Supporting Information

Templating synthesis of dual-functional porous MoS_2 nanoparticles with photothermal conversion and catalytic properties

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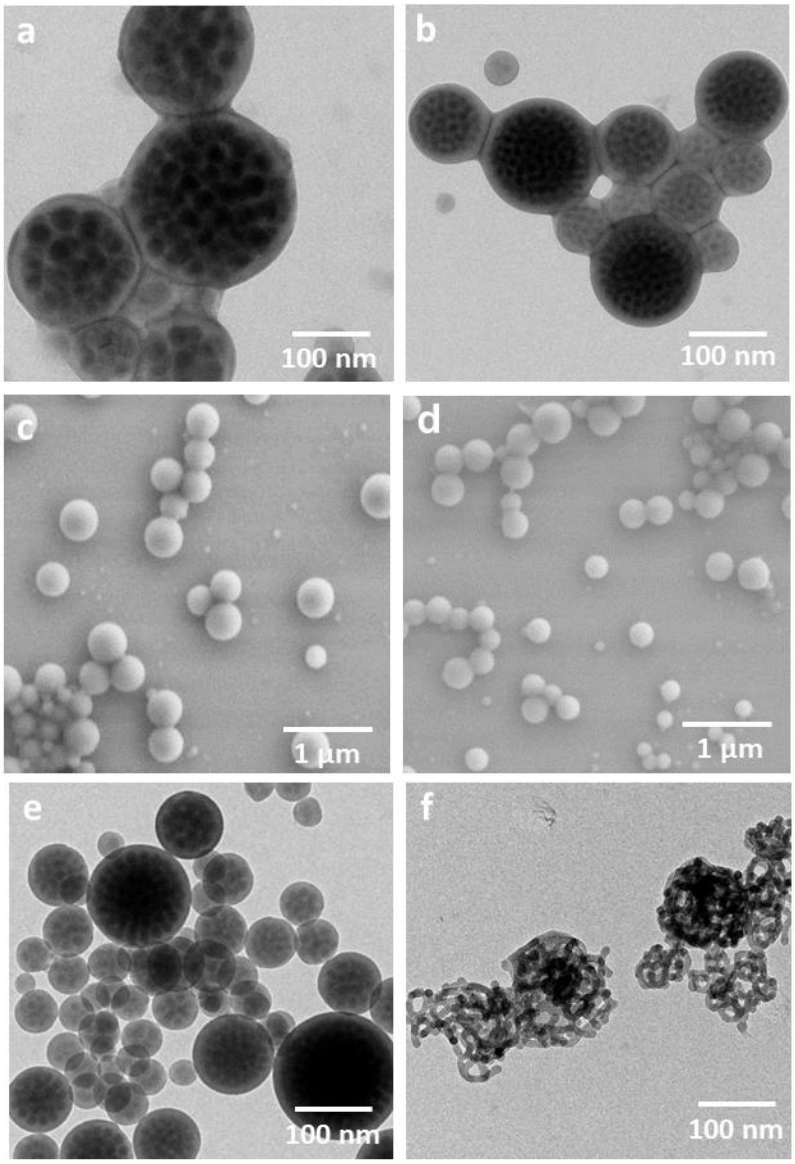

Fig. S1 TEM images of (a) $PS_{38.5k}$-*b*-$P2VP_{23k}$ and (b) $PS_{48.5k}$-*b*-$P2VP_{16.5k}$ particles before swelling. The polymer particles were stained by I_2 vapor for 20 min. The dark contrast shows the distribution of P2VP domains. SEM image of (c) $PS_{38.5k}$-*b*-$P2VP_{23k}$ and (d) $PS_{48.5k}$-*b*-$P2VP_{16.5k}$ particles after swelling at 50 °C. TEM images of the $PS_{48.5k}$-*b*-$P2VP_{16.5k}$ particles swelling at (e) 30 and (f) 90 °C.

