Supplementary Information

One-pot hydrothermal synthesis of mesoporous $Zn_xCd_{1-x}S$/ Reduced graphene oxide hybrid material and its enhanced photocatalytic activity

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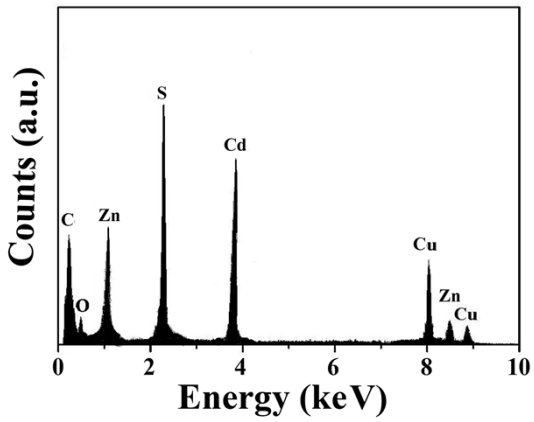

Fig. S1. The EDX spectrum for $Z_{4.0}CSG$.

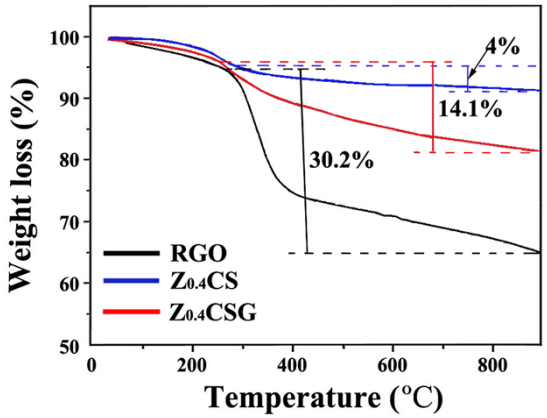

Fig. S2. TGA curves for pure RGO, pure $Z_{0.4}CS$, and $Z_{0.4}CSG$ hybrid materials.

The thermo-gravimetric analyses (TGA) have been carried out to determine the Z_xCS and RGO content in Z_xCSG hybrid materials [1]. The weight loss for pure RGO, pure $Z_{0.4}CS$ NPs and $Z_{0.4}CSG$ hybrid material as the representative samples are analysed, as shown in Fig. S2. When the temperature is lower than 300 °C, the weight losses mainly come from the absorbed water and oxygenated function groups (such as -COOH, -OH) for pure RGO, and the absorbed water for $Z_{0.4}CS$. The weight losses for pure RGO and pure $Z_{0.4}CS$ are mainly caused by the oxygenolysis from 300 to 800 °C, which are the 30.2 wt % and 4.0 wt %, respectively [2, 3]. The weight loss for

$Z_{0.4}$CSG hybrid material is about 14.1 wt% from 300 to 800 °C. Therefore, the weight ratio of the RGO in $Z_{0.4}$CSG is estimated according to the correlation of the weight loss from $Z_{0.4}$CS NPs and $Z_{0.4}$CSG between 300-800 °C. The estimated RGO content in $Z_{0.4}$CSG by TGA is about 10.1 wt%, and the residual weight of 89.9 % should be the weight of $Z_{0.4}$CS NPs. The Z_xCS and RGO content in other samples are also estimated in the same way, and the results are shown in Table 2.

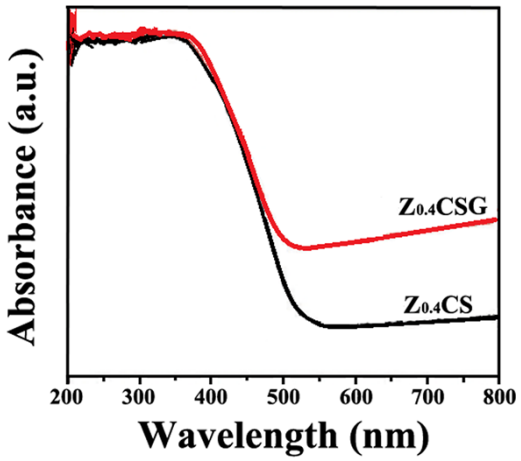

Fig. S3. UV-vis diffuse reflectance spectra of $Z_{0.4}$CS NPs and $Z_{0.4}$CSG

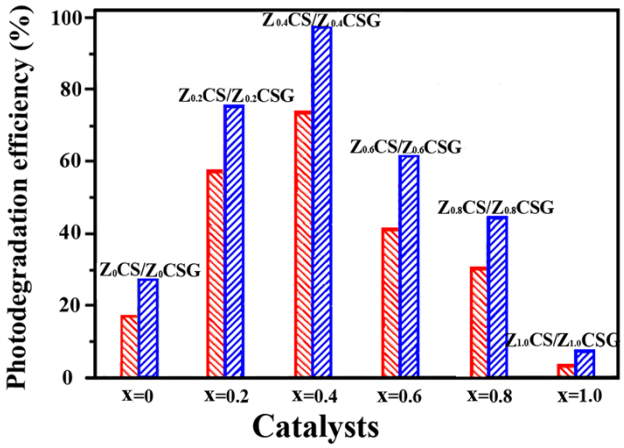

Fig. S4. Comparison of degradation efficiencies for Z_xCS NPs and Z_xCSG under VL irradiation

Table 2. The RGO and Z_xCS content in Z_xCSG hybrid materials (wt %)

Sample	Z_xCS	RGO	weight ratio for Z_xCS and RGO
Z_0CSG	88.7	11.3	7.8:1
$Z_{0.2}CSG$	89.5	10.5	8.5:1
$Z_{0.4}CSG$	89.9	10.1	8.9:1
$Z_{0.6}CSG$	89.3	10.7	8.3:1
$Z_{0.8}CSG$	89.4	10.6	8.4:1
$Z_{1.0}CSG$	90.2	9.8	9.2:1

Table 3. The inorganic ions concentration in the MB degradation solution for Z_xCSG catalysts after 120 min irradiation. (mM/L)

Catalyst	SO_4^{2-}	NO_3^-	NH_4^+
Z_0CSG	-	-	-
$Z_{0.2}CSG$	0.038	0.043	0.013
$Z_{0.4}CSG$	0.063	0.051	0.022
$Z_{0.6}CSG$	0.042	0.027	-
$Z_{0.8}CSG$	0.008	-	-
$Z_{1.0}CSG$	-	-	-

The SO_4^{2-}, NO_3^-, NH_4^+concentration in the degradation solution for MB after 120 min irradiation are determined by ion chromatography. The previous reports have shown that SO_4^{2-} is one of the main products for MB mineralization, and it is widely used to evaluate the efficiency of the catalytic degradation of MB [4, 5]. The formation of SO_4^{2-} is ascribed to that heteroatom S from the degradated MB molecule undergoes a direct oxidation from the oxidation degree -2 to the highest final stable +6 after visible light irradiation for 120 minutes. Meanwhile, nitrogen atoms in the -3 oxidation state produce NH_4^+ cations that subsequently are oxidized into NO_3^- ions [6, 7].

References

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