Merging of gold and semiconductor at nanoscale

Kamysbayev Vladislav

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NANYANG TECHNOLOGICAL UNIVERSITY

URECA
Undergraduate Research Experience on CAmpus

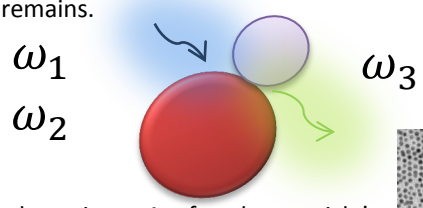
Category: 6 **Student: Kamysbayev Vladislav** **Project ID: SPMS13042**
School of Physical and Mathematical Sciences

Merging of Gold and Semiconductor at Nanoscale

Or how to force beams of light to interact?

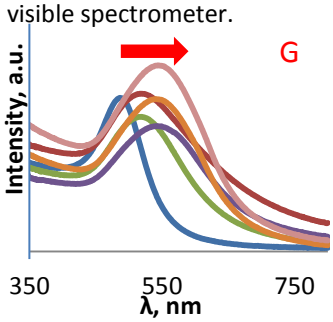
INTRODUCTION

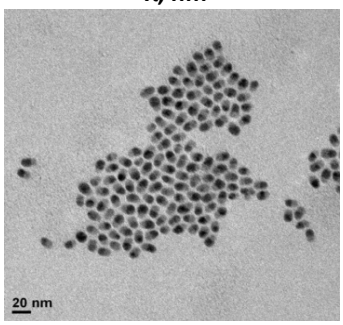
Composite **semiconductor nanoclusters** of different materials could provide unique properties which are usually inaccessible by single component nanostructures. Interaction between quantum confined electronic states of a semiconductor part and dialectic confined plasmons of a metallic part could increase optical nonlinearity of the medium. However**, the main challenge of** combining materials with large lattice mismatches together in various shapes still remains.



We chose inert Au for the particle's plasmonic part, whilst its semiconductor part was CdSe whose properties are well studied and understood.

An epitaxial growth of a semiconductor shell over the different diameter gold cores was carried out at 180°C in oleylamine as a solvent implementing the multiple injection method. The samples were characterized on a transmission electron microscope (TEM) and UV-visible spectrometer.





RESULTS

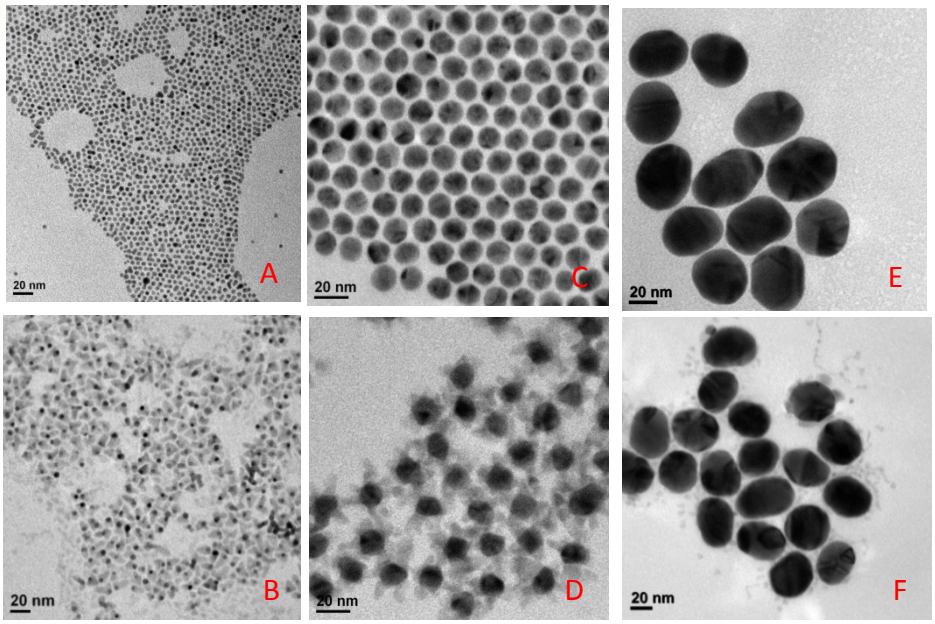


Figure 1. TEM images of Au NPs and hybrid structures **(A)** 5nm Au; **(B)** Au(5nm)-CdSe; **(C)** 13.3 nm Au; **(D)** Au(13.3nm)-CdSe; **(E)** 36 nm Au, and **(F)** Au(36 nm)-CdSe. **(G)** evolution of the UV-vis. spectra for 13.3 nm Au NPs upon increasing CdSe amount.

SUMMARY AND FUTURE WORK

Our study has shown that ligand plays a crucial role in tuning the interfacial strain between Au and CdSe. The three systems - although treated under the same conditions - have shown completely different morphologies of hybrid structures. Future work would include another shape of heterostructures based on the recently obtained by our group $Au - Ag_2S$ dimer nanoparticles.

References

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Project Title: Fabrication of Heteronanostructures
Supervisor: Assoc Prof Chen Hongyu
Collaborator: Mr Wang Weizhi