Supplementary Information

Unusual reactivity of MoS_2 nanosheets

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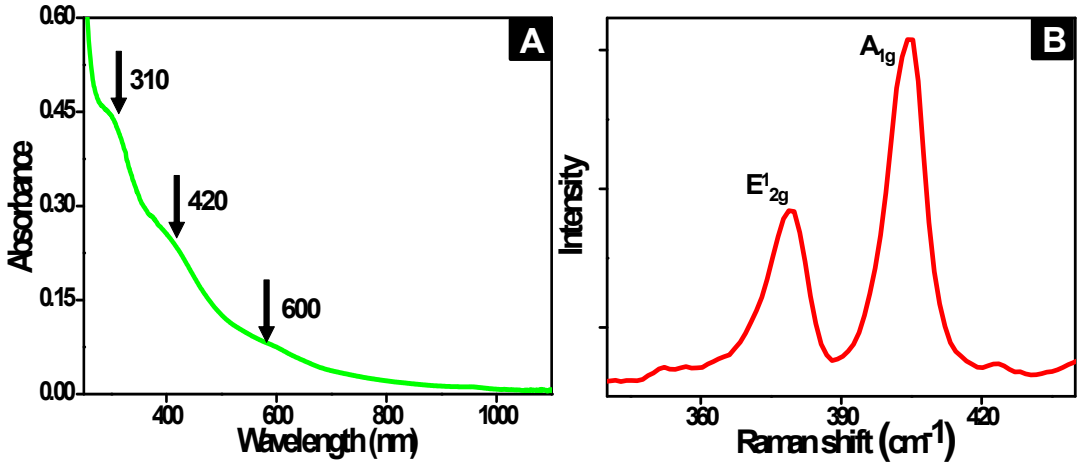

Figure S1. (A). UV/Vis spectrum of MoS_2 nanosheet after exfoliation. (B) Raman spectrum of MoS_2 nanosheets (NSs).

