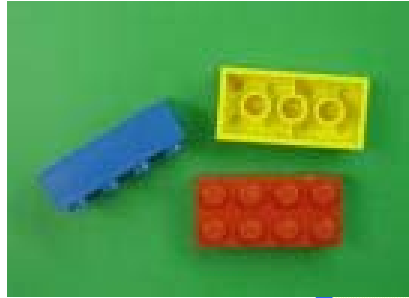


Nanoparticles; Optical and Biomedical Applications

Jaebeom Lee

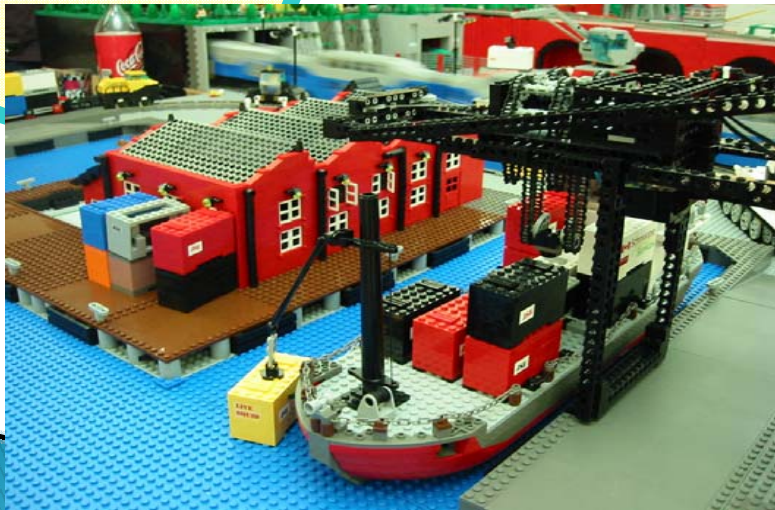
**Department of Nanomedical Engineering
Pusan National University**

Re-construction



Individual

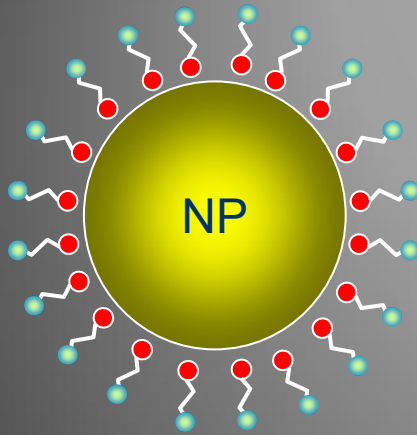
Combination
to have Function



➔ Nanomaterials assemblies

- Expected better or novel optical properties of combined nano-hybrids
- Customized optical and electromagnetic properties of nanomaterials
- Possibly advanced nano devices application for environmental and bio-sensing, solar cell, photovoltaics, imaging, non-linearity, photonics, optoelectronics, etc.

Nanomaterials We used



Stabilizers

- *Water-based Synthesis*
- *Control the sizes of NP*
- *Easy to bind other materials*

