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Supporting Information

# Facile Synthesis and Enhanced Photocatalytic Activity of Ag-SnS Nanocomposites

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**Table S1.** Composition of SnS and Ag-SnS (1:8, 1:6 and 1:4) nanocomposites obtained from SEM-EDX study.

| **Loaded Sample** | **Composition (At. %) From EDX (FESEM)** | | |
|---|---|---|---|
| | Ag | Sn | S |
| **SnS** | 0 | 54.41 | 45.59 |
| **Ag-SnS (1:4)** | 12.82 | 46.15 | 41.03 |
| **Ag-SnS (1:6)** | 9.78 | 55.74 | 34.48 |
| **Ag-SnS (1:8)** | 6.13 | 47.20 | 46.67 |

**Table S2.** Photocurrent measurement analysis of SnS and Ag-SnS (1:8, 1:6 and 1:4) nanocomposites.

| **Sample** | $\mathbf{I^{photon}/I^{dark}}$ **(nA)** |
|---|---|
| **SnS** | 1.5 |
| **Ag-SnS (1:8)** | 1.6 |
| **Ag-SnS (1:6)** | 1.9 |
| **Ag-SnS (1:4)** | 4.8 |

**Table S3.** Details of various Ag based photocatalyst for the degradation of various dye.

| **Catalyst** | **Name of pollutant** | **Photo degradation condition** | | | **% of Degradation** | **Time** | **Reference** |
|---|---|---|---|---|---|---|---|
| | | Dye Conc. | Catalyst amount (mg per ml) | Irradiated Source | | | |
| Ag/CdS | MB | 10 mg/L | 30 mg/200 ml | 500 W halogen lamp | 95.35 | 240 min | 1 |
| Ag/$Ag_2S$/CuS | 2,4 – dichlorophenol | 50 mg/L | 30 mg/100 ml | Visible light | 76 And 100 | 30 min and 3h | 2 |
| Ag–TiO2/CNFs | MB | 10 mg/L | 100 mg/100 ml | 13 W fluorescent lamp | 81 | 50 min | 3 |
| Ag−ZnO | MO<br>MB<br>4-NP | 10mg/L<br>10mg/L<br><br>5mg/L | 2 mg/20 ml | visible light irradiation (λ > 500 nm). | 100<br>100<br>100 | 5h<br>4h<br>6h | 4 |
| Ag−ZnO | Methyl orange | 5.0 x $10^{-5}$ M) | 30 mg/90 ml | 3 x 6 W fluorescent Hg-lamp | 95.8 | 40 min | 5 |
| Ag/ZnO@C | Reactive black | 10 mg/L | 30 mg/50 ml | 500 W xenon lamp | 95.8% | 120 | 6 |
| Ag-ZnS-MWCNTs | Rh-B | 4 mg/L | 1250 mg/1000 ml | VLI | 87.53 | 116 | 7 |
| ZnO/Ag | Methyl orange | 3 x $10^{-5}$ mol/L | Required wt%/500 ml | projection lamp (7748XHP 250 W, Philips, λb532 nm) | 99 | 120 | 8 |
| Ag-SnS (1:4) | Congo red | 10mg/L | 10 mg/40 ml | 250 W Hg lamp | 100 | 100 | This work |