S2. Supporting information 2

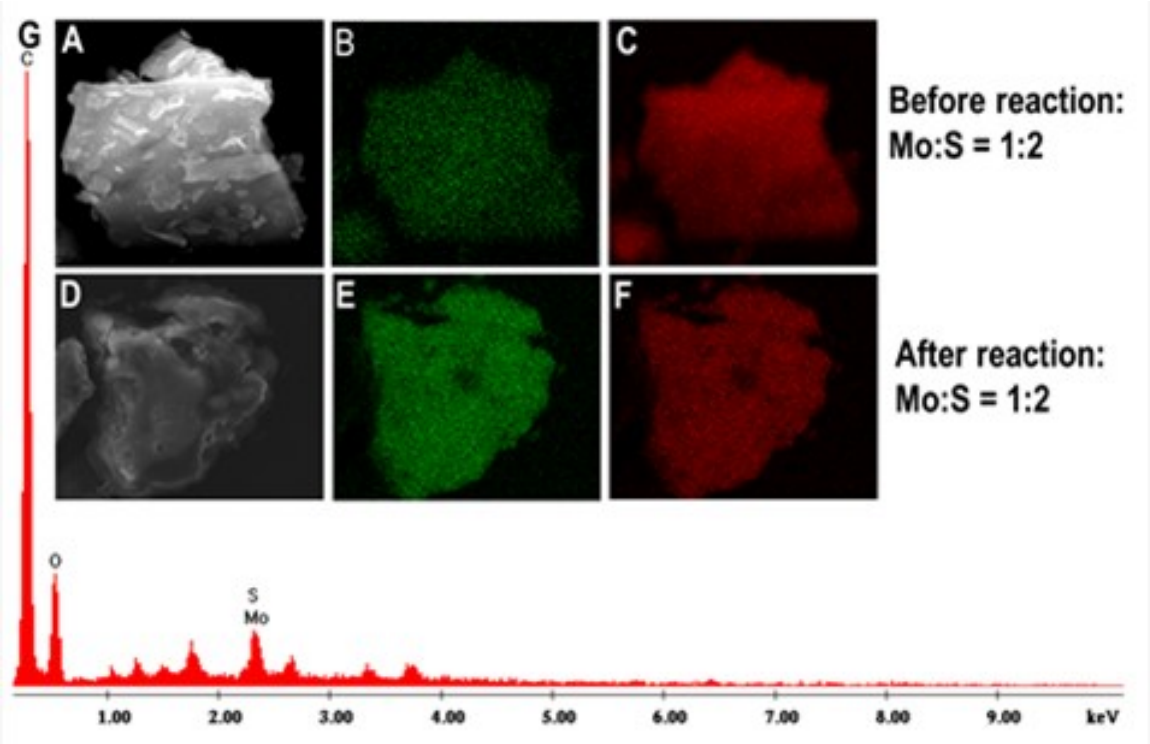

Figure S2. (A) SEM image, (B) and (C) EDS maps of Mo and S, respectively before the reaction. (D) SEM image, (E) and (F) EDS maps of Mo and S, respectively after immersion in $AgNO_3$ solution for 24 h. The Mo and S ratio before and after $AgNO_3$ treatment remains the same confirming the absence of reaction. (G) EDS spectrum taken from bulk MoS_2 sample post $AgNO_3$ treatment.

S3. Supporting information 3

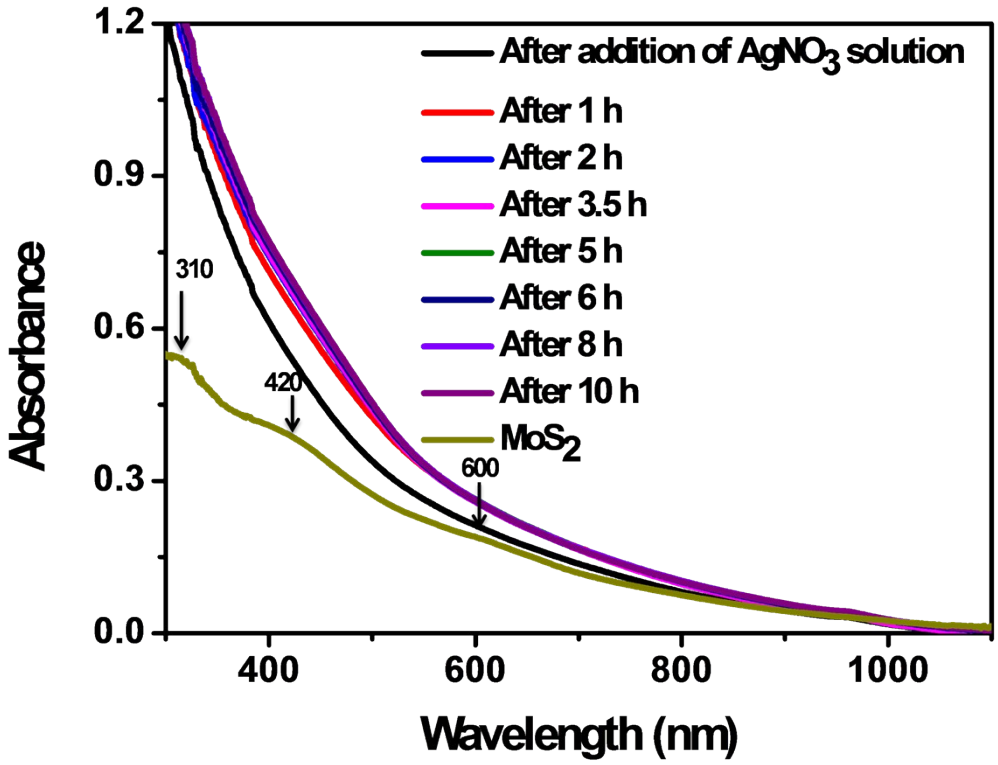

Figure S3. Time dependent UV/Vis spectra of the reaction between MoS_2 (500 µL) and $AgNO_3$) solution (400 µL, 5.8 mM). Just after the addition of $AgNO_3$ solution, the peaks at 420 nm and 310 nm vanished.

