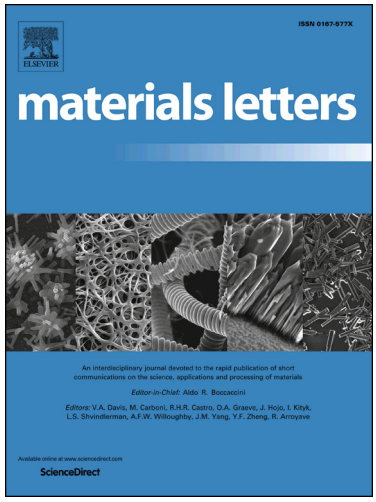

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Graphene-loaded porous $ZnCo_2O_4$ nanosheets composite as counter electrode for dye-sensitized solar cells

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Abstract

Graphene-loaded porous $ZnCo_2O_4$ nanosheets composite ($ZnCo_2O_4$/RGO) had been synthesized by annealing the precursors, which were obtained after a simple hydrothermal method. Scanning electron microscope (SEM) and transmission electron microscopy (TEM) images revealed the microstructure of as-synthesized products. Raman spectroscopy confirmed the existence of RGO in the composite. $ZnCo_2O_4$/RGO composite exhibited great electrocatalytic property for reduction of I^{3-}, which showed enormous enhancements than that of pure $ZnCo_2O_4$ and RGO. It can be ascribed to the synergetic effect between porous $ZnCo_2O_4$ nanosheets and RGO films. As counter electrode (CE) for dye-sensitized solar cells (DSSCs), $ZnCo_2O_4$/RGO composite gained power conversion efficiency (PCE) of 6.73%, which was up to 88% of that for Pt CE (7.69%).

Keywords: Composite materials; Semiconductors; Solar energy materials.

1. Introduction

Solar energy has been considered as a leading green energy. Compared with other photoelectrochemical devices, sandwich-structured dye-sensitized solar cells (DSSCs) have a series of advantages, such as simple fabrication process, earth-abundant materials, environment-friendly and considerable photovoltaic efficiency [1-3]. DSSCs structure consists of three important components, a dye-sensitized photoanode, a redox-active electrolyte and a counter electrode (CE) [4]. Amongst the three components, CE acts as a catalyst to reduce the redox couple and a electrode to transfer electronics. So the ideal CE should possess excellent catalytic activity and great electrical conductivity [5, 6]. At present, platinum (Pt) is the widely used CE material in DSSCs. Unfortunately, the disadvantages such as extremely rare and expensive restrict the large-scale commercialization of Pt [7, 8]. It is necessary to develop an alternative CE with cost-effective and good catalytic ability for DSSC. Many alternative materials such as conductive polymers [9, 10], metal sulfides/carbides/nitrides/oxides [11-15] and some carbon-related materials [16, 17] have been applied.

In this study, graphene-loaded porous $ZnCo_2O_4$ nanosheets composite ($ZnCo_2O_4$/RGO) had been

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