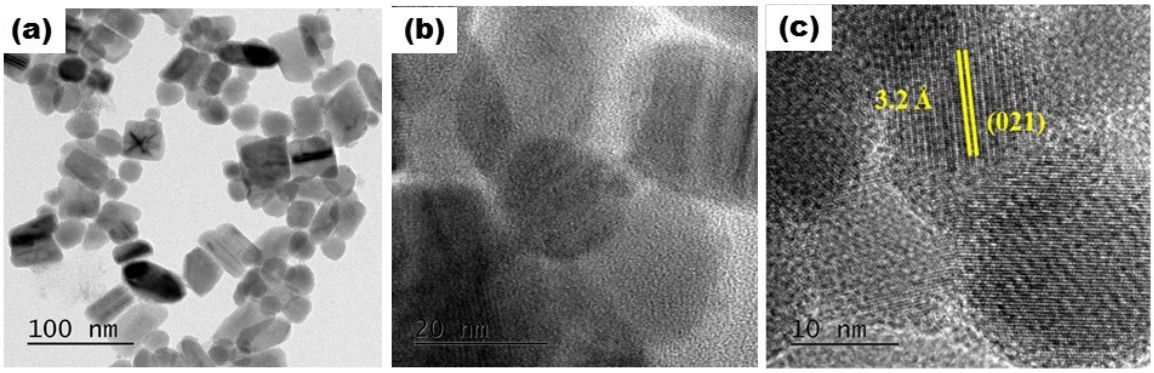


**Figure S1.** (a) and (b) TEM images (c) HRTEM image of SnS nanocrystals.

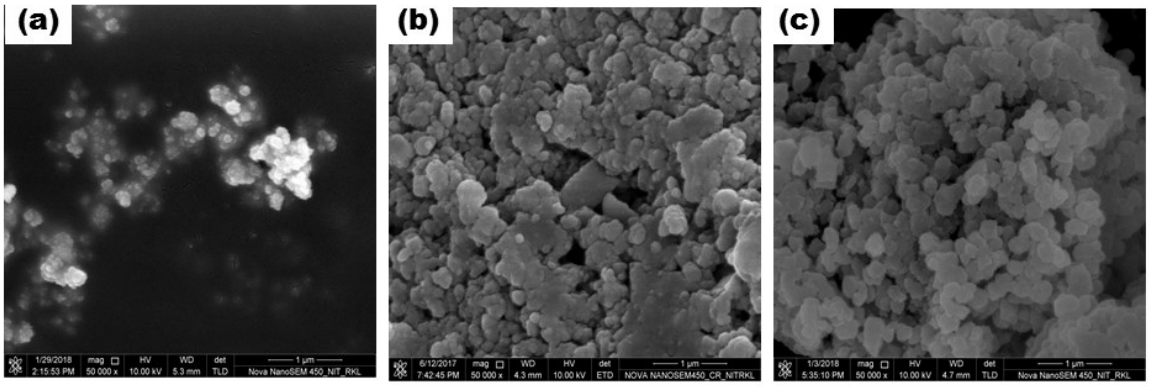


**Figure S2.** FESEM images of Ag-SnS nanocomposites with varying ratio of Ag:SnS (a) 1:8, (b) 1:6 and (c) 1:4.

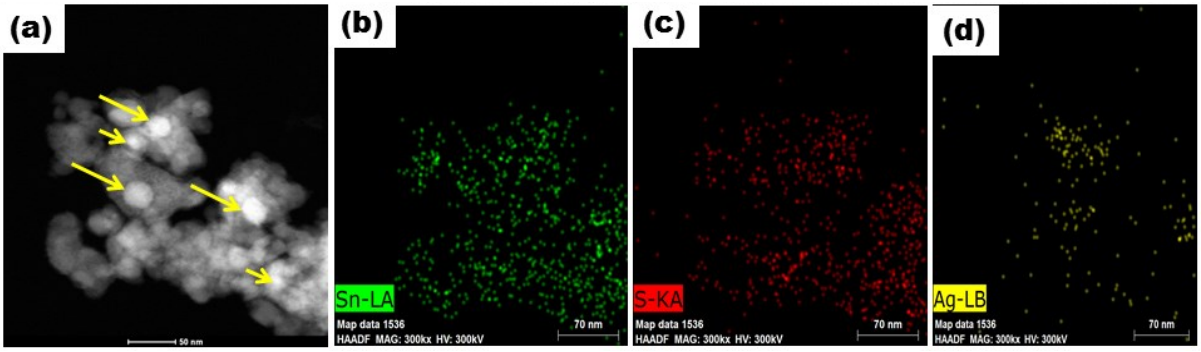


**Figure S3.** HAADF Elemental mapping of Ag-SnS nanocomposite with Ag:SnS ratio of 1:4.

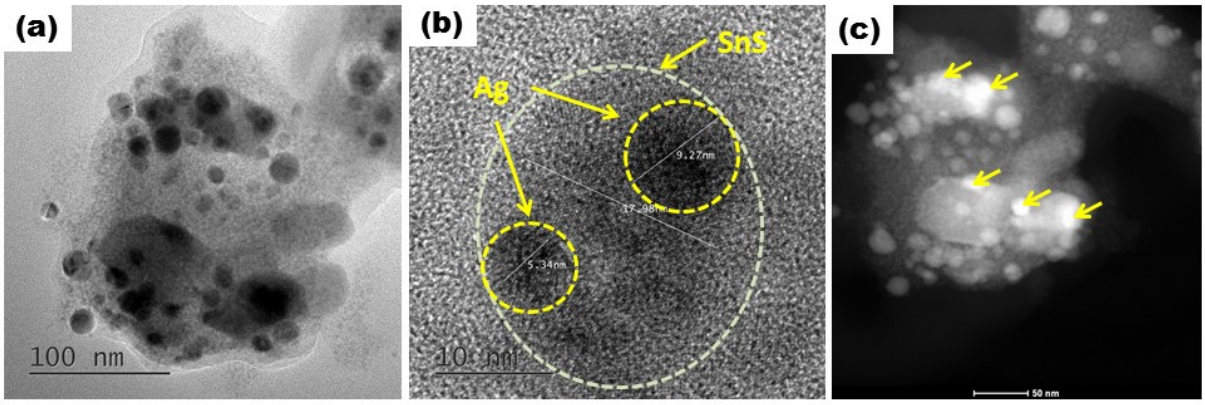


