課題番号　　:F-13-HK-0067
利用形態　　:機器利用
利用課題名（日本語）　　:
Program Title (English)　　:Photoreaction project in the environmental remediation
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1. 概要（Summary）

We study new efforts to synthesize the Ag@AgX@Graphene (X = Cl, Br) nanocomposites, where an accelerated graphene oxide (GO) reduction and generation of Ag nanocrystals occurred simultaneously by photoreducing AgX@GO nanocomposites. Interestingly, the cubic Ag@AgCl and quasi-cubic Ag@AgBr nanoparticles were manipulated by the orientation growth of AgX nanoparticles on the amphiphilic GO template. The obtained hetero-products display enhanced plasmonic photocatalytic activity and good recycling stability toward the acridine orange (AO) pollutant under sunlight irradiation, which is ascribed to the synergistic effect of strong SPR excited by Ag nanocrystals and the conductive graphene sheet network for rapid carrier transfer and export between two components in the composite system. It is anticipated to open new possibilities in the application of graphene-based composites as the photocatalysts in environment remediation.

2. 実験（Experimental）

In this platform program, the photocurrent response tests were performed using an electrochemical analyzer (ALS/CH Instruments 852C, ALS) in a standard three-electrode system using the as-prepared samples as the working electrodes with a diameter of ~3mm, a platinum electrode as the counter electrode, and Ag/AgCl as the reference electrode. 1M Na_2SO_4 aqueous solution was used as the electrolyte. For the working electrodes, 20mg catalyst was suspended in 1mL nafion aqueous solution (2wt%); the mixtures were sonicated for 15 min to disperse it evenly to obtain a slurry. The slurry was coated onto the glass carbon electrode and dried under ambient conditions. The current–time (i–t) curves were collected at 1.0V vs. Ag/AgCl reference electrode. The intensity of sunlight irradiation was 80 mW cm^{-2} using a super solar simulator (WXS-156S-L2, AM 1.5GMM, illumination wavelength: 400nm to 1100nm) with one-sun irradiation.

3. 結果と考察(Results and Discussion)

The transient photocurrent response of Ag@AgCl and graphene involved Ag@AgCl@Graphene photocatalysts was recorded as shown in Fig. 1. Several on–off cycles via intermittent sunlight irradiation were performed. The photocurrent value of Ag@AgCl@Graphene increased rapidly to a comparatively constant value when the light was on, and the photocurrent value decreased gradually to zero when the light was off. In contrast, there scarcely existed any photocurrent density for the Ag@AgCl sample. The involvement of graphene supply transport channels for the photogenerated electrons from the conduction band of the AgCl semiconductor leads to the gradual decrease of photocurrent to zero. In addition, the fast photoresponse features also exhibited a good reproducibility during the repeated on–off cycles. Based on the above results, the proposed fabrication of heterogeneous components consisting of Ag@AgCl and gauzelike graphene sheets is a feasible strategy to develop active photocatalysts

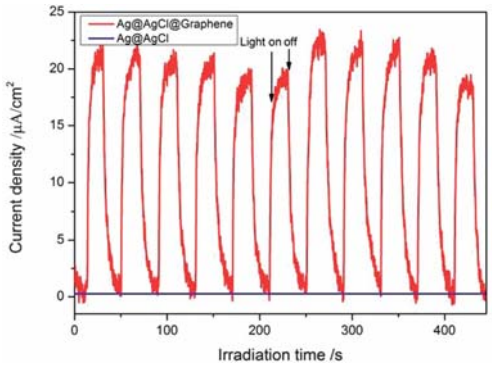

Fig.1 Photocurrent response of Ag@AgCl and Ag@AgCl@Graphene nanocomposites in 1M Na_2SO_4 aqueous solution under sunlight irradiation.

4. その他・特記事項（Others）　なし。

5. 論文・学会発表（Publication/Presentation）

Wang Y, Sun L, Fugetsu B. Morphology-controlled synthesis of sunlight-driven plasmonic photocatalysts Ag@AgX (X=Cl, Br) with graphene oxide template. Journal of Materials Chemistry A 2013;1(40):12536-44.

6. 関連特許（Patent）　なし。