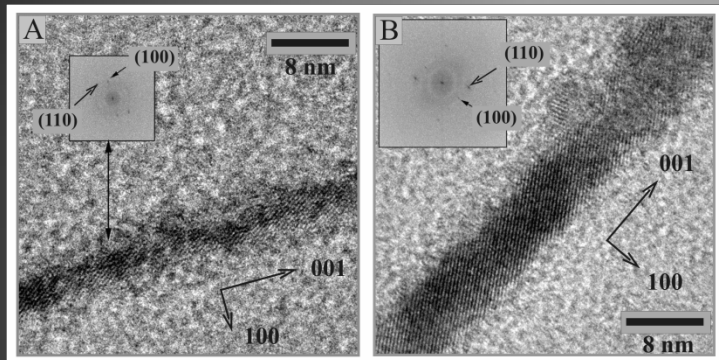
Nanoparticles, Nanorods

- *CdTe, CdSe, CdS, HgTe*
- *Au, Ag*

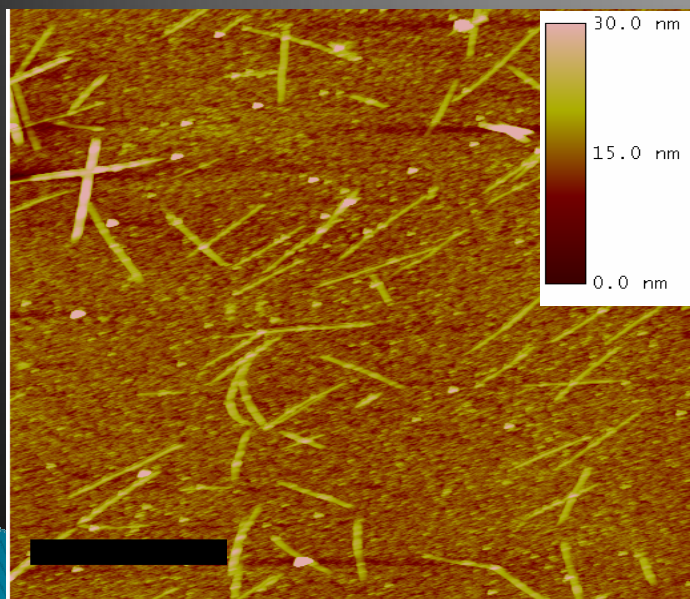


High Luminescence of CdTe NWs

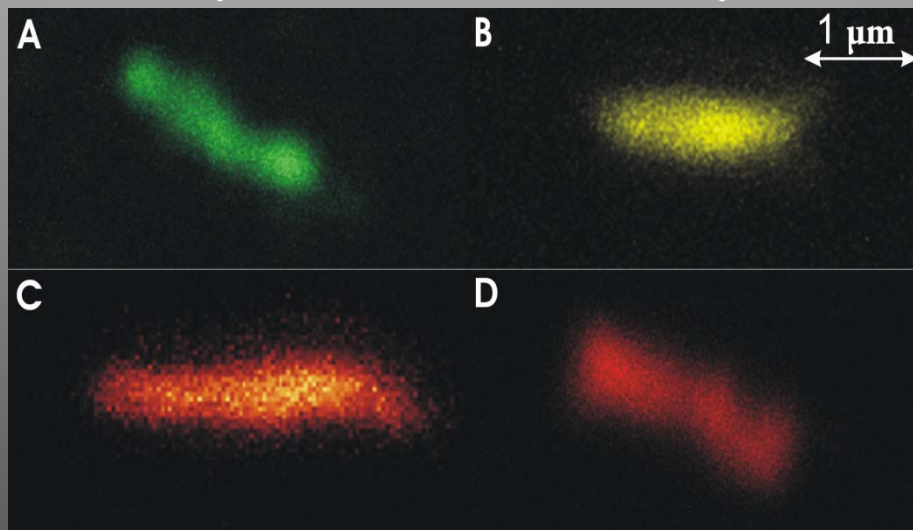
Nanoparticle → *Nanowires*



*Strong Luminescence
Aqueous Dispersions*