**Figure S4.** (a) and (b) TEM images (c) HAADF - STEM image of decorated Ag-SnS nanocomposites with Ag: SnS ratio of 1:6.

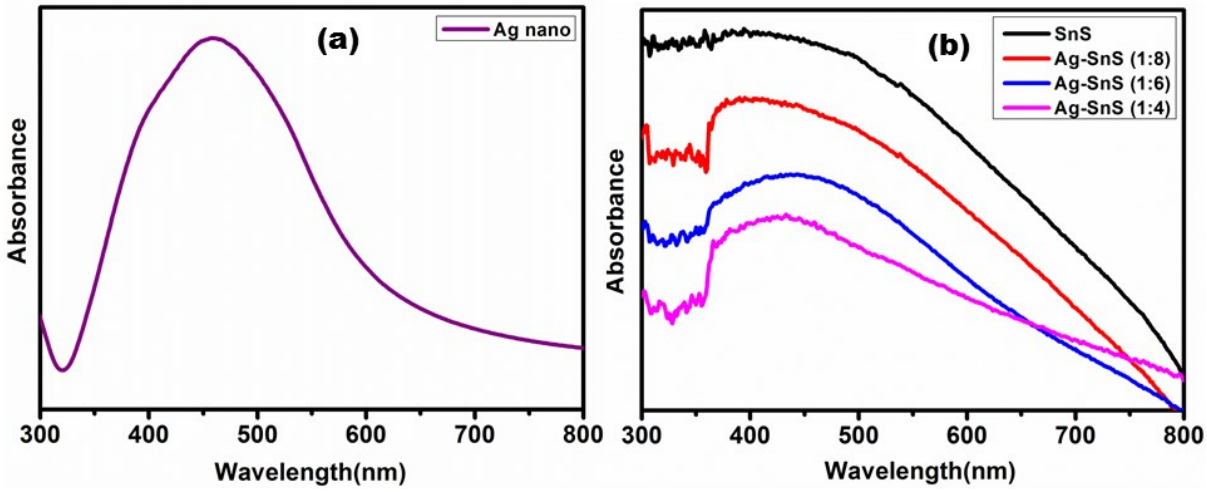


**Figure S5.** UV – Vis study of Ag-SnS nanocomposites using $BaSO_4$ as reference. (a) Absorption spectra of Ag synthesized within 1 hour and (b) Absorption spectra of SnS and Ag–SnS nanocomposites.

