Electronic Supplementary Material (ESI) for Journal of Materials Chemistry A

Electronic Supplementary Information

Synergetic effect of sulfonated graphene and silver as co-catalysts for highly efficient photocatalytic hydrogen production of ZnO nanorods

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Electronic Supplementary Information

Experimental details

Synthesis of ZnO, ZnO/Ag and SG/ZnO: For the synthesis of pure ZnO, 330 mg of $Zn(CH_3COO)_2 \cdot 2H_2O$, 210 mg of HMTA and 50 mL of DI water were mixed together. The mixture was stirred for 1 h and then transferred to 100 mL glass bottle. Finally, the glass bottle was heated to 95 °C for 10 h. The precipitate was washed with ethanol and water thoroughly, and then dried for further usage. For the synthesis of Ag/ZnO composites, 100 mg of ZnO was dissolved in 25 mL of EG under ultrasonication and the mixture was put in 100 mL three-necked flask. The flask was heated to 160 °C under vigorous stirring for 30 min. Then, 5 mL EG containing well dissolved $AgNO_3$ of 20 mg was injected into the hot mixture slowly over a period of 10 min. The mixture was kept for another 30 min and let it cool down to room temperature naturally. Finally, the product was washed with DI water and ethanol for several times. For the synthesis of SG/ZnO composites, 15 mg of SG was well dissolved in 10 mL of ethanol under ultrasonication for 30 min. 48 mg of $Zn(CH_3COO)_2 \cdot 2H_2O$ (0.03 M) was added into the homogenous SG solution and the mixture was stirred for 1 h. The resulted solution was centrifuged and washed with ethanol for twice. Then, the precipitate was annealed at 300 °C for 1 h to form ZnO nanocrystal seeds on SG sheets. Thereafter, SG/ZnO nanocrystal seeds were mixed with 330 mg of $Zn(CH_3COO)_2 \cdot 2H_2O$ (0.03 M), 210 mg of HMTA and 50 mL of DI water.

Electronic Supplementary Information

The mixture was stirred for 1 h and then transferred to 100 mL glass bottle, which was heated to 95 °C for 10 h. SG/ZnO can be obtained by washing the precipitate with ethanol and water.

Table S1 Element analysis of the SG/ZnO/Ag composite.

Element	Weight%	Atomic%
C	38.74	63.23
O	20.82	25.51
Zn	33.70	10.11
Ag	3.68	0.67
Si	0.30	0.21
Pt	2.76	0.27
Total	100.00	100.00

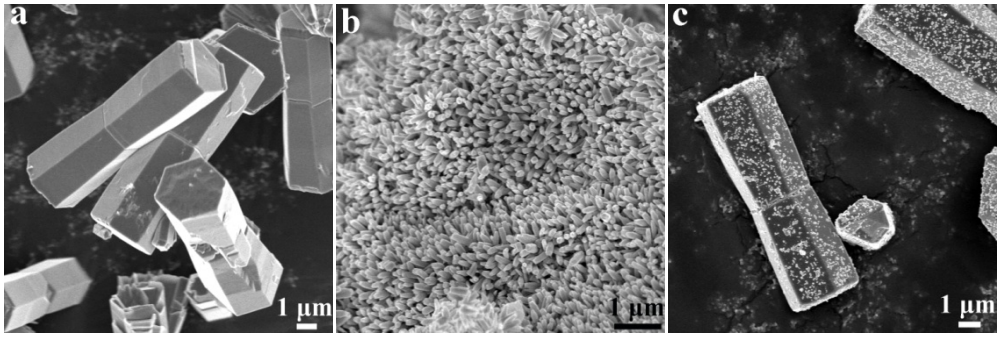

Fig. S1 (a) FESEM image of ZnO rods; (b) FESEM image of SG/ZnO composites; and (c) FESEM image of ZnO/Ag composites.

Electronic Supplementary Information

Table S2 Surface area of synthesized samples.

Sample name	Surface area (m^2 g^{-1})
ZnO	**5.34**
ZnO/Ag	**12.57**
SG/ZnO	**42.63**
SG/ZnO/Ag	**48.52**

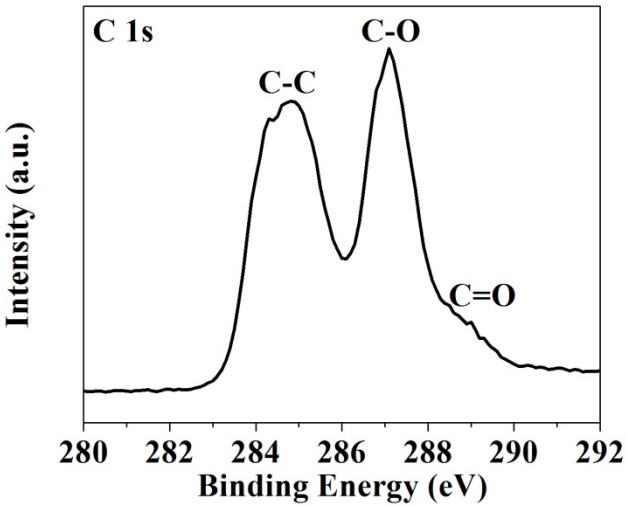

Fig. S2 High resolution XPS spectrum of C 1s from GO.

Electronic Supplementary Information

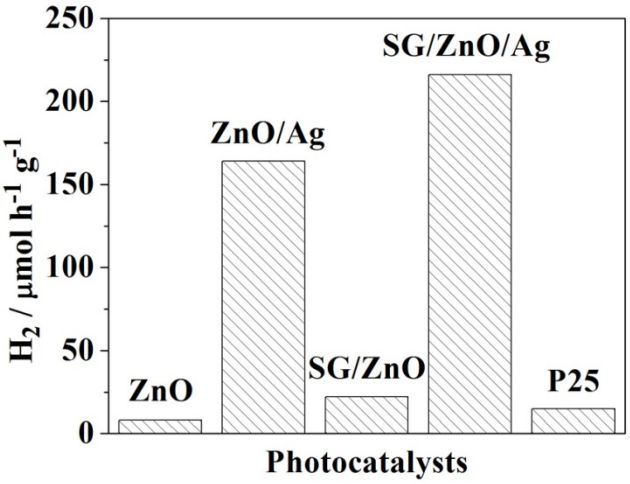

Fig. S3 Hydrogen evolution rate of ZnO, ZnO/Ag, SG/ZnO, SG/ZnO/Ag and P25, respectively, under simulated solar light.