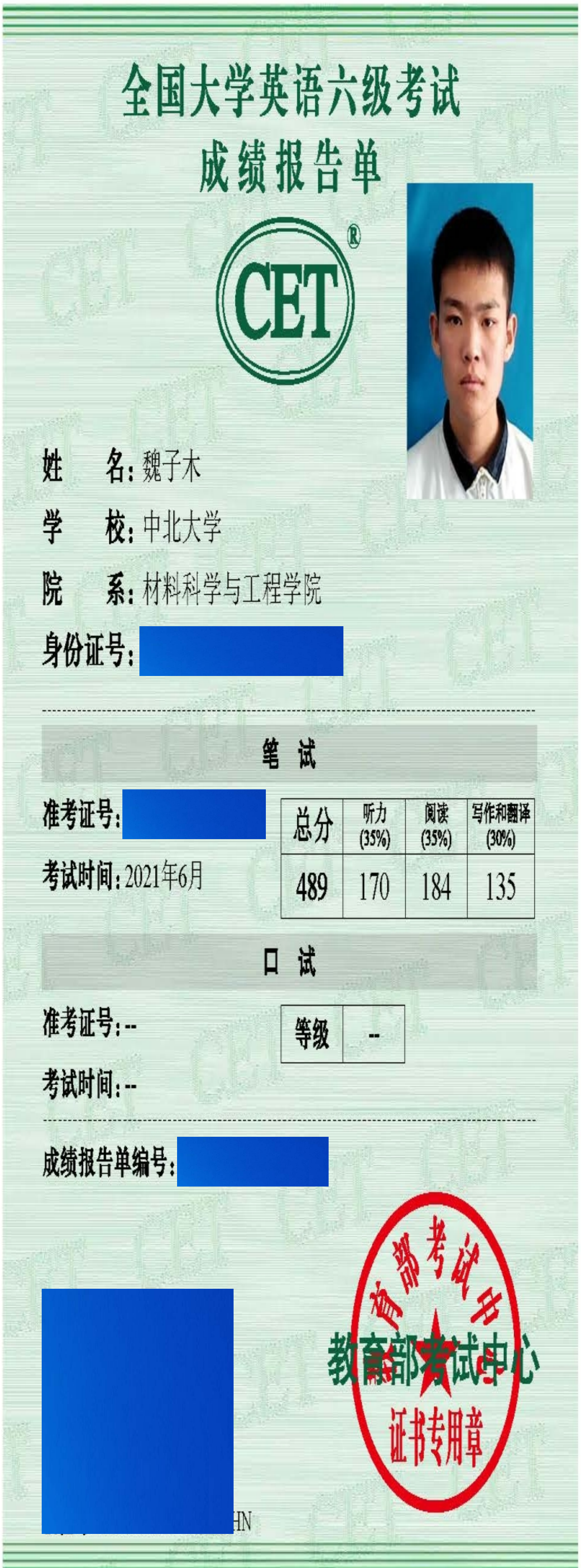
4、 外语能力证书



全国大学英语六级考试
成绩报告单

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考试时间：2021年6月

总分	听力 (35%)	阅读 (35%)	写作和翻译 (30%)
489	170	184	135

口　试

准考证号：--
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Boron-Doped BiOBr Nanosheets with Enhanced Photocatalytic Activity for Sulfanilamide and Dyes

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Abstract: A boron-doped BiOBr photocatalytic nanosheet was synthesized using a one-step hydrothermal method. The effects of solvent, temperature, and boron doping content on the morphology and photocatalytic performance were investigated. The boron-doped samples synthesized with acetic acid at 180 °C (1B-AB) showed optimal photocatalytic performance, achieving 80% efficiency in degrading sulfanilamide (SN) within 6 h. After five cycles, the degradation rate decreased by 21%. The 10% boron doping reduced BiOBr's bandgap (from 2.90 to 2.88 eV), improving visible light utilization and reducing electron–hole pair recombination. The 1B-AB photocatalyst also demonstrated excellent activity against anionic dyes like methyl orange (MO) and malachite green (MG). Hydroxyl radicals (·OH) and superoxide anions ($\cdot O_2^-$) were identified as the main active species in the SN degradation process.

Keywords: BiOBr nanosheets; hydrothermal method; compound material; visible photocatalytic degradation; degrade contaminants

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1. Introduction

Sulfonamide antibiotics (SAs) and azo dyes are prevalent organic pollutants in water sources due to their extensive use in the medical and industrial fields [1]. These compounds exhibit high environmental persistence, ecotoxicity, bioaccumulation potential, and resistance to degradation, resulting in their prolonged presence in the environment. Such persistence poses significant risks to both ecosystems and human health [2–4]. Therefore, developing efficient and sustainable technologies for the removal of persistent organic pollutants from water has become a critical challenge in the field of environmental pollution remediation [5].

