye-sensitized solar cells; Electrocatalytic activity; Molybdenum carbide; Molybdenum oxide

1. Introduction

The development of transition metal carbides at nanometer scales has attracted increasing interest because of its potential uses in electronic and catalytic applications[1–3]. The nano-sized materials showed different physical and chemical properties compared to bulk materials. The applications of nanostructured materials depend on the shape and size distribution of the particles. The metal carbides have superior physical and chemical properties compared with metal oxides and nitrides in many aspects such as high wear resistance, thermal and electrical conductivity, high chemical stability, mechanical