Electronic Supplementary Material (ESI) for Catalysis Science & Technology.

SUPPORTING INFORMSTION

Three-dimensional bandgap-tuned Ag_2S quantum dots/reduced graphene oxide composites with enhanced adsorption and photocatalysis under visible light

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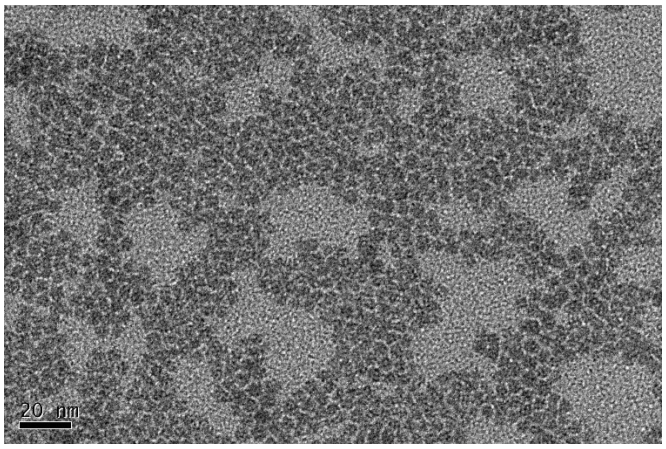

Figure S1. TEM image of the as-synthesized Ag_2S quantum dots.

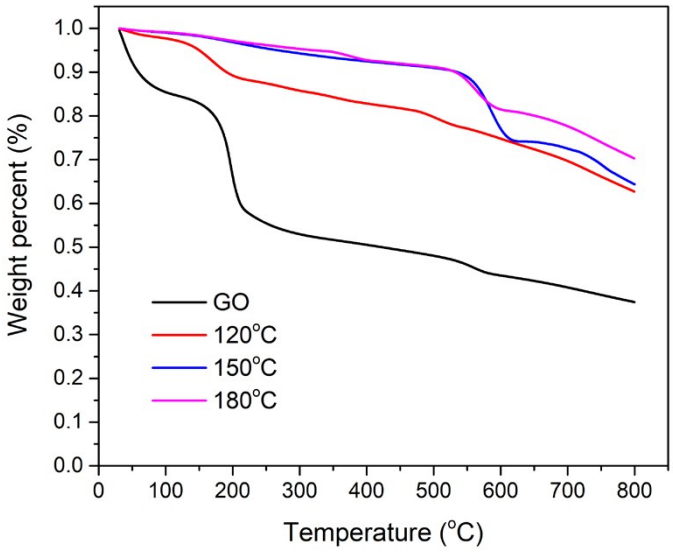

Figure S2. Thermogravimetric analysis of GO and as-synthesized composites.

Thermogravimetry experiment was conducted to further analyze the thermal stability and decomposition of GO and the as-prepared composites. The results are shown in Figure S2. As to GO, the weight loss before 100°C is mainly attributed to the evaporation of adsorbed water molecules. With the increasing temperature, the second weight loss between 150°C and 250°C is caused by the labile oxygen functional groups. In contrast, this loss process isn't observed in all the synthesized composites, implying a change of the surface groups. The 120°C sample shows a

weight loss between 100°C and 200°C, which is similar with our previous research caused by the Ag_2S QDs surface molecules such as thioglycollic acid. The 150°C and 180°C samples don't show a distinctive weight loss until at 500°C, which might be assigned to a more stable structure connecting Ag_2S QDs and rGO.

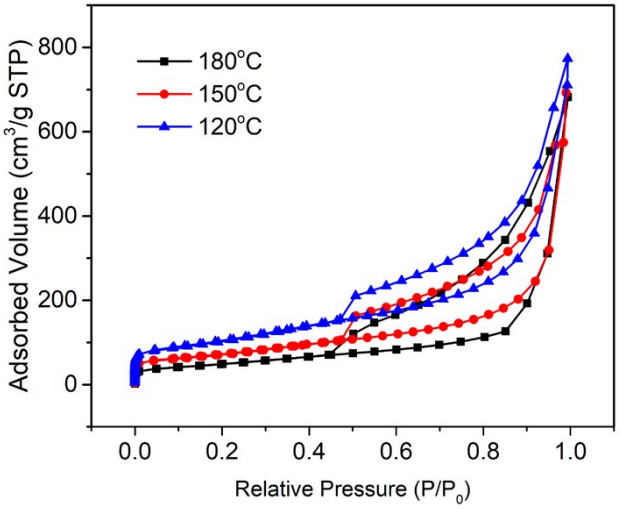

Figure S3. Nitrogen adsorption-desorption isotherms for as-synthesized composites.

Nitrogen adsorption-desorption isotherm curves of as-synthesized composites at different temperatures have been carried out to investigate the specific surface area, as shown in Figure S3. According to IUPAC classification, all the three isotherm curves belong to typical type IV isotherms, with obvious adsorption hysteresis. The BET (Brunauer-Emmett-Teller) surface area values then were calculated based on these isotherm curves. The 120°C sample has the largest surface area value of 374.1 m^2/g, while 150°C and 180°C are 277.1 m^2/g and 185.4 m^2/g, respectively. This decreasing trend of surface area along with increasing temperature is consistent with the adsorption property for methyl orange of different samples, which may be attributed to the increasing deposition of Ag_2S QDs and the decrease of porosity. The hysteresis loops of as-synthesized composites, which occur at P/P_0 range from 0.5 to 1.0, all belong to type H3. These

phenomena suggest the presence of slit-like pores and formation of mesoporous structure, which should be caused by the aggression of Ag_2S QDs on the graphene surface.