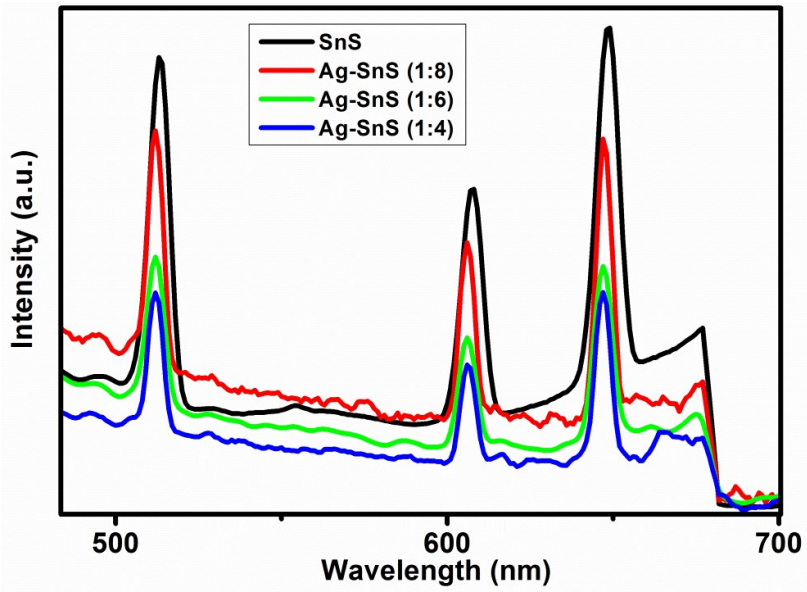


**Figure S6.** Room-temperature photoluminescence spectra of SnS and Ag-SnS nanocomposites (1:8, 1:6 and 1:4).

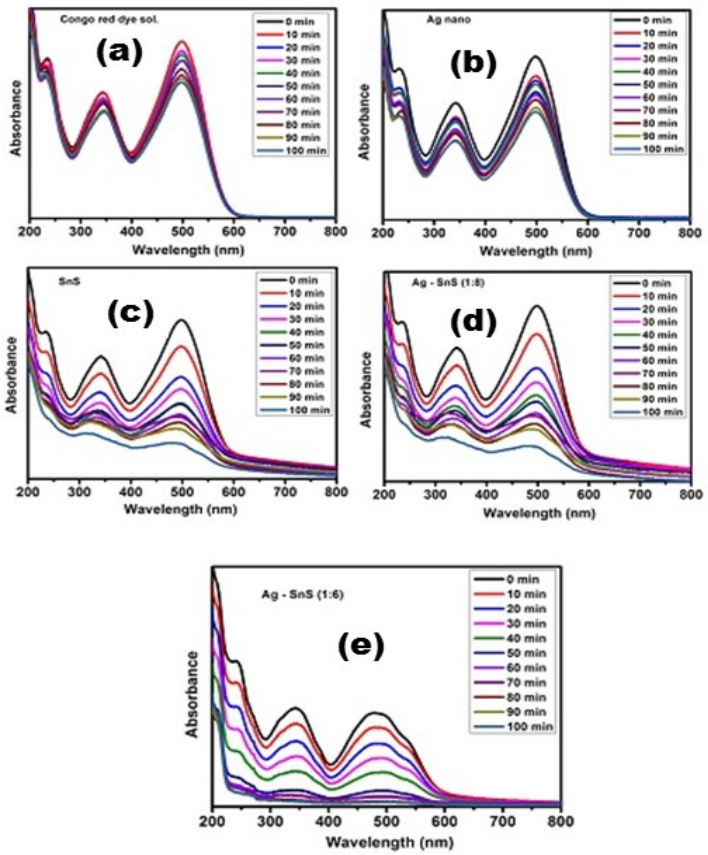


**Figure S7.** (a - e) UV-Vis absorbance spectra of $10^{-4}$ M Congo red dye solution at different irradiation time without catalyst and using 10 mg of Ag nano, SnS and Ag-SnS (1:8, 1:6) catalysts.

