Reduction mechanism of Au metal ions into Au nanoparticles on molybdenum disulfide

Yuan Yuan 1, Bingqiao Yang 2, Feifei Jia 1,3*, Shaoxian Song 1,3

1 Hubei Key Laboratory of Mineral Resources Processing and Environment, Wuhan University of Technology, Luoshi Road 122, Wuhan, Hubei, 430070, China
2 School of Xingfa Mining Engineering, Wuhan Institute of Technology, Xiongchu Avenue 693, Wuhan, Hubei, 430073, China
3 School of Resources and Environmental Engineering, Wuhan University of Technology, Luoshi Road 122, Wuhan, Hubei, 430070, China

* Corresponding author. Tel: +8618062600346, E-mail: feifeijia@whut.edu.cn
Supporting Information includes 7 pages, 11 figures.

Figures

Fig. S1. X-ray diffraction (XRD) pattern of natural mica.

Fig. S2. X-ray diffraction (XRD) pattern of highly oriented pyrolytic graphite (HOPG).
**Fig. S3.** X-ray diffraction (XRD) pattern of tungsten disulfide (WS₂).

**Fig. S4.** AFM images of mica (a, b) and HOPG (c, d) surfaces before (left images) and after (right images).
images) HAuCl₄ solution loading. The experiments were carried out under AFM laser irradiation with wavelength of 670 nm.

Fig. S5. X-ray photoelectron spectroscopy (XPS) spectra of molybdenum disulfide (a), mica (b), and HOPG (c) after 15 min HAuCl₄ loading under light irradiation with wavelength of 390-780 nm.

Fig. S6. XPS spectra of tungsten disulfide after reacting with HAuCl₄ for 24h under light irradiation with wavelength of 390-780 nm and light intensity of 150W: wide-scan XPS spectra (a), Au 4f spectra (b).
Fig. S7. Height distribution of Au particles on molybdenum disulfide after being exposed in HAuCl₄ solution and being irradiated at 385-415 nm and 420-780 nm wavelength.

Fig. S8. AFM images of the MoS₂ after 15 min HAuCl₄ at 5 °C (a) and 67 °C (b) under light irradiation with wavelength of 390-780 nm.
**Fig. S9.** Height distribution of the Au particles on MoS$_2$ after 15min HAuCl$_4$ at 5°C and 67°C under light irradiation with wavelength of 390-780 nm.

**Fig. S10.** Height distribution of Au particles on molybdenum disulfide after being exposed in HAuCl$_4$ solution under 420-780 nm irradiation with different light intensities: low light intensity (100W), medium light intensity (200W), and high light intensity (300W).
Fig. S11. Height distribution of Au particles along defects and in flat area of MoS$_2$ surface after HAuCl$_4$ solution loading under 25°C.