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High activity of Ag-doped $Cd_{0.1}Zn_{0.9}S$ photocatalyst prepared by the hydrothermal method for hydrogen production under visible-light irradiation

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Abstract

Background: The hydrothermal method was used as a new approach to prepare a series of Ag-doped $Cd_{0.1}Zn_{0.9}S$ photocatalysts. The effect of Ag doping on the properties and photocatalytic activity of $Cd_{0.1}Zn_{0.9}S$ was studied for the hydrogen production from water reduction under visible light irradiation.

Results: Compared to the series prepared by the co-precipitation method, samples prepared by the hydrothermal method performed with a better photocatalytic activity. The sample with the optimum amount of Ag doping showed the highest hydrogen production rate of 3.91 mmol/h, which was 1.7 times higher than that of undoped $Cd_{0.1}Zn_{0.9}S$. With the Ag doping, a red shift in the optical response was observed, leading to a larger portion of the visible light absorption than that of without doping. In addition to the larger absorption in the visible-light region, the increase in photocatalytic activity of samples with Ag doping may also come from the Ag species facilitating electron–hole separation.

Conclusion: This study demonstrated that Ag doping is a promising way to enhance the activity of $Cd_{0.1}Zn_{0.9}S$ photocatalyst.

Introduction

The development of clean and renewable hydrogen energy through a sustainable production process is still a big issue to be addressed. Solar energy is a very attractive option as it is the most abundant energy. The conversion of solar energy to chemical energy by photocatalytic processes, such as photocatalytic water reduction in the presence of semiconductor photocata-