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PHYSICAL CHEMISTRY OF NANOCLUSTERS AND NANOMATERIALS

Synthesis and Characterization of AgCl/ZnO Nanocomposites for High Efficiency Photodegradation of Methylene Blue[1]

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Abstract—AgCl/ZnO nanocomposites with different contents of loaded AgCl were synthesized by deposition-precipitation method. The analytical results showed that cubic AgCl nanoparticles supported on the surface of self-assembled nanopetals of flower-like ZnO nanostructure. The photocatalytic properties of AgCl/ZnO nanocomposites were investigated through the photodegradation of methylene blue induced by UV radiation. In this research, the AgCl/ZnO nanocomposites have higher photocatalytic activity than pure ZnO.

Keywords: AgCl/ZnO nanocomposites, X-ray diffraction, photocatalysis

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INTRODUCTION

Catalytic splitting of water induced by ultraviolet (UV) was reported by Fujishima and Honda [1]. Photocatalysis by semiconductors has been under intensive study and was considered as one of the most interesting techniques through the degradation of pollutants. The semiconducting photocatalyst has been focused on organic and mineralization pollutant removal from wastewater containing paints, textiles, waste of metallurgical industries because it is an environmental and cost-effective technology [2, 3]. ZnO, an *n*-type oxide with a wide band gap of 3.37 eV and high exciton binding energy of 60 meV, is a promising semiconducting photocatalyst owing to its thermal stability, high electron mobility, low cost, high oxidative capacity and high surface area [4–6]. Moreover, the photocatalytic activity of ZnO is low because it has a rapid recombination rate of photogenerated electron-hole pairs [4, 7]. To inhibit the recombination process in ZnO, heterostructure of wide-band gap and narrow-band gap semiconductors is created in order to enhance the photocatalytic activity [8, 9].

AgX (X = Cl, Br, I) materials have often been performed as sensitizers to enhance the photocatalytic activity of UV-responding semiconductors because they have photosensitive properties [10, 11]. Among them, AgCl has been used to incorporate with other metal oxide semiconductors by forming AgCl/oxide heteronanostructures with enhanced photocatalytic properties. The highly dispersed AgCl species can promote the separation potential of photogenerated charge carriers and the photodegradation activity of heteronanostructure interface [11, 12]. Yin et al. reported that AgCl/SmOCl composites remarkably showed the enhanced photocatalytic activity to decompose Rhodamine B within 40 min induced by simulated solar radiation [13]. Pirhashemi and Habibi-Yangjeh succeeded in synthesizing of AgCl/ZnO nanocomposites in water at 90°C by a simple one-pot refluxing method [14]. They show the degradation of methylene blue (MB) of about 3.3 and 3.5 fold greater than those of ZnO and AgCl nanostructures, respectively.

In this research, a facile one-step fabrication of novel AgCl/ZnO nanocomposites is reported. The AgCl/ZnO nanocomposites were investigated for photodegradation of methylene blue (MB) induced by UV radiation. The nanocomposites showed much

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