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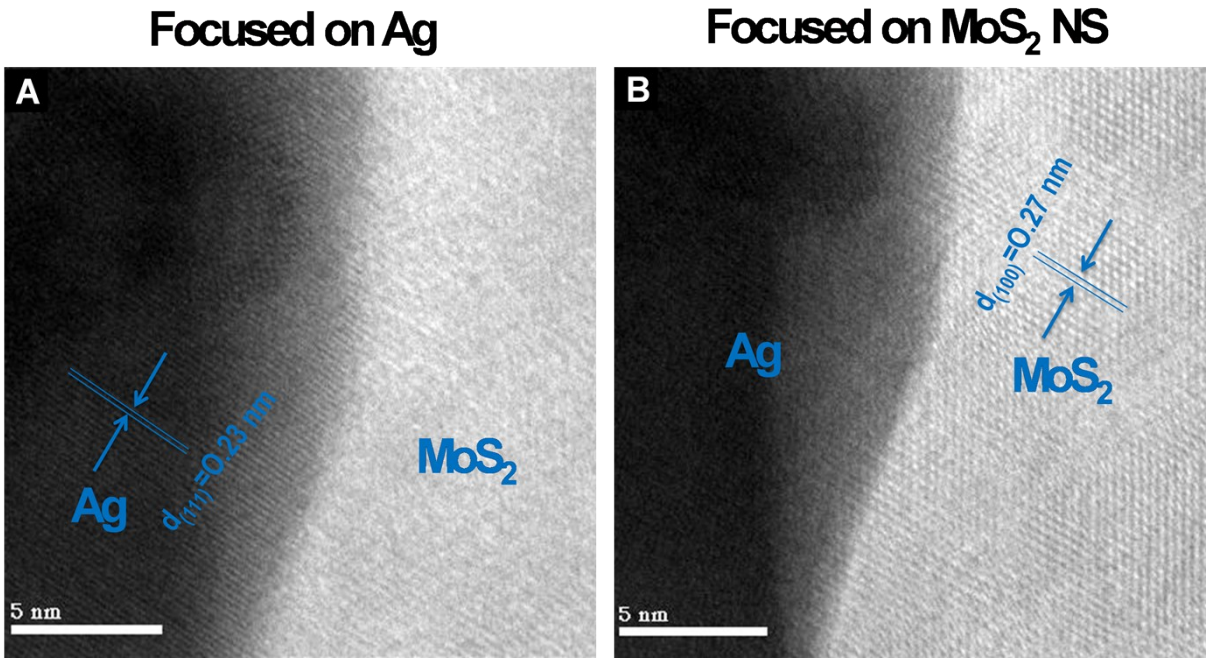

Figure S4. HRTEM images of Ag NP on the MoS_2 NS, (A) image taken by focusing the Ag NP and (B) image taken by focusing the MoS_2 NS.

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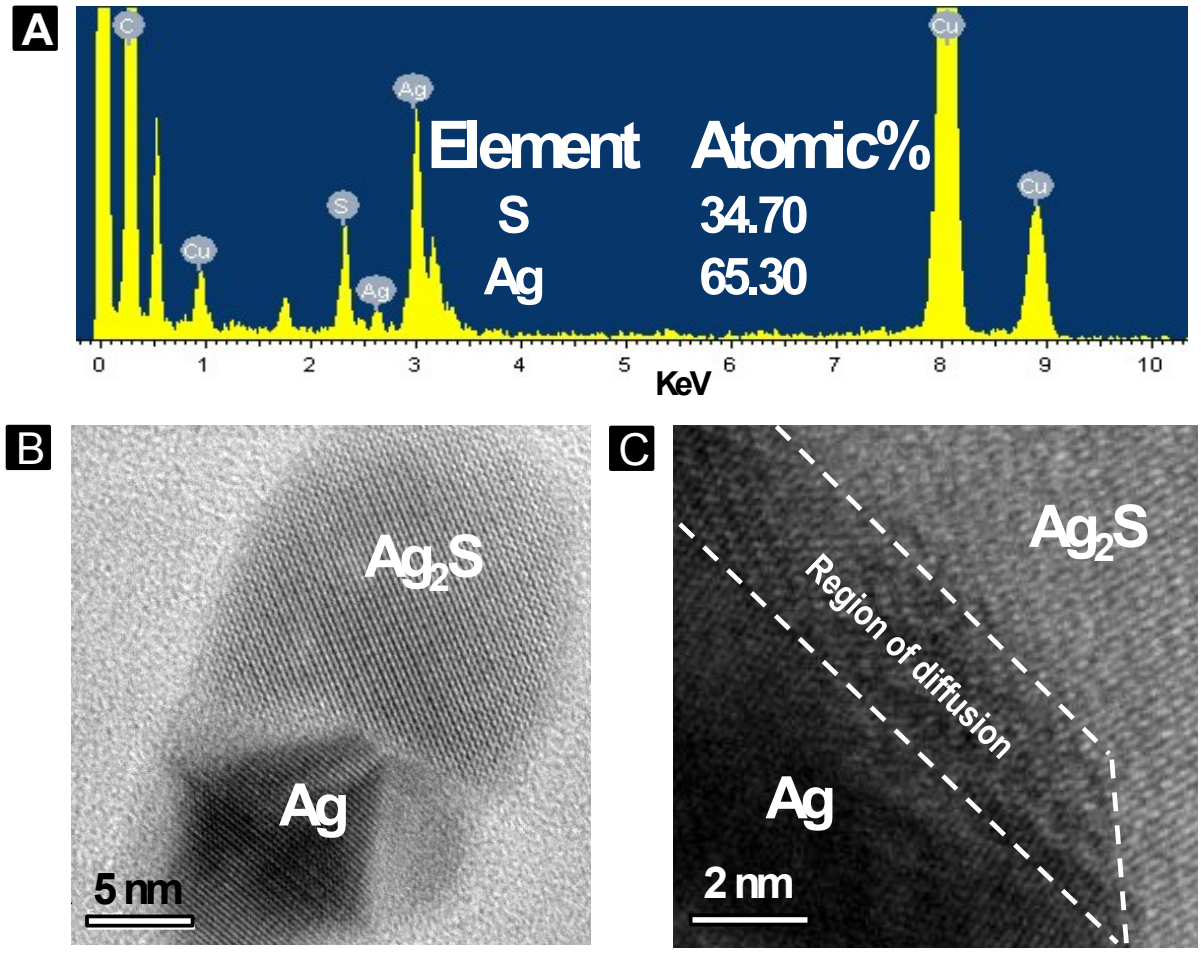