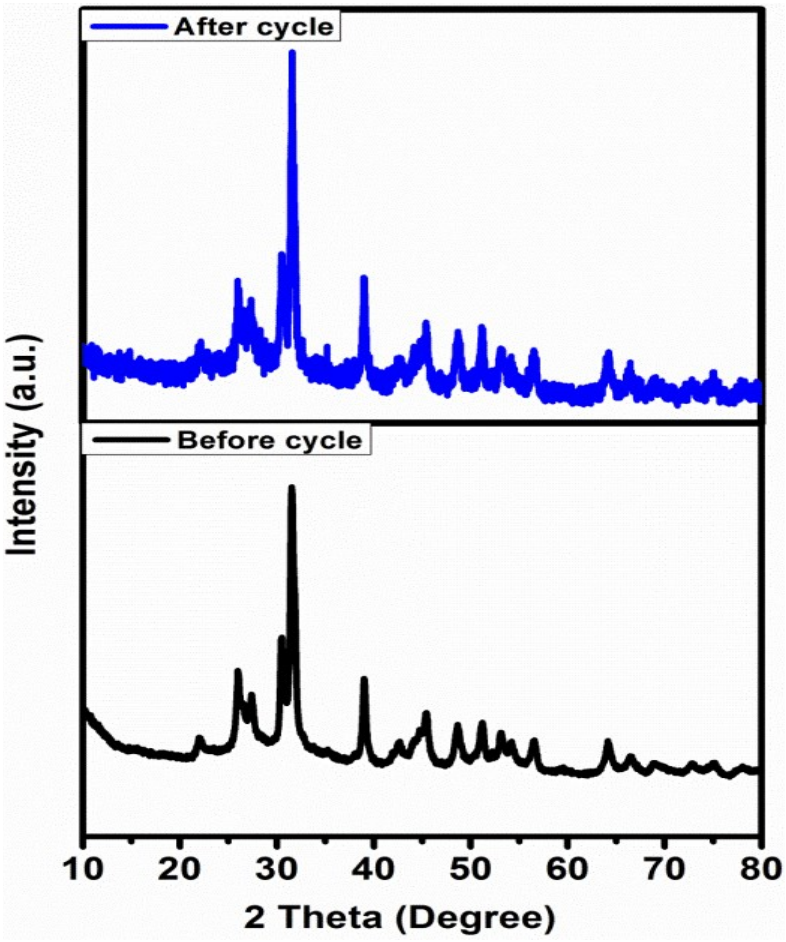


**Figure S8**. PXRD pattern of Ag-SnS nanocomposite (1:4) before catalysis process (bottom) and after five catalytic cycles (top).

