The study on photocatalytic performance of Metal amorphous \( /TiO_2\) nanocomposite materials

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Abstract. Based on the composite \(TiO_2\) / metal the excellent properties of amorphous in catalytic. Found in the process of experiment, the different micro - nano amorphous particles compound nanometer anatase \(TiO_2\) dual azo dyes and other organic pollutants, under natural conditions with efficient, fast, catalytic degradation effect.

1. Introduction

In recent years, the research on the photocatalytic degradation of organic pollutant in the report. Many scholars at home and abroad in laboratory research with nanometer \(TiO_2\) treatment of organic pollutants, and made a certain progress.\(TiO_2\) due to its low price, nontoxic and high stability, can be recycling use of the advantages of popular[1-3].

\(TiO_2\) materials have good photocatalytic properties, in the light of a certain intensity can stimulate produce electrons and holes, and photocatalytic effect. The project is in prophase study, found that aluminum base amorphous composite titanium dioxide particles [4,5], can be in the natural environment, efficient implementation catalytic degradation of methyl orange degradation rate significantly promoted, created a new type catalytic degradation of azo dye method [6].

2. The experimental scheme

2.1. Micro-nano \(TiO_2\) / metal amorphous composites preparation

Materials used for Fe and Al based amorphous materials prepared by a rejection of amorphous strips, Cu by vacuum melting furnace and Zr based.Powder material used in the ball mill for amorphous thin belt and amorphous block. Before a ball mill experiment preliminary crushing material to further and better for the next experiment operation.First put the treated amorphous debris goal in grinding and argon gas is piped in, will the air discharge tank, prevent oxidation phenomenon occurring in the reaction process.Such as ball mill pot preparation is completed, the equipment used in oxygen protected by ball mill will iron-based amorphous materials according to ball mill 6 h at a speed of 250 r/min, made of amorphous metal powder, including particle size of about 50 nm-70 nm.
2.2. The preparation of nanometer titanium dioxide
USES of titanium dioxide prepared by sol gel: dissolve 5 mL tetrabutyl titanate in beaker containing 10 mL of ethanol solution, stir in 1.5 mL glacial acetic acid solution and carries on the preliminary. Put the beaker used in electromagnetic stirring device into the rotor in the beaker, then stir in 0.8 mL evaporate water to, and to control the temperature of 65 ℃ to maintain 12 h; Then, titanium dioxide material from the powder under the protection of nitrogen will product times burn 3 h under 500 ℃ [7].

For the preparation of compound powder: titanium dioxide before roasting with iron-based amorphous powder join in the ball mill for ball mill 4 h. After take out the mixed powder, the same will result in the protection of nitrogen burn 3 h under 500 ℃ times, to obtain the required product. Using the same method, the preparation of iron fund of alloy and titanium dioxide composite powder.

2.3. Test analysis
Laboratory instrument equipment are: the field emission scanning electron microscopy (sem), liquid chromatograph, ultraviolet spectrophotometer, optical profiler, ultraviolet aging test chamber, electrochemical workstation [8].

![Figure 1. Experimental analysis and characterization of equipment.](image)

3. Organization of the Text
To carry out the different micro-nano amorphous particles (Fe, Al, Cu, Zr base, etc.) with nanometer anatase TiO₂ composite catalytic organic chlorides, printing and dyeing wastewater, surfactant and microbial catalytic degradation of performance, such as observation contrast different degradation effect of composite materials, research and development new type of TiO₂ / amorphous composite synergistic catalytic material system, expand the photocatalytic technology.

3.1. Micro-nano TiO₂ / metal amorphous composites preparation
Completed the necessary Cu40, Al80 Ni20, Zr50 Cu45 - Ti5 amorphous with the preparation, selection of work. Through the observation, the choice of alloy, with good morphology to the preparation of amorphous strip.

![Figure 2. Strip of amorphous materials](image)
3.2. **Fe base amorphous powder catalytic processing experiment indoor conditions**

Fe, base amorphous strips catalytic processing experiment indoor conditions. Preparation of 1.5 g/L concentration of methylene blue, Fe, aluminum amorphous strip, 5-8 cm length in the methylene blue, (25°C) under the condition of indoor, observation of amorphous Fe base treatment effect of methylene blue solution. Preparation of 1.5 g/L concentration of methylene blue, the Fe base amorphous powder, particle size 5 um in methylene blue, (25°C) amorphous composite TiO2 powder on the treatment effect of methylene blue solution, as shown in the figure below.

![Image](image-url)

**Figure 3.** Fe amorphous powder composite TiO2 powder processing methylene blue (from left to right in turn for Fe amorphous powder, compound Fe amorphous TiO2 powder, TiO2 powder.

By above, visible and ultraviolet light conditions, Fe base amorphous composite TiO2 powder of methyl orange has good treatment effect, methyl orange is a transparent, composite powder at the bottom of the precipitation in the solution, and Fe amorphous under the condition of ultraviolet to methyl orange
also has a certain effect, but obviously not as good as the processing efficiency of compound powder, description composite powder under the condition of no uv than Fe base amorphous powder, TiO₂ powder higher processing efficiency, but under the condition of uv, Fe base amorphous composite TiO₂ powder processing efficiency.

3.3. TiO₂/Amorphous composites characterization analysis

Under the condition of room temperature (25°C), Fe base amorphous open circuit potential is poorer, electrochemical impedance has certain data, but for the polarization characteristics of amorphous correlation is not very clear, the next step focuses on consulting relevant literature, to determine the relationship between impedance and polarization characteristics.

![Figure 4. Impedance diagram of Fe/Al amorphous powder composites](image)

When the concentration of Fe amorphous too, methylene blue receive limit contact with the catalyst, the catalytic activity of Fe amorphous is restricted, can't make full use of and the addition of hydrogen peroxide, reaction with Fe amorphous generated Fe²⁺. When Fe²⁺ concentration is higher, can lead to not participate in Fenton reaction of Fe²⁺ hydrolysis precipitation affects the reaction rate.

4. Conclusion

Based on previous has and the test conditions of the test results, this project focus on the TiO₂ amorphous composites was studied catalytic degradation of methyl orange degradation conditions and influence factors, discuss the micro and nano TiO₂ base amorphous composite materials efficient catalytic degradation mechanism; Micro-explore the sun na Fe base amorphous composite nanometer TiO₂ catalytic degradation mechanism of the degradation of methylene blue, the analysis of the effect of sunlight on the degradation process.

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