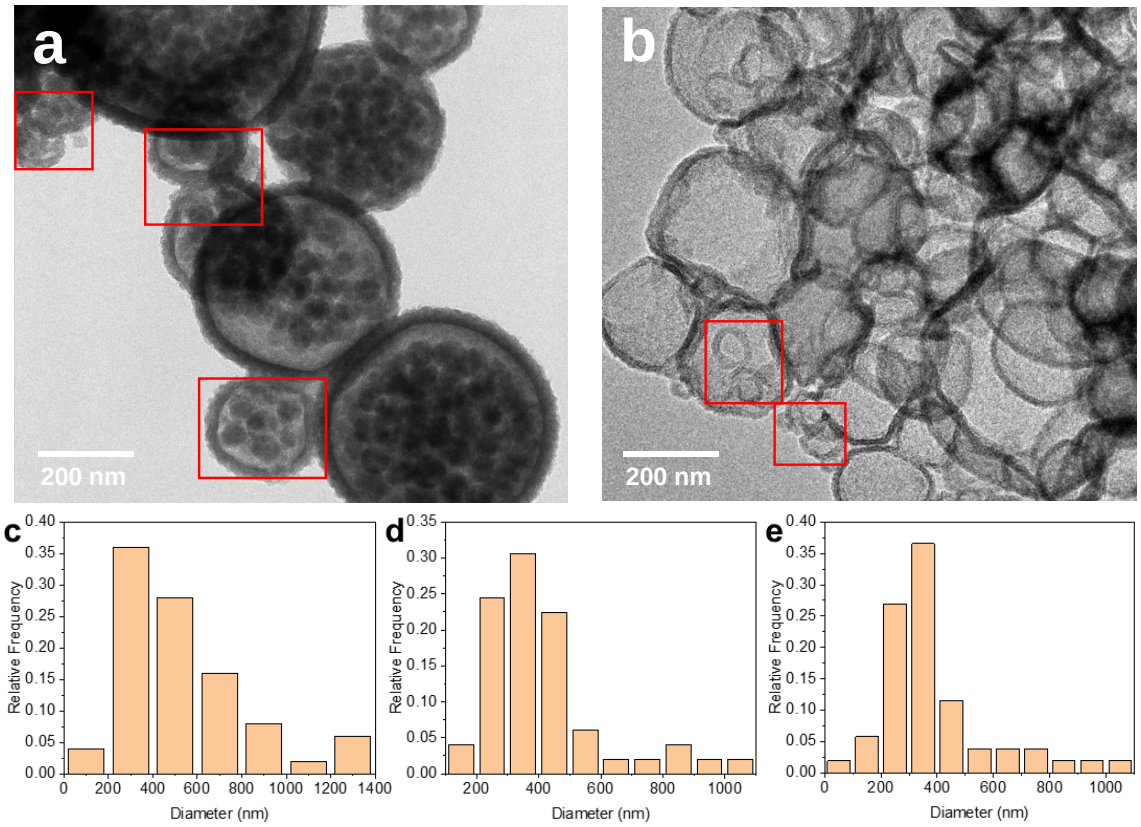

Fig. S2 TEM images of (a) MoS_2 PLNPs and (b) MoS_2 HNPs. The histograms of particle size distribution of the MoS_2 PNPs prepared at the precursor concentration of (c) 1, (d) 1.5 and (e) 3 mg/mL.

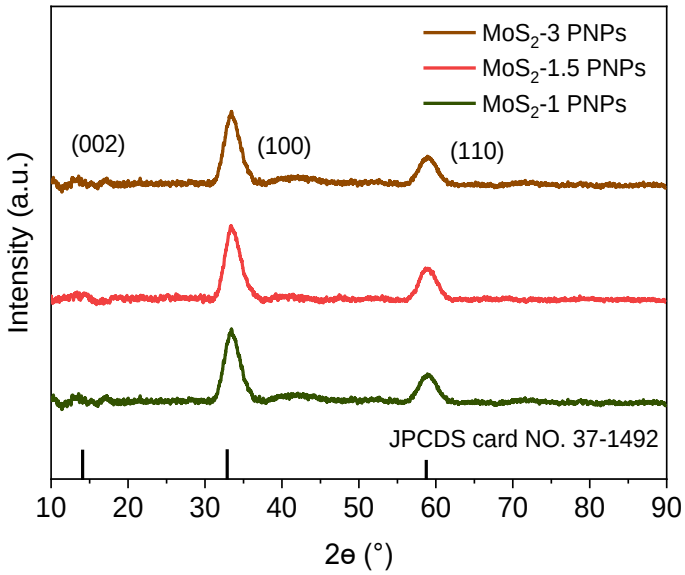

Fig. S3 XRD patterns of various MoS_2 PNPs.