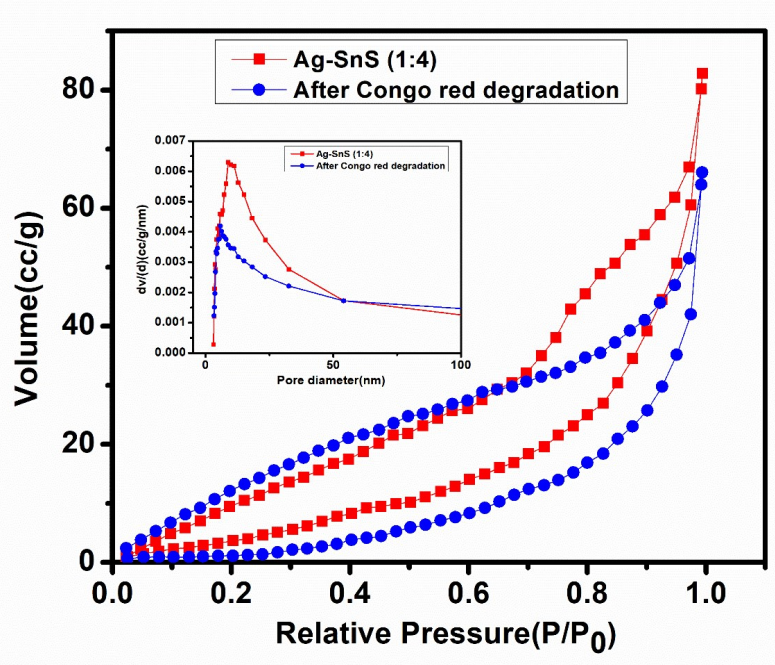


**Figure S9.** Nitrogen adsorption–desorption isotherms of Ag-SnS (1:4) nanocomposite before and after nine cycles of dye degradation.

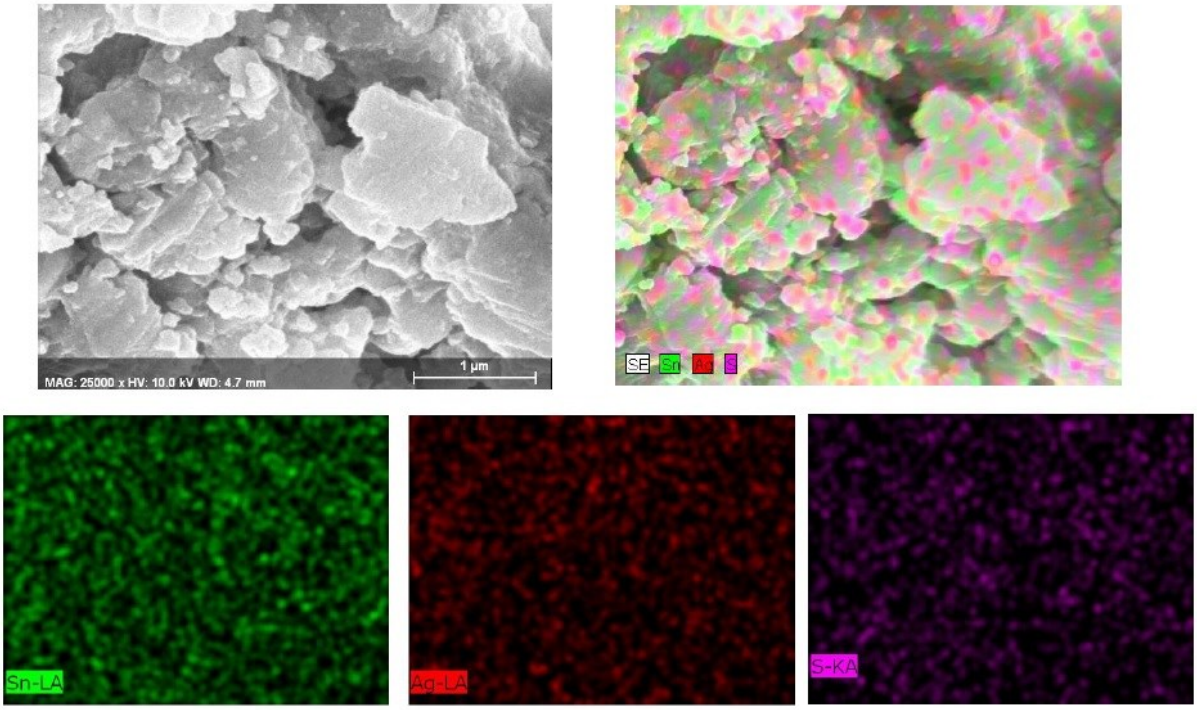


**Figure S10.** FESEM images of Ag-SnS (1:4) nanocomposite and elemental mapping after nine cycles of photo degradation of dye.

