

A plasmonic heterostructure using charge transfer effect improved LSPR for enhanced upconversion luminescence

Supporting Information

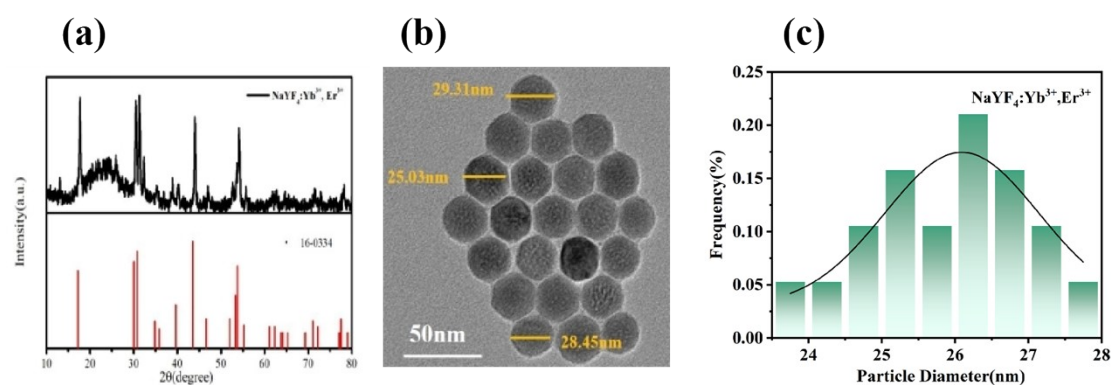


Figure S1. (a) XRD pattern of the as fabricated $\text{NaYF}_4:\text{Yb}^{3+},\text{Er}^{3+}$; (b). TEM images of $\text{NaYF}_4:\text{Yb}^{3+},\text{Er}^{3+}$; (c). Particle size distribution of $\text{NaYF}_4:\text{Yb}^{3+},\text{Er}^{3+}$ nanoparticles

Figure S1. (a) shows the the diffraction peak position of the sample was highly matched with the standard card JCPDS:16-0334 of hexagonal phase NaYF_4 . No other diffraction peaks or large angular shifts were observed, indicating that Yb^{3+} and Er^{3+} doping does not affect the crystal structure of the matrix material. **Figure S1.** (b) shows the transmission electron microscope image of $\text{NaYF}_4:\text{Yb}-\text{Er}(30\%, 2\%)$ nanoparticles prepared by co-precipitation method. The average size of the sample was 26.6 nm with good dispersion **Figure S1.** (c). The sample was dried and the structure of the material phase was determined by X-ray diffraction. As shown in The sample prepared by co-precipitation method is pure phase, which is the basis for the subsequent experiments.