Figure S5. (A) EDS spectrum of the network like Ag_2S structure. The Ag and S ratio is almost 2:1 which confirmed that the structure is of Ag_2S. (B) HRTEM image of 'Janus' type particles. (C) Expanded view of the marked region from Figure 1Biii. Ag and Ag_2S phases can be seen to be separated by a region, where the growth of Ag_2S from Ag by S diffusion can be seen.

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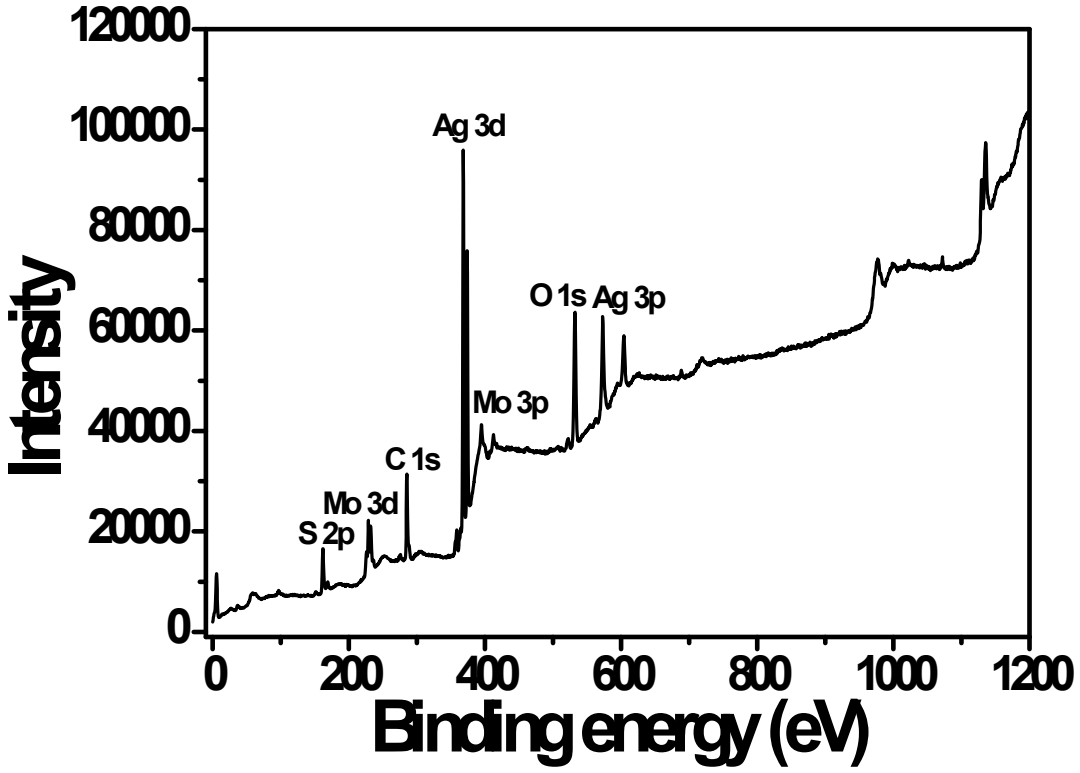

Figure S6. The XPS survey spectrum of all the element for the reaction between MoS_2 (500 μL) and $AgNO_3$ (400 μL, 5.8 mM).