Photocatalytic technology is recognized as an efficient approach for water pollutant removal, owing to its favorable characteristics such as mild reaction conditions, ease of implementation, high efficiency, environmental friendliness, and cost-effectiveness [6]. Research on photocatalysts has primarily focused on the development of various semiconductor materials, including non-metallic photocatalysts, metal sulfides, and metal oxides [7]. As a typical V-VI-VII ternary semiconductor, bismuth oxybromide (BiOBr) has become a research hotspot in the field of photocatalysis due to its remarkable visible light absorption capacity, low toxicity, and excellent photocatalytic efficiency [8]. However, the intrinsic wide bandgap and low specific surface area of pristine BiOBr limit its potential for visible light absorption and photocatalytic degradation [9]. Therefore, improving its photocatalytic

Construction of $ZnIn_2S_4$-Based Heterojunction and its Photocatalytic Applications: Research Progress①

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Abstract

Zinc indium sulfide ($ZnIn_2S_4$), a ternary metal sulfide with a unique layered structure, is gaining interdisciplinary interest for its nontoxicity, ease of preparation, excellent visible light absorption capability, and good photo-electrocatalytic performance. Despite its potential, $ZnIn_2S_4$ faces challenges like high photogenerated carrier recombination rates, poor light stability, and susceptibility to photo-corrosion. Researchers have proposed various modification strategies, with semiconductor heterojunction construction being particularly notable. This paper introduces types of $ZnIn_2S_4$-based composite material heterojunctions and focuses on their applications in photocatalysis, concluding with a summary and future outlook.

Keywords

$ZnIn_2S_4$, Heterojunction, Photocatalysis

1.Introduction

$ZnIn_2S_4$, or zinc indium sulfide, is a ternary transition metal sulfide that has garnered significant attention as a visible light-responsive photocatalyst. The inherent electronic structure of $ZnIn_2S_4$, which depends on specific synthesis processes, offers an adjustable band gap of 2.06-2.65 eV [1], which makes it responsive in the visible light region. $ZnIn_2S_4$ is free of toxic metal ions, has widely available synthesis materials, and is easy to synthesis. Its unique layered structure provides a large specific surface area conducive to photocatalytic reactions. Simultaneously, $ZnIn_2S_4$ possesses abundant active sites (such as sulfur vacancies, edge sites, and vacancies), excellent visible light absorption capabilities, and outstanding photo-electrocatalytic performance [2-4]. These advantages have generated significant interdisciplinary interest in $ZnIn_2S_4$ for applications

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Synergistic enhancement of the photocatalytic activity of g-C_3N_4 via in-situ surface alkalization and CQDs loading strategies

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ABSTRACT

The CQDs/alkaline carbon nitride heterojunction photocatalysts were synthesized employing dicyandiamide as the nitrogen material, Citric acid was used as the carbon source, while KCl and NH_4Cl were as alkaline reagents. The study investigated the influence of CQDs on the adsorption performance, photocatalytic activity, and band structure of alkalized carbon nitride. The dark adsorption results revealed that CNK/CQDs1: 12 exhibited outstanding adsorption performance, capable of degrading adsorbed pollutants in a relatively short period. The photocatalytic degradation study demonstrates that CNK/CQDs1:12 exhibits significantly higher degradation efficiencies compared to the pristine CN and alkalinized CNK samples, with degradation efficiencies of 94.4 % for Methylene Blue (MB) and 71.68 % for tetracycline hydrochloride (TC-HCl) within 60 min. This is due to the synergistic effects of alkalization of the g-C_3N_4 surface and CQDs loading, which modified the heterojunction interfacial charge transfer efficiency, suppressing the recombination of photoelectron-hole pair, extending the life span of transient photogenerated carriers, thereby improving photocatalytic activity. Free radical trapping experiment indicated that h^+ and $\cdot O_2^-$ are the primary active species during the photocatalytic degradation process of CNK/CQDs1:12.

1. Introduction

As a new contaminant processing technology, photocatalytic technology enjoys the distinct advantages of mild reaction conditions, a high degree of mineralization of organic matter, and no secondary pollution [1–3]. Among the numerous photocatalysts, the non-metal semiconductor g-C_3N_4 has garnered significant attention in the field of photocatalysis due to its advantages such as good chemical stability, low cost, ease of availability, environmental friendliness, and easily tunable electronic structure. However, the narrow visible-light-responsive region of pristine g-C_3N_4 and its inherent lattice defects lead to rapid complexation of photogenerated carriers on the catalyst surface. Surface alkalization is a facile and effective means of surface modification. Surface alkalinization modification can generate surface hydroxylation, increase the number of catalytic activation sites on the surface of photocatalysts, optimize the energy band structure, and broaden the light absorption range [4–6]. However, the issue of limited adsorption capacity still exists in alkali-modified photocatalysts. This is because, the catalytic reaction usually occurs at the catalyst surface in multiphase catalytic systems [7,8]. Hence, the adsorption of contaminants on the surface of the catalyst is critical for the following oxidation [9,10]. Excellent adsorption enables the pollutants to be closer to the active substances and facilitates the degradation of organic pollutants [8,11]. Photocatalysis after adsorption can decompose the adsorbed contaminants within a short time.

Carbon quantum dots (CQDs) represent a novel category of zero-dimensional carbon nanomaterials characterized by dimensions <10 nm, which can exist in amorphous or nanocrystalline sp^2 carbon clusters, either fused with sp^3 carbons to shape a structure similar to diamond [12]. CQDs have exhibited great potential in catalysis due to their exceptional optical properties, rich surface functional groups, and remarkable adsorption properties [12]. Moreover, owing to their superior up conversion photoluminescence and electron transfer properties, CQDs can improve how semiconductor-based photocatalysts react to visible light and facilitate the separation of photogenerated carriers [13,14]. Liu [23] prepared CQDs-loaded $ZnIn_2S_4$ photocatalysts (CQDs/$ZnIn_2S_4$), which exhibited excellent adsorption, photo-absorption, and interfacial charge transfer. CQDs/$ZnIn_2S_4$ not only displayed promising

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