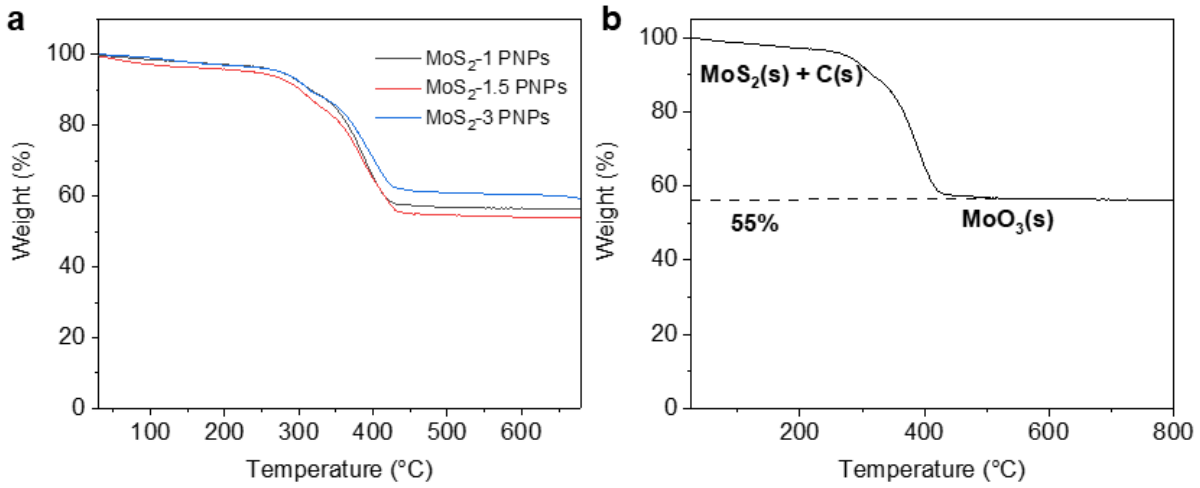

Fig. S4 TGA curves of (a) various MoS_2 particles and (b) the chemical variation of the MoS_2-1.5 PLNPs particles during calcination.

Taking MoS_2-1.5 PLNPs for example, the components change during calcination is as below:

$$3O_2(g) + MoS_2(s) \rightarrow MoO_3(s) + SO_3(g)$$

$$O_2(g) + C(s) \rightarrow CO_2(g)$$

Here we assume the initial amount of carbon and MoS_2 is x and y, respectively. The molar masses of MoS_2 and MoO_3 are 160.1 g/mol and 143.9 g/mol, respectively. Then the calculation equations of the mass equilibrium before and after calcination is below:

$$x + y = 100\%$$

$$\frac{143.9}{160.1} \times y = 55\%$$

Therefore, the amount of carbon and MoS_2 is calculated to be 38.9 % and 61.1 %. The results of various MoS_2 PNPs are summarized in **Table S1**.