S7. Supporting information 7

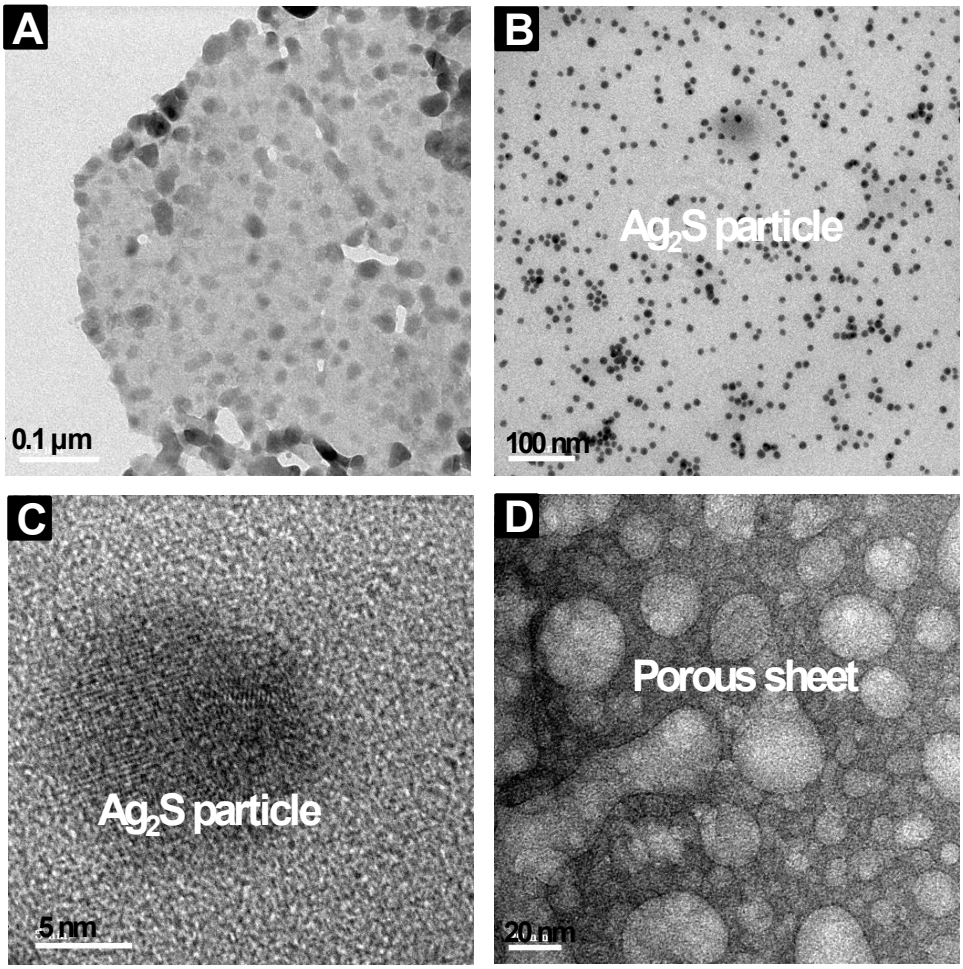

Figure S7. Reaction between prepared Ag NPs@citrate and MoS_2 nanosheet. (A) TEM image of Ag NPs on the MoS_2 sheet. Image was taken just after the addition of Ag NPs to the aqueous dispersion of MoS_2 nanosheet. (B) TEM image of Ag_2S particle formed after 12 h of reaction. (c) HRTEM image of Ag_2S particle. (D) TEM image of amorphous, porous sheet after the reaction.