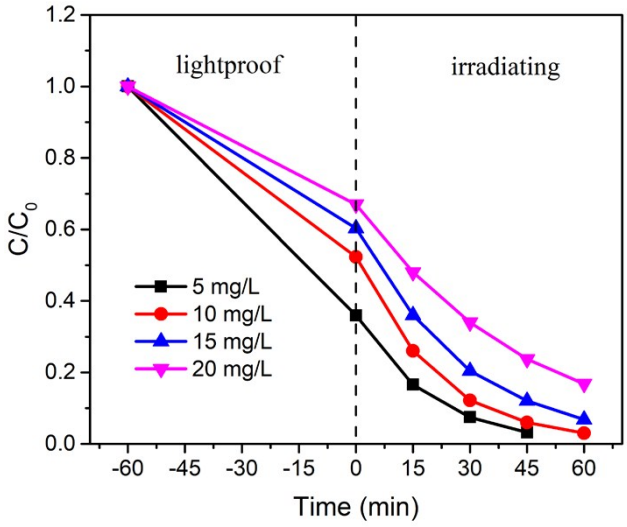

Figure S4. The effect of initial concentration of RhB on the photocatalytic activity of Ag_2S QDs/rGO nanocomposite obtained at 150°C.

In order to further investigate the photocatalytic property of as-synthesized composites, we measured the degradation efficiency for different initial concentrations of RhB using 150°C sample as the catalyst under visible light irritation. As shown in Figure S4, the dye concentration varies from 0.05 to 0.2 mg/L with fixing solution amount at 300 mL and composite amount at 0.03g. As to 5 mg/L condition, over half amount of RhB is adsorbed during dark period and the degraded amount increases over 95% in 45 min. As the initial concentration of RhB increases, the degradation efficiency inclines to decrease, with only about 82% being decomposed on the condition that the initial concentration is 20 mg/L. This tendency may be attributed to the competition of adsorption between dye molecules and dissolved O_2 onto the catalyst surface. With more dye molecules exist on the photocatalytic sites, it will be more difficulty for O_2, an essential electron acceptor during photodegradation process, to adsorb onto the catalyst surface

and participate in the reaction.

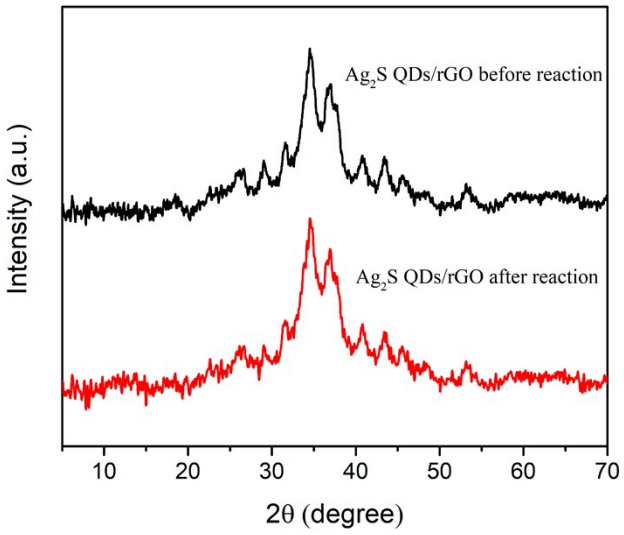

Figure S5. XRD patterns of Ag_2S QDs/rGO composite obtained at 150°C before and after four consecutive photocatalytic reactions.

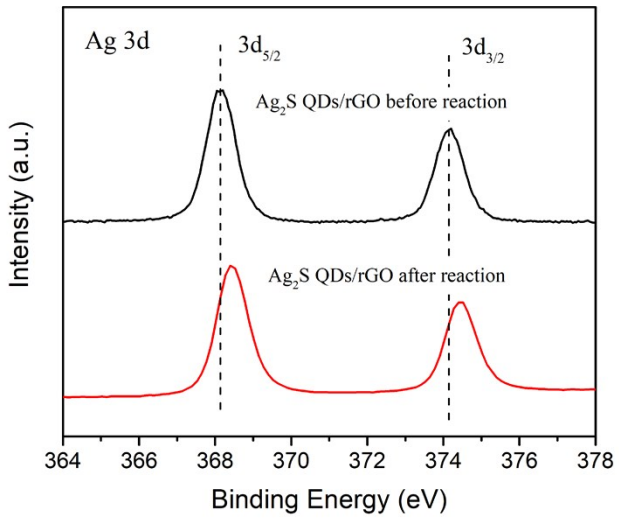

Figure S6. XPS high-resolution spectra of Ag 3d of Ag_2S QDs/rGO composite obtained at 150°C before and after four consecutive photocatalytic reactions.

Table S1. The summary of the liner fit between ln(C/C_0') and Time (min).

	Intercept		Slope		Statistics
sample	Value	Standard Error	Value	Standard Error	Adj. R-Square
TiO_2	-0.00243	0.0021	-0.00512	5.72596E-5	0.9995
120	-0.00263	0.00236	-0.01135	6.42906E-5	0.99987
150	0.01986	0.01786	-0.03971	4.85985E-4	0.9994
180	-0.00505	0.00415	-0.01213	1.12827E-4	0.99965
Bulk Ag_2S	-2.85153E-4	2.07738E-4	-2.71812E-5	5.65392E-6	0.84681