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## The Up-Conversion Effect Induced NIR-Photocatalytic Performance of $\text{Bi}_{2-x}\text{Er}_x\text{WO}_6$ Photocatalysts

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**Abstract:**  $\text{Bi}_{2-x}\text{Er}_x\text{WO}_6$  photocatalysts were synthesized by a microwave solvothermal-calcination method. The  $\text{Er}^{3+}$  ions were doped into the crystal of  $\text{Bi}_2\text{WO}_6$  and the photocatalysts show an up-conversion effect of the  $\text{Er}^{3+}$  4f electrons:  $^4\text{I}_{15/2} \rightarrow ^4\text{F}_{7/2}$ ,  $^4\text{I}_{15/2} \rightarrow ^2\text{H}_{11/2}$ ,  $^4\text{I}_{15/2} \rightarrow ^4\text{S}_{3/2}$  and  $^4\text{I}_{15/2} \rightarrow ^4\text{F}_{9/2}$ . The  $\text{Er}^{3+}$  ions absorb NIR light and convert it into visible light so that extra photons and electrons-holes are generated. The degradation rates of the  $\text{Bi}_{2-x}\text{Er}_x\text{WO}_6$  photocatalyst reach 96% within 270 min and 95% within 30 min under the simulated sunlight and NIR light, which confirms the enhancement of the degradation performance by the up-conversion effect.

**Keywords:**  $\text{Bi}_2\text{WO}_6$ ,  $\text{Er}^{3+}$  doping, up-conversion, NIR, semiconductors, functional

### 1. Introduction

In recent years, environmental pollution became a serious social issue. Organic pollutants degrading with semiconductors has been valued by the researchers for low energy consumption and environment friendliness [1-3]. With advantages of the desirable energy band structure, the favorable photoresponse range, and non-toxicity,  $\text{Bi}_2\text{WO}_6$  [4] has been one of the most promising photocatalysts.

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