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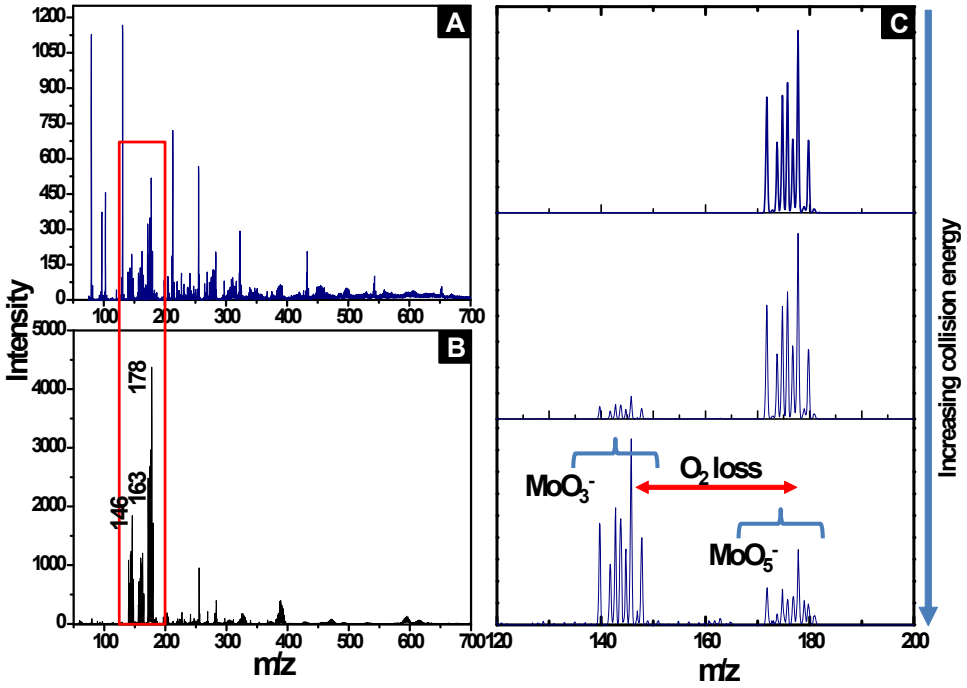

Figure S8. (A) Full range ESI MS spectrum of the sample taken after 6 h of the reaction. (B) ESI MS spectrum of ammonium molybdate taken as a blank to compare with the sample. (C) MS2 of the peak at m/z 178.

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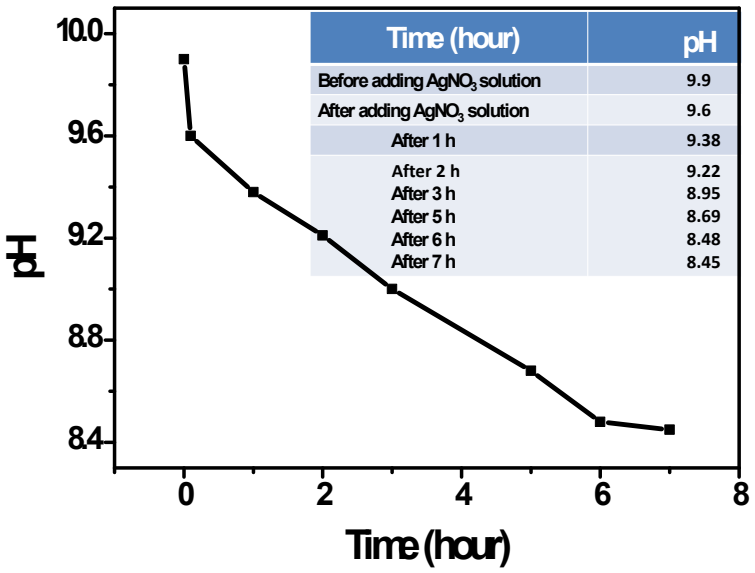

Time (hour)	pH
Before adding $AgNO_3$ solution	9.9
After adding $AgNO_3$ solution	9.6
After 1 h	9.38
After 2 h	9.22
After 3 h	8.95
After 5 h	8.69
After 6 h	8.48
After 7 h	8.45

Figure S9. Time dependent pH monitoring during the reaction. pH of the reaction mixture decreases with time confirming the formation of H^+ ion during the reaction.