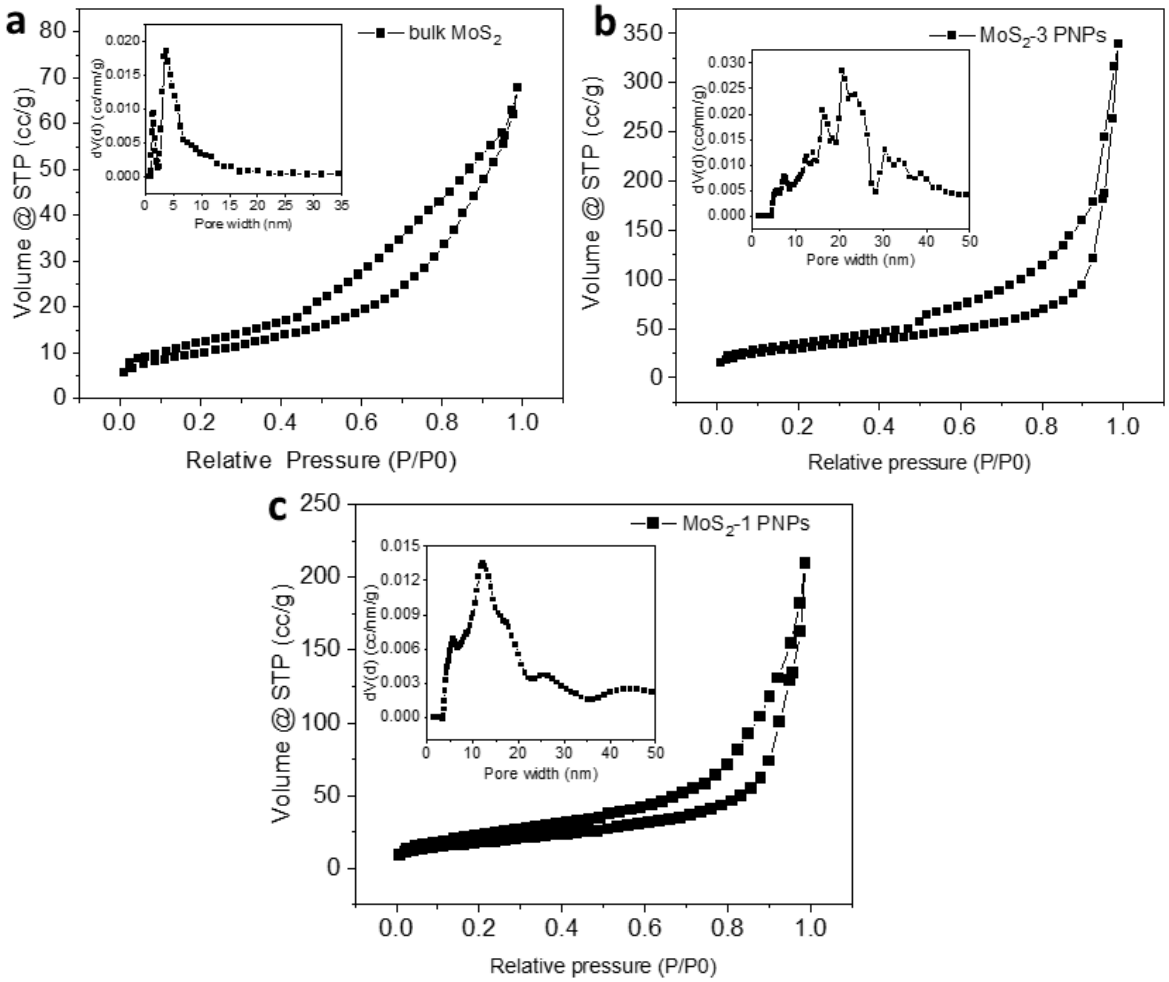

Fig. S5 Isothermal N_2 adsorption and desorption of various MoS_2 particles. The insets are the corresponding curves of pore size distribution.

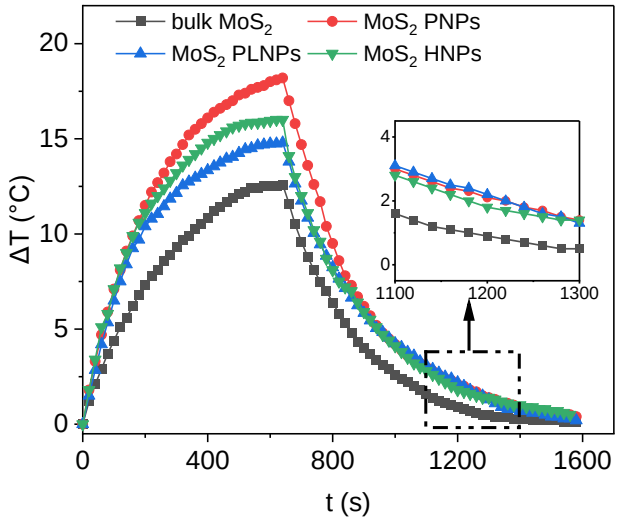

Fig. S6 Temperature change *vs.* time of MoS_2 particles with various morphologies when the laser on and off.

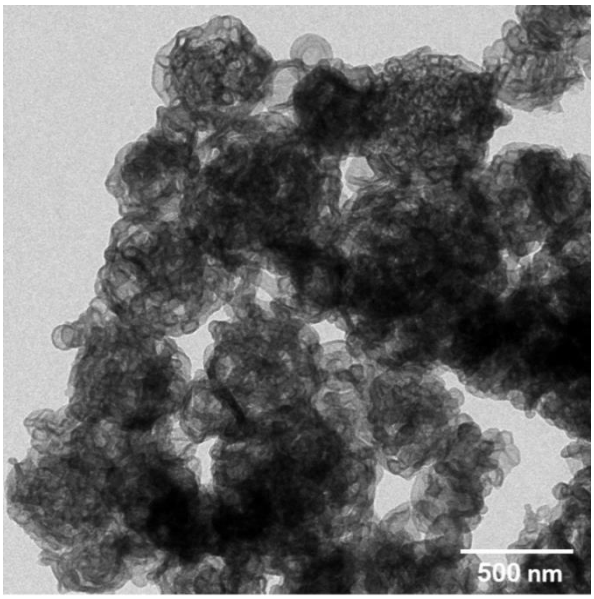

Fig. S7 TEM image of the MoS_2 -1.5 PNPs after 5 photothermal test cycles.