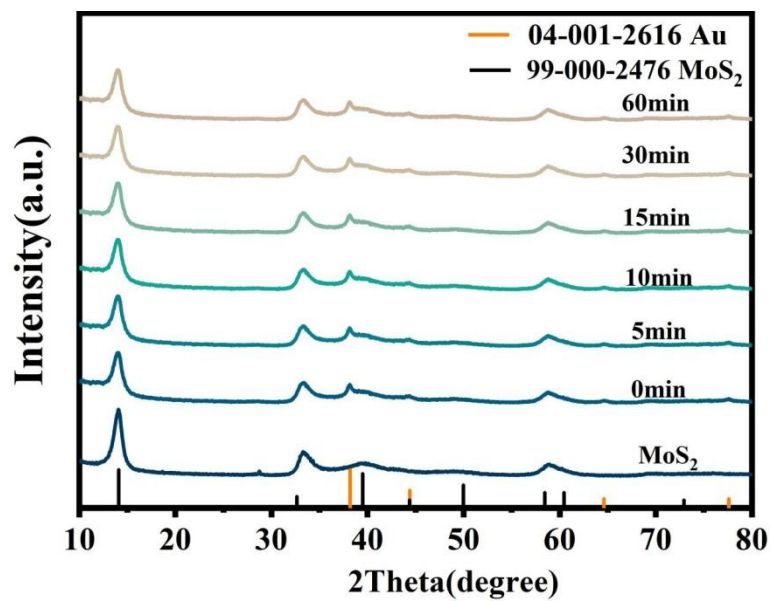


Figure S2. XRD pattern of the as fabricated Au/MoS₂ composite heterostructures

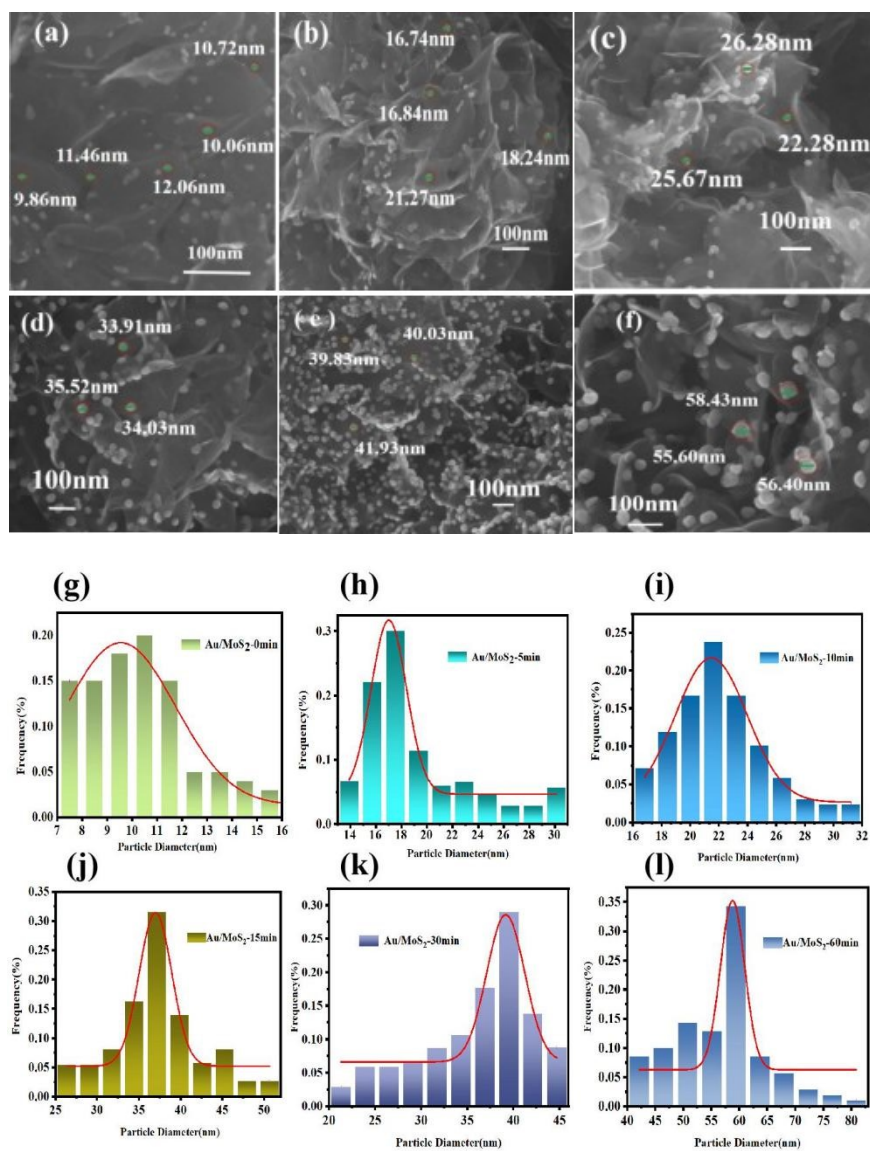


Figure S3. SEM micrograph of Au/MoS₂ Composite hetero-structures at different aging times (a) 0min; (b):5min; (c):10min; (d):15min; (e):30min; (f):60min. Particle size distribution of Au nanoparticles under different aging times (g) 0min; (h):5min; (i):10min; (j):15min; (k):30min; (l):60min.

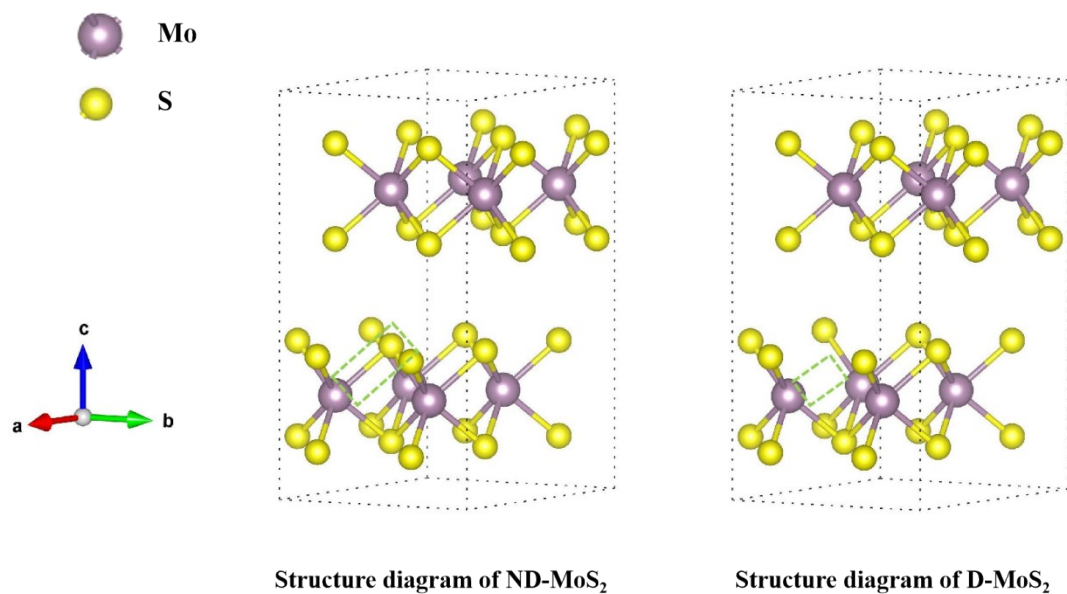


Figure S4. Schematic diagram of two types of MoS₂ structures introduced in DFT calculation