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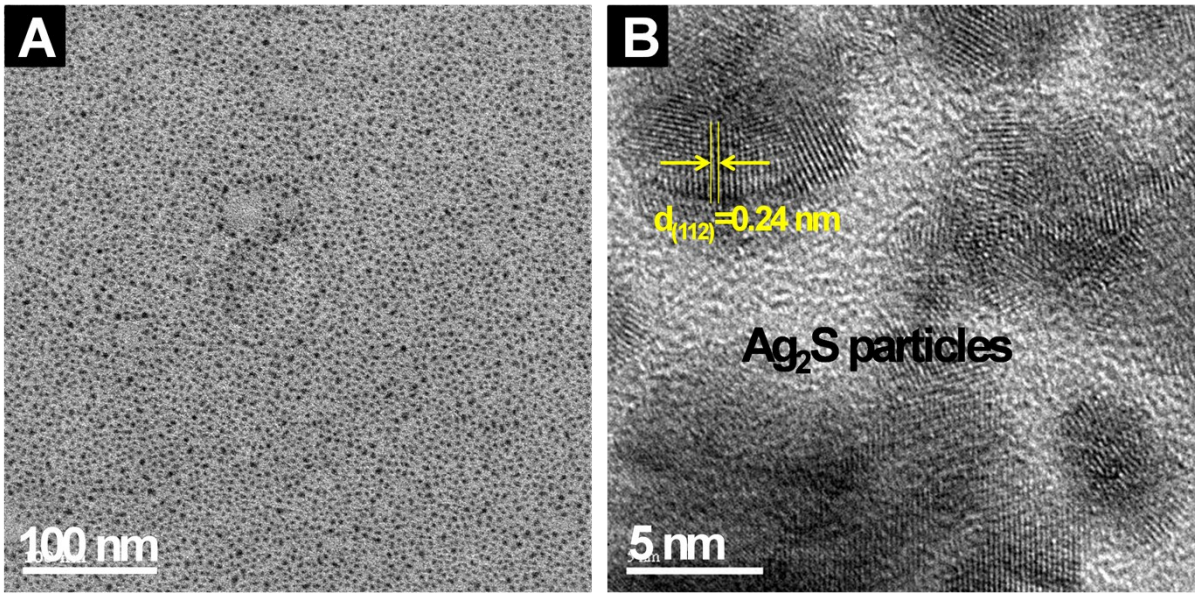

Figure S10. MoS_2 NSs react with silver acetate the same way as $AgNO_3$. (A) TEM image of the particles and (B) HRTEM image of the same.

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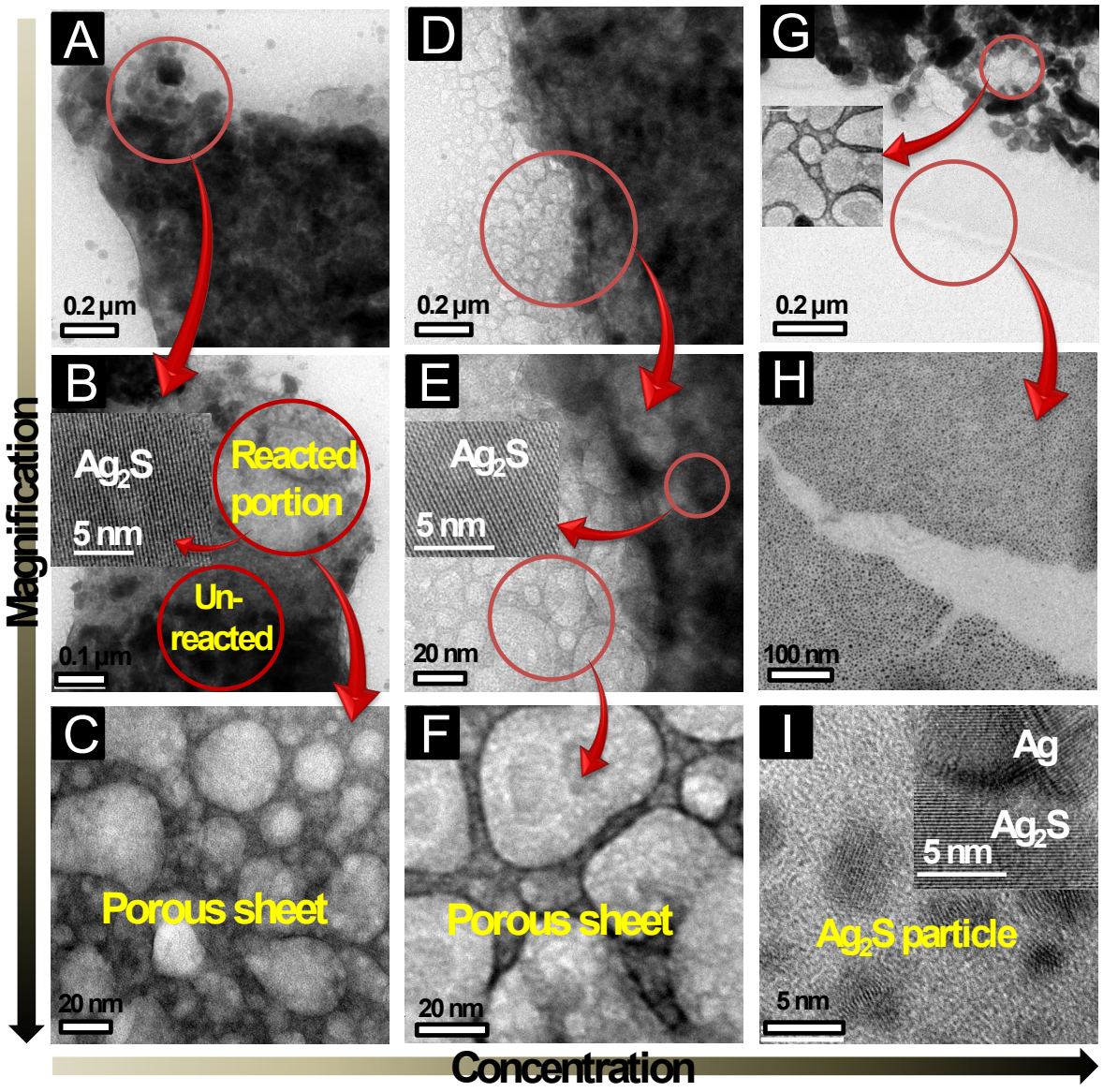

