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Effect of liquid phase plasma on photocatalysis of water for hydrogen evolution

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ABSTRACT

This study examined the effects of liquid phase plasma irradiation on the photocatalytic decomposition of water for hydrogen evolution. TiO_2 and metal-loaded TiO_2 nanocrystallites were introduced as photocatalysts. Na-Y zeolite was applied as a support for the TiO_2 nanocrystallites. The photocatalytic activities of the photocatalysts were estimated for hydrogen production from water. Hydrogen evolution appeared in the photodecomposition of water without photocatalysts. This was caused by the decomposition of water by plasma irradiation in water directly. The hydrogen evolution efficiency improved with increasing conductivity of water. The rate of hydrogen evolution was increased by the metal loading (Ni, Co, Fe) on the TiO_2 surface. Na-Y zeolite can be used as an efficient photocatalytic support for the fixation of TiO_2. The TiO_2 nanocrystallites were incorporated above 40 wt% on Na-Y support.

Introduction

Photocatalysis is a favorable method for hydrogen production because it can use solar energy sustainably and efficiently. This process is attractive economically more conventional methods compared to steam reforming process and water electrolysis [1,2]. Photocatalytic water splitting is an effective method for converting solar energy to hydrogen as clean and renewable hydrogen energy [3–5]. Many studies have been attempted to develop a photosensitive catalysts under UV as well as visible light illumination [6–9]. Recently, the development of the visible light sensitive photocatalysts for the hydrogen generation from water has attracted considerable attention [9–15]. In addition, the light sources and photocatalysts are very important in a photochemical reaction. Although a range of light sources have been employed in photocatalysis, there are few reports on photocatalysis using liquid phase plasma (LPP) by irradiation into water directly [16].

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