

High photocatalytic performance of $\text{ZnGa}_2\text{O}_4/\text{Ga}_2\text{O}_3$ double shell hollow sphere structure prepared by one-step hydrothermal method

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1. Preparation of $\text{ZnGa}_2\text{O}_4/\text{Ga}_2\text{O}_3$ heterojunction

The specific steps are as follows:

(1) The precursor HS-Z obtained in 2.2.1, GaCl_3 and triphenylamine ($\text{C}_{18}\text{H}_{15}\text{N}$) were dissolved in 40 mL DMF in different proportions as shown in Table S1, and stirred evenly. Since HS-Z is already obtained, it is only necessary to generate the precursor of Ga_2O_3 on its surface. Therefore, the hydrothermal temperature is set to 240 °C and the hydrothermal time is set to 8 h. It should be noted that the ratio in the table is the ratio of GaCl_3 and HS-Z, and ZG0 is a ZnGa_2O_4 double-shell hollow sphere obtained by direct annealing of HS-Z. The GO sample is a precursor of GaCl_3 and $\text{C}_{18}\text{H}_{15}\text{N}$ hydrothermal preparation, and Ga_2O_3 quantum dots are obtained by annealing at the same temperature.

(2) After the hydrothermal reaction, the precipitate is centrifugally washed and dried. The product was heated at 2 °C/min, held for 2 h at 600 °C, and then cooled naturally. The $\text{ZnGa}_2\text{O}_4/\text{Ga}_2\text{O}_3$ heterojunctions with different composite proportions can be obtained.

Table S1 Amounts of the reagents used to prepare the samples.

Sample Name	Ratio	GaCl ₃ /mol	C ₁₈ H ₁₅ N/mol	HS-Z/mol
ZG0	0:1	0	0	0.003
ZG1	1:1	0.003	0.003	
ZG2	2:1	0.006	0.006	
ZG3	3:1	0.009	0.009	
ZG4	4:1	0.012	0.012	
GO	1:0	0.003	0.003	-