Figure S11. Changes of MoS_2 sheet with increasing concentration of added $AgNO_3$ solution. TEM image (A-C) for 200 µL, (D-F) for 800 µL, (G-I) for 1.6 mL, added $AgNO_3$ (5.8 mM) solution. For 200 µL $AgNO_3$, some parts of MoS_2 remained unreacted (B). For 1.6 mL $AgNO_3$ solution small Ag-Ag_2S particle formed (I). (C), (F) TEM image of reacted MoS_2 sheet.

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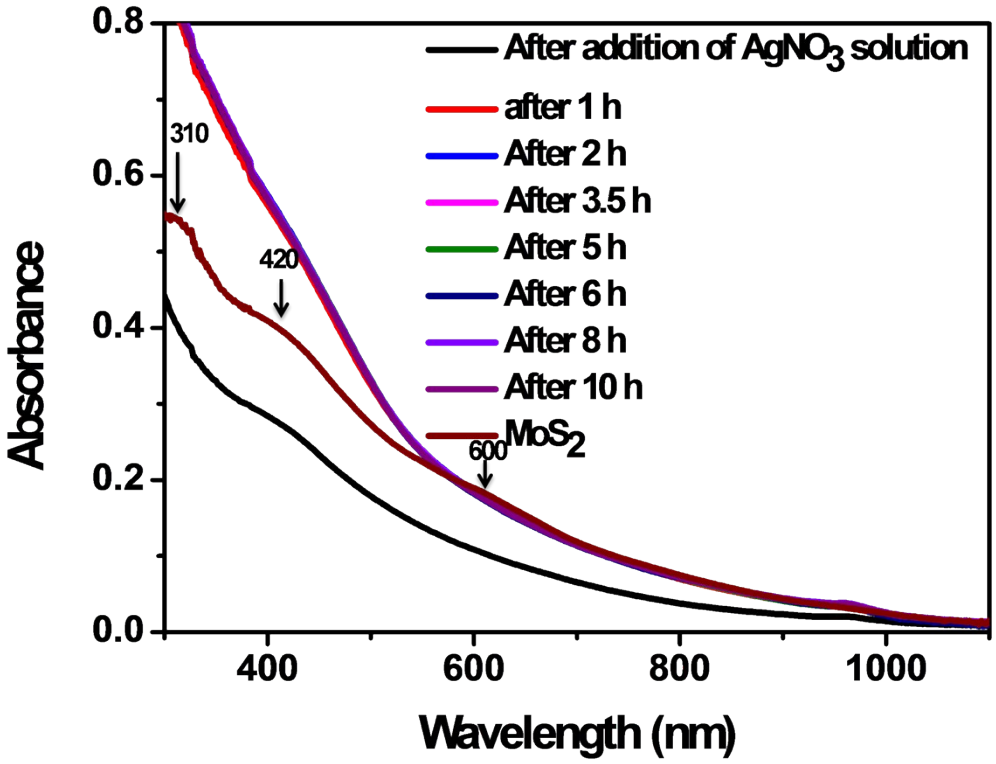

Figure S12. UV/Vis spectra of the reaction between MoS_2 NS (500 µL) and $AgNO_3$ solution (200 µL, 5.8 mM). After 10 h of reaction also the hump at 420 nm is present. The intensity of the peak gets reduced after 10 h of reaction which confirmed that some of the MoS_2 nanosheets reacted while some were still unreacted.