Introduction

Research on plasmonics in hybrid structures of graphene and metal nanostructures has led to a surge of interest in other atomically thin two dimensional (2D) materials, especially MoS\(_2\). It has been reported that with the decoration of gold nanoparticles, 2D MoS\(_2\) field effect transistor displays an enhanced photocurrent. However, there have been no in-depth reports yet on the plasmonic interaction mechanism between metallic nanostructures (MN) and 2D MoS\(_2\). Moreover, current published work addresses only devices with gold nanoparticles randomly distributed on MoS\(_2\). In our work, we demonstrate the precise patterning of MN on 2D MoS\(_2\) and investigate the effect of metal patterns on the optical response of MoS\(_2\).

Results and Discussion A:

Photoluminescence (PL) of MoS\(_2\) with and without antenna

![PL mapping](image1.png)

![PL intensity](image2.png)

![PL mapping](image3.png)

![PL intensity](image4.png)

Figure 2 (a) PL mapping and (b) PL intensity of MoS\(_2\) with and without single antenna; (c) PL mapping and (d) PL intensity of MoS\(_2\) with and without dimer antenna.

Results and Discussion B

![SEM](image5.png)

![Relative Reflectance](image6.png)

Figure 3 SEM of gold dimer antenna on MoS\(_2\).

Figure 4 Relative reflectance of MoS\(_2\) with single or dimer antenna compared with pristine MoS\(_2\).

Conclusion

Gold single antenna and dimer antenna were fabricated by electron beam lithography on monolayer MoS\(_2\) which was grown by chemical vapor deposition. The SEM image shows the controllable distribution of gold antenna on MoS\(_2\). The relative reflectance confirms that the well designed gold antenna has strong resonance at 660 nm which increased the scattering of light emitted by MoS\(_2\), as a result, enhancing the photoluminescence of MoS\(_2\) as shown in PL mapping and single spectrum.

References

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