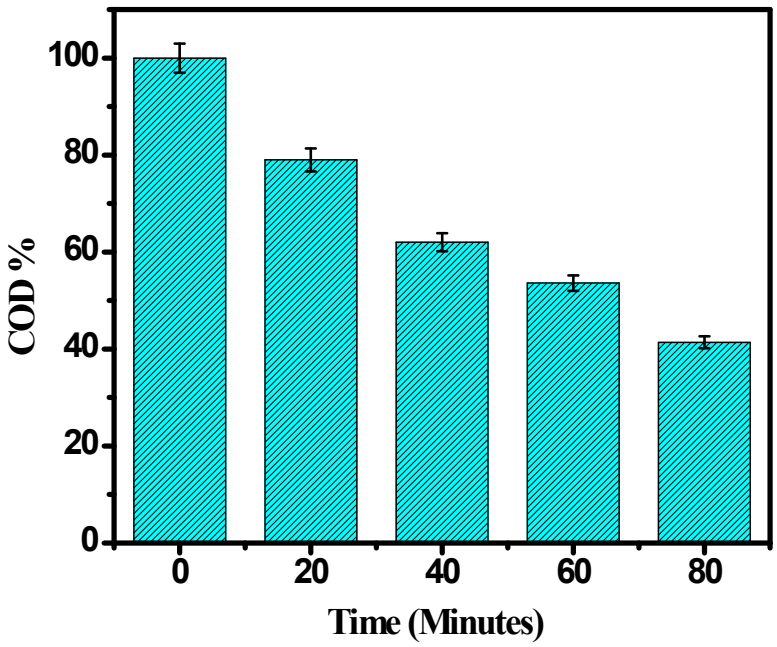


**Figure S11.** COD percentage at different time interval during the photocatalytic degradation of Congo red dye using Ag-SnS (1:4) nanocomposite.

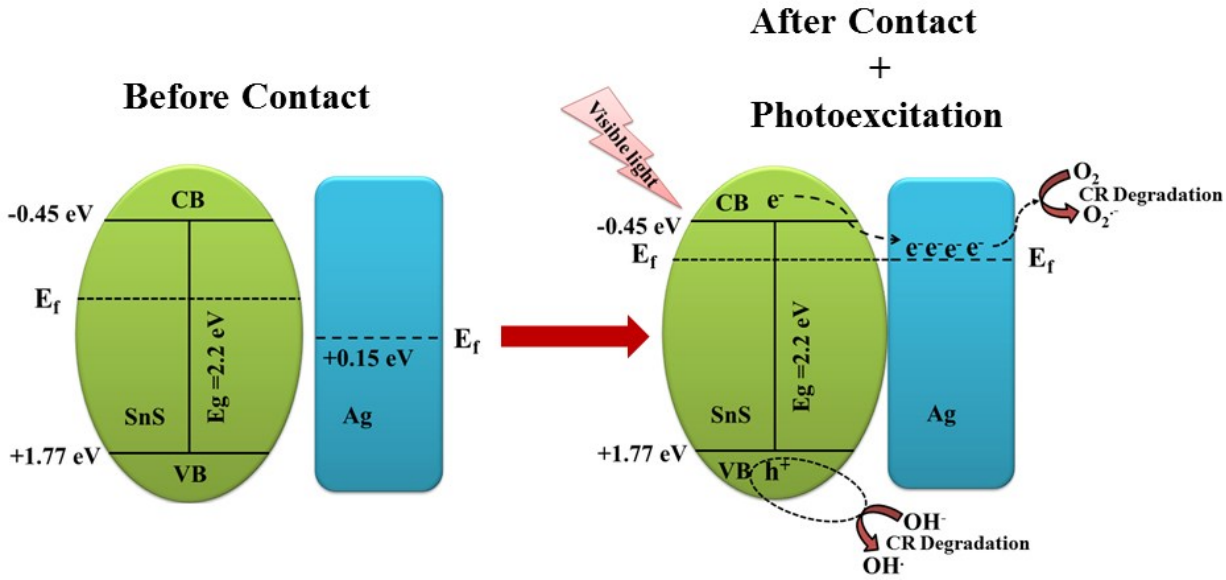


**Figure S12.** Schematic illustration of the light induced charge separation mechanism in Ag-SnS before and after contact.

**References.**


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