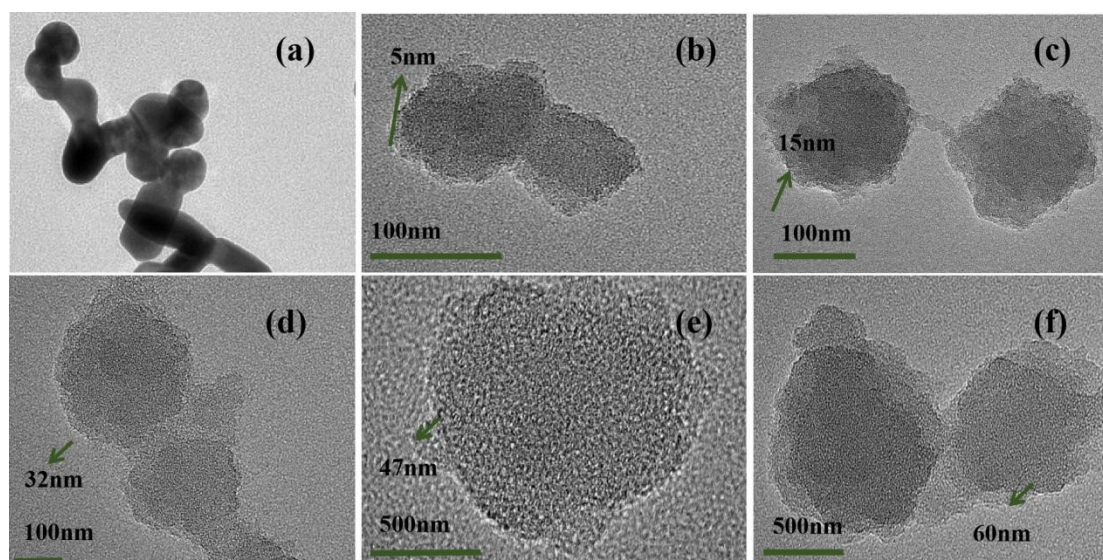


Figure S5. TEM image of Au; SiO₂ coated Au with different layer thickness b); 5nm; c): 15nm; d): 32nm; e): 47nm; f): 60nm

The D-MoS₂ and Au/D-MoS₂ composite heterostructures have a very pronounced thermal effect (Figure 4a-d). D-MoS₂, Au/D-MoS₂ with different aging time were irradiated under laser, and the temperature of the spot irradiation region

increased rapidly. In the experiment, the temperature of Au/D-MoS₂ reaches 170 °C from room temperature in only 1 min under laser irradiation, and the temperature of MoS₂ rises to 70 °C under the same time irradiation.

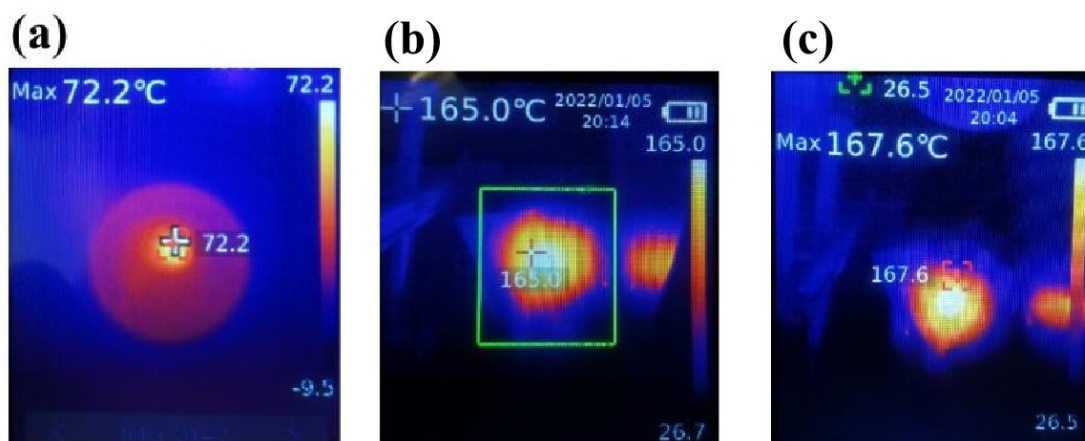


Figure S6. Imaging temperature of different samples irradiated by laser for 1 min recorded by thermal imager. (a) D-MoS₂; (b) Au/MoS₂-10min; (c) Au/MoS₂-15min.