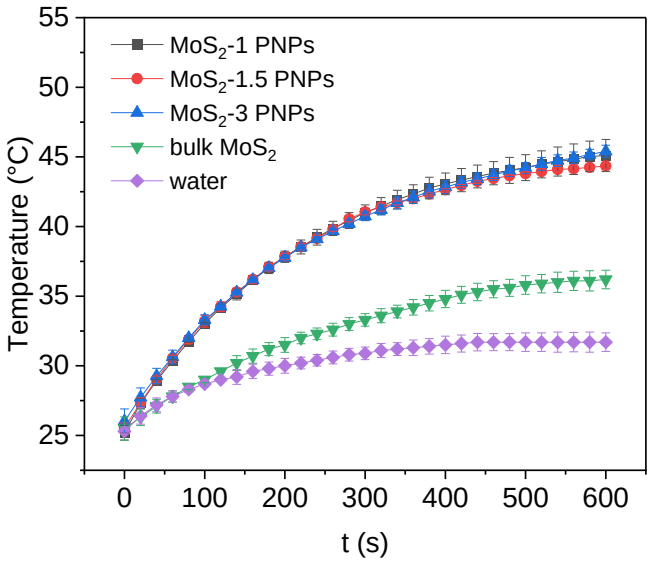

Fig. S8 Temperature change of water and various MoS_2 PNPs at 0.1 mg/ml under NIR irradiation at 3 W/cm^2.

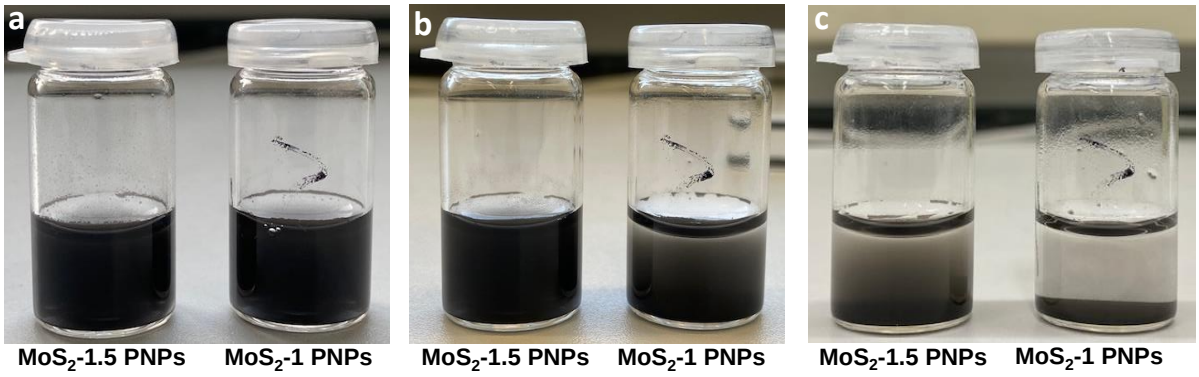

Fig. S9 Photos of MoS_2 dispersions after storing for (a) 0 h, (b) 1.5 h and (c) 3h.