Quantum yield 29%



Quantum yield 16%

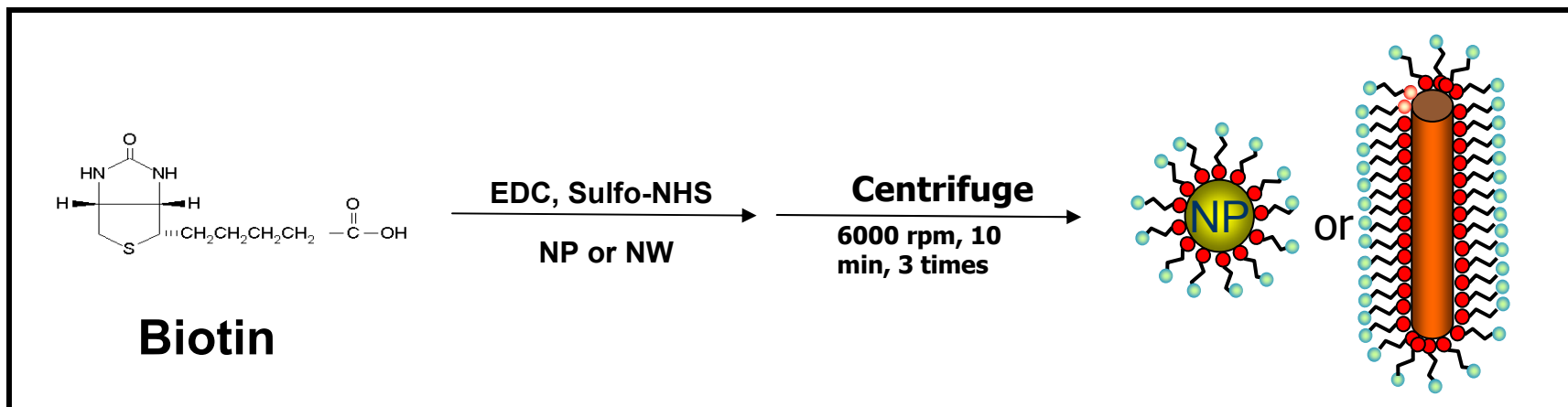
Quantum yield 6%

Quantum yield 2.3%

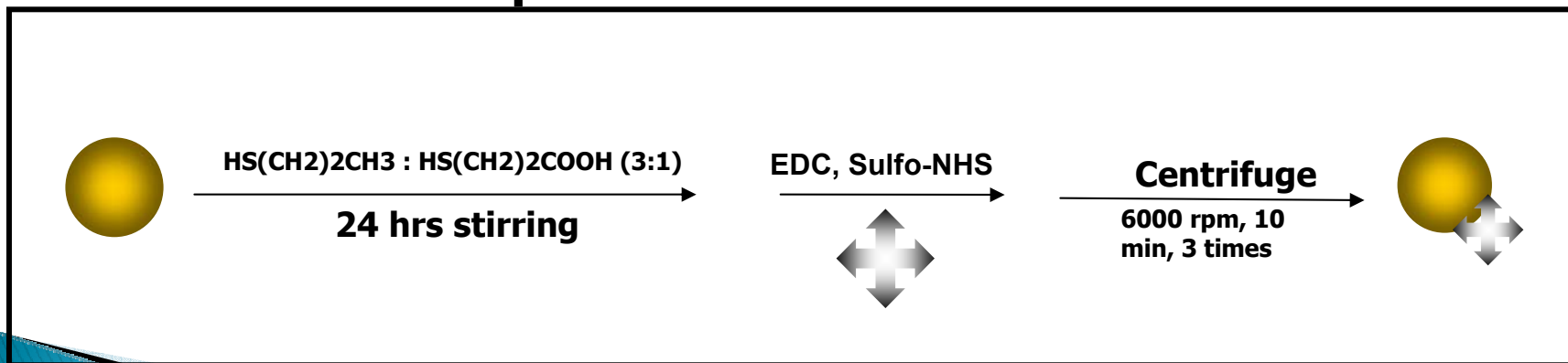
Immobilization

EDC : 1-ethyl-3-(3-dimethylamino propyl) carbodiimide hydrochloride
Sulfo-NHS : N-hydroxy-sulfosuccinimide

CdTe NW-Biotin

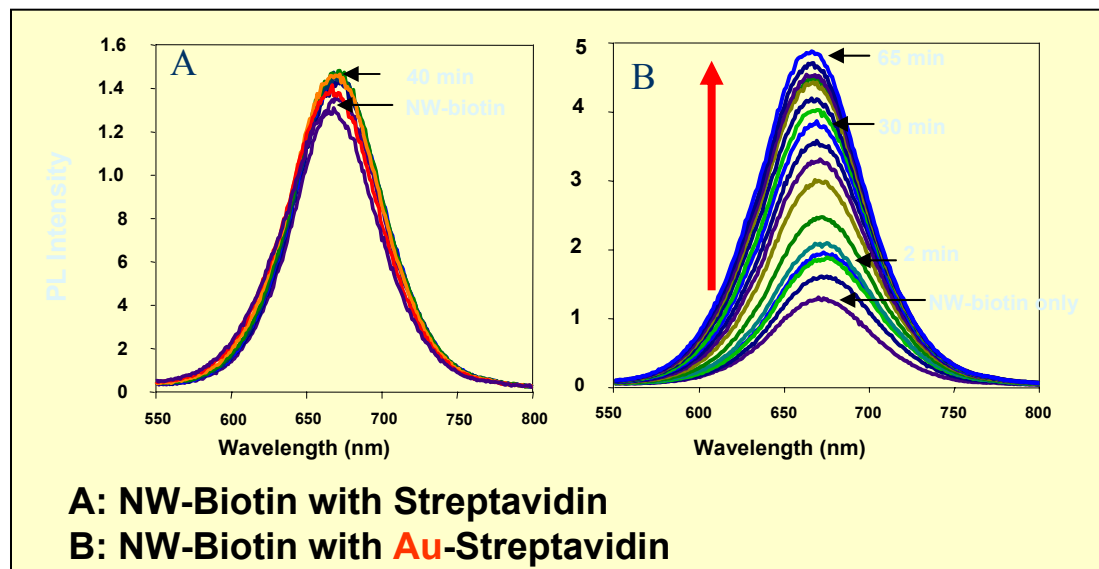
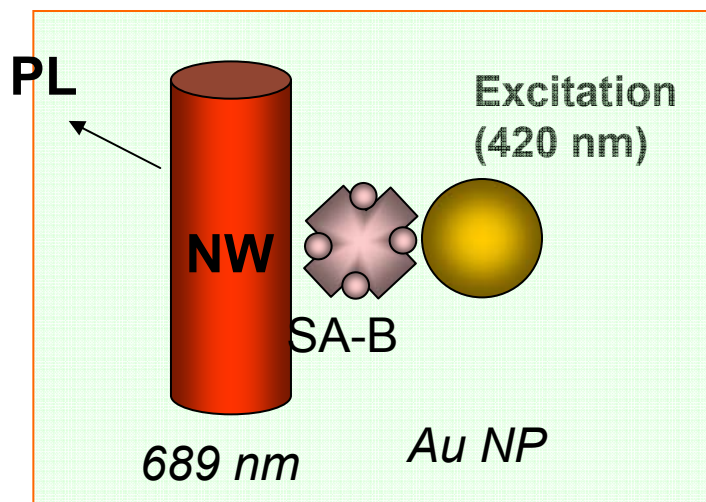


Au or CdTe NP-Streptavidin

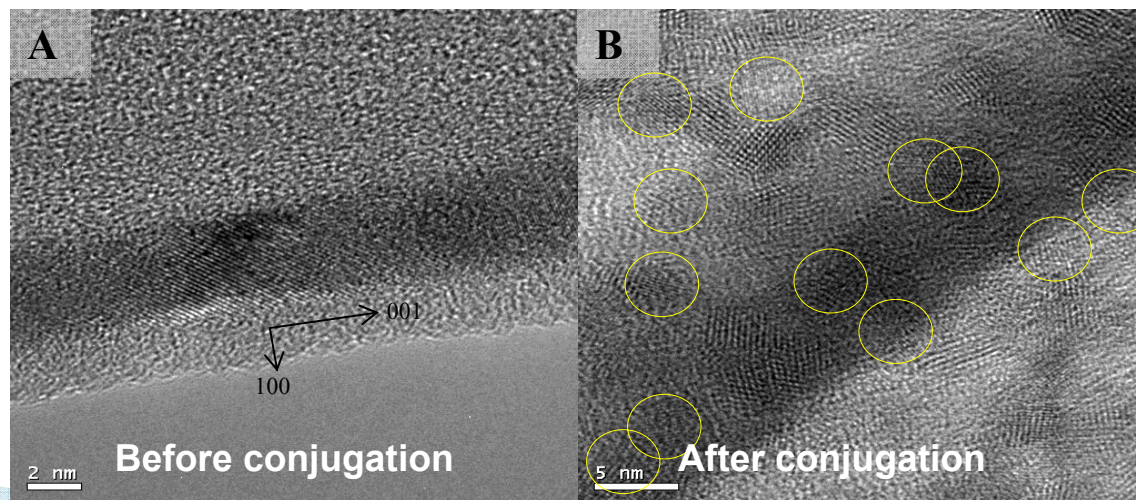


SA Biotin Au NP

Luminescence Enhancement via Nanowires and Au Nanoparticles Assembles

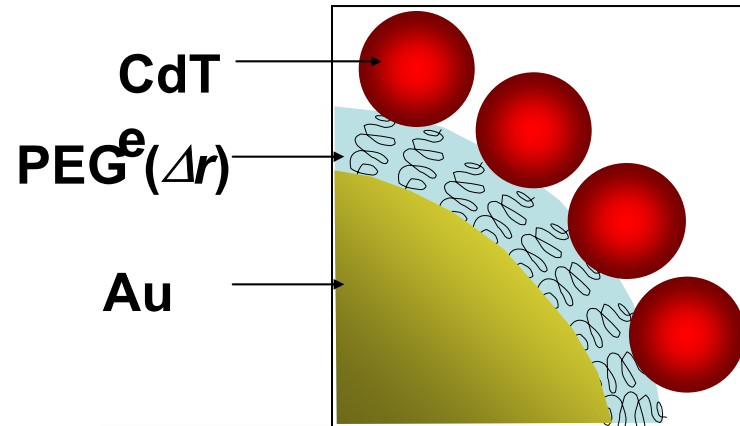
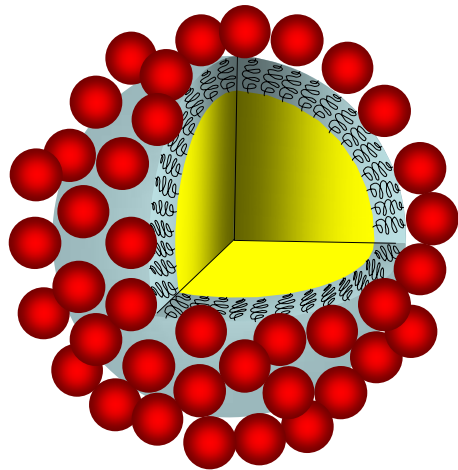


Microscopic images



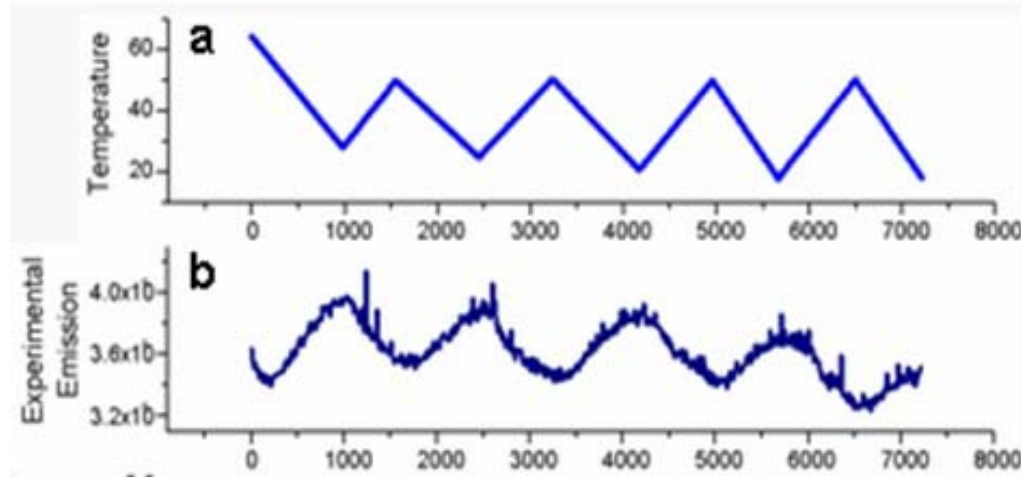
5-fold
PL
enhancement

Nanothermometer



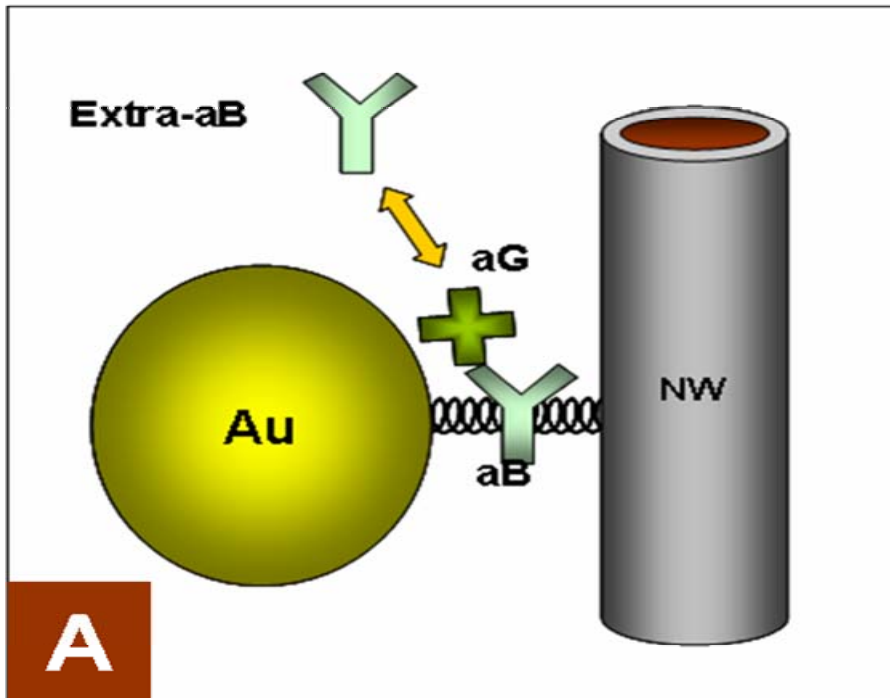
Stretch!

↳ Depending on *Temperature*



Temperature oscillations result in emission modulation

Nano Litmus paper biosensor



Sensing is based on wavelength shift of the emission intensity

Not on the intensity change

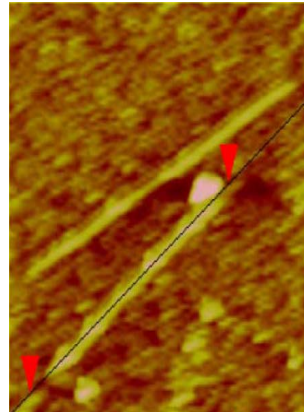
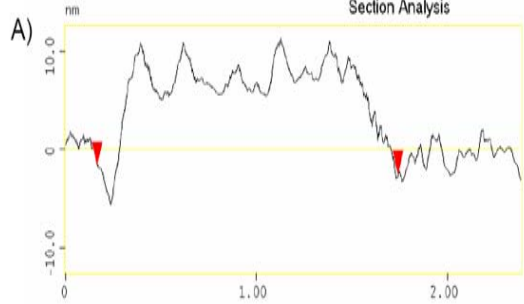
No need for internal standards

Robust operation

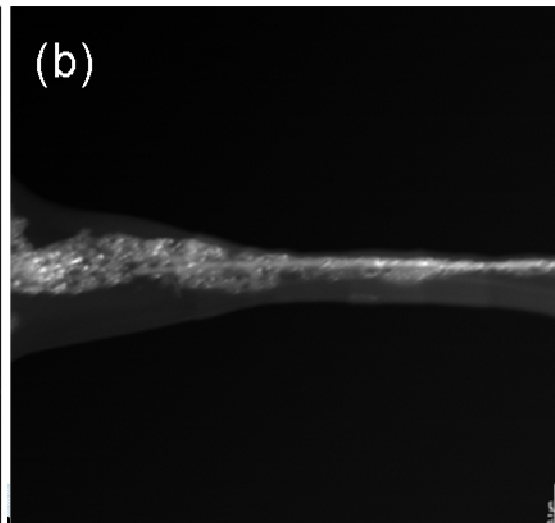