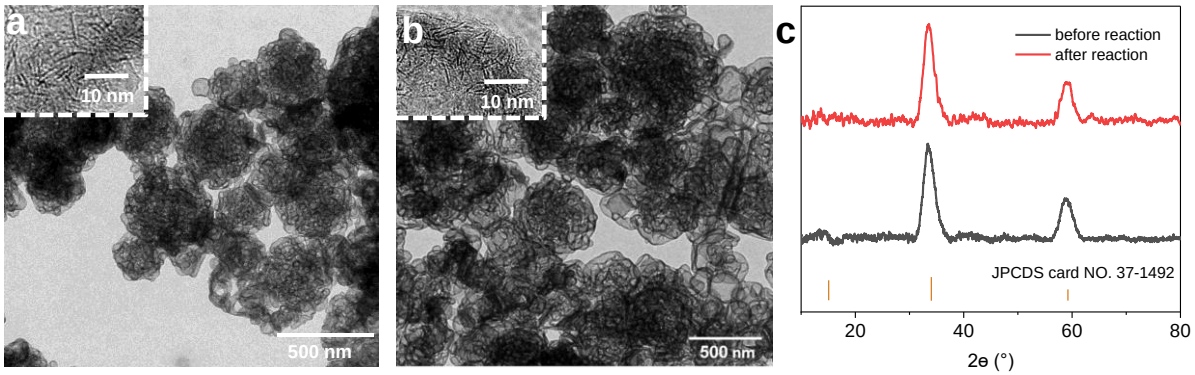

Fig. S10 TEM image of the MoS_2 -1.5 PNPs (a) before and (b) after 5 catalytic cycles. (c) XRD patterns before and after catalytic reactions.

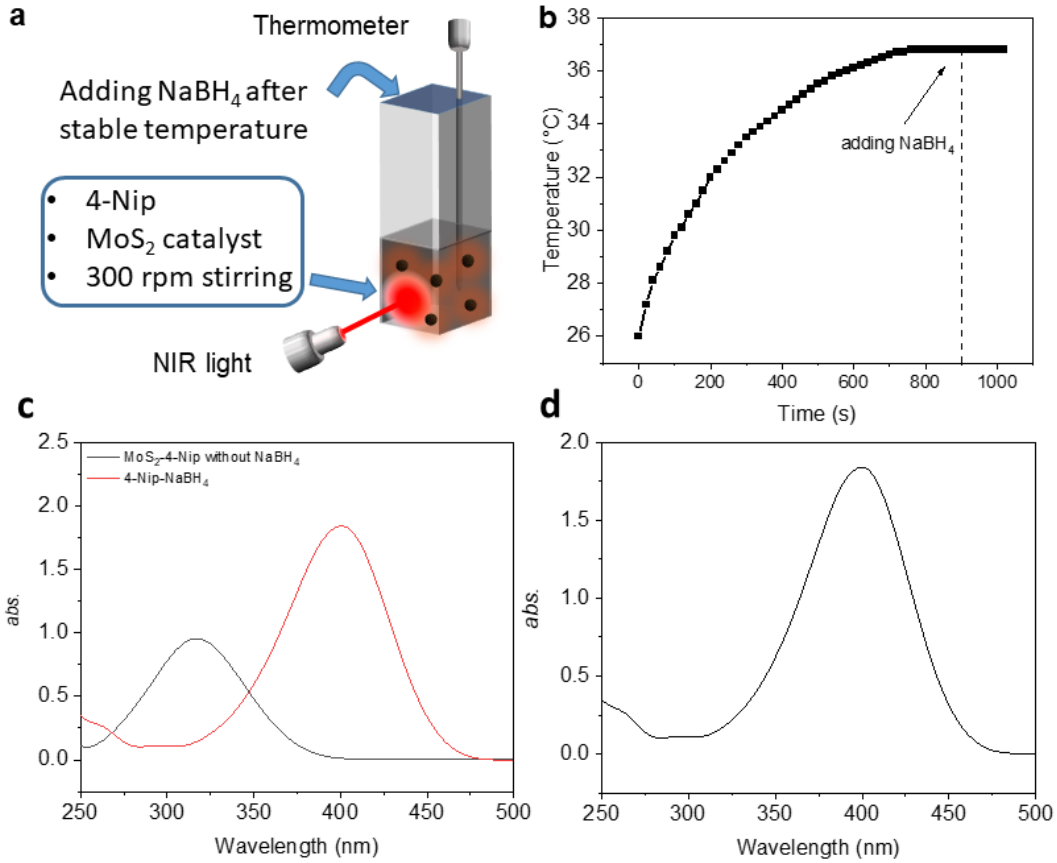

Fig. S11 (a) Schematic illustration of the catalytic reduction reaction under NIR light irradation at 0.05 mg/ml and 3 W/cm^2. (b) Photoheating curve of MoS_2-1.5 PNPs. UV-vis absorption spectra of the reaction solution (c) without $NaBH_4$ or MoS_2-1.5 PNPs, and (d) when $NaBH_4$ was replaced by NaOH (0.5 mM) after irradiation for 15 min.

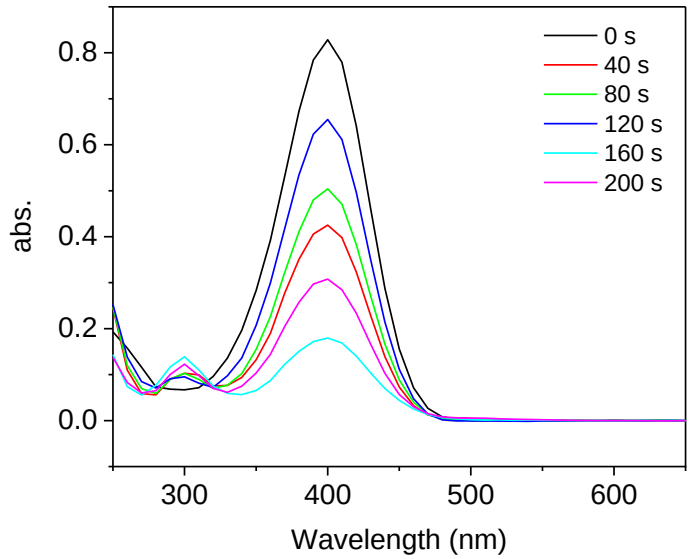

Fig. S12 UV-vis absorption spectra of the reduction of 4-Nip with MoS_2-1.5 PNPs at 0.05 mg/ml and 3 W/cm^2 within 200 s.

Table S1 Mass fraction of carbon and MoS_2 in various particles.

Sample	**MoS_2 (%)**	**Carbon (%)**
MoS_2-1 PNPs	63.3	36.7
MoS_2-1.5 PNPs	61.1	38.9
MoS_2-3 PNPs	69.2	30.8

Table S2 Specific surface area of various MoS_2 PNPs.

Sample	**Specific surface area(m^2/g)**
bulk MoS_2	36.3
MoS_2-1 PNPs	139.9
MoS_2-1.5 PNPs	106.6
MoS_2-3 PNPs	81.6

Table S3 Summary of k_{app} of various MoS_2 PNPs.

Content (mg/mL)	**k_{app} (s^{-1})**			
	bulk MoS_2	**MoS_2-1 PNPs**	**MoS_2-1.5 PNPs**	**MoS_2-3 PNPs**
0.04	$2.93\times10^{-3}\pm5.8\times10^{-4}$	$3.03\times10^{-3}\pm4.1\times10^{-5}$	$3.98\times10^{-3}\pm2.1\times10^{-4}$	$2.11\times10^{-3}\pm1.9\times10^{-4}$
0.06	$4.47\times10^{-3}\pm7.4\times10^{-4}$	$5.41\times10^{-3}\pm7.4\times10^{-4}$	$7.55\times10^{-3}\pm7.4\times10^{-4}$	$3.26\times10^{-3}\pm7.7\times10^{-4}$
0.08	$4.74\times10^{-3}\pm5.8\times10^{-4}$	$8.05\times10^{-3}\pm1.6\times10^{-4}$	$10.74\times10^{-3}\pm1.6\times10^{-4}$	$6.34\times10^{-3}\pm4.3\times10^{-4}$
0.1	$7.67\times10^{-3}\pm2.1\times10^{-4}$	$9.97\times10^{-3}\pm5.6\times10^{-4}$	$12.31\times10^{-3}\pm5.6\times10^{-4}$	$6.95\times10^{-3}\pm1.7\times10^{-4}$

Table S4 Summary of k_{app} of MoS_2-1.5 PNPs in the presence/absence of NIR light illumination.

1/T (K^{-1})	**k_{app} without NIR light (s^{-1})**	**1/T (K^{-1})**	**k_{app} with NIR light (s^{-1})**
0.00333	$4.43\times10^{-3}\pm2.31\times10^{-4}$	0.00332	$5.96\times10^{-3}\pm2.66\times10^{-4}$
0.00330	$5.11\times10^{-3}\pm2.03\times10^{-4}$	0.00328	$7.65\times10^{-3}\pm2.57\times10^{-4}$
0.00327	$5.43\times10^{-3}\pm6.02\times10^{-4}$	0.00326	$7.68\times10^{-3}\pm3.38\times10^{-4}$
0.00325	$6.66\times10^{-3}\pm3.61\times10^{-4}$	0.00323	$8.54\times10^{-3}\pm3.58\times10^{-4}$
0.00321	$7.66\times10^{-3}\pm2.04\times10^{-4}$	0.00320	$9.94\times10^{-3}\pm5.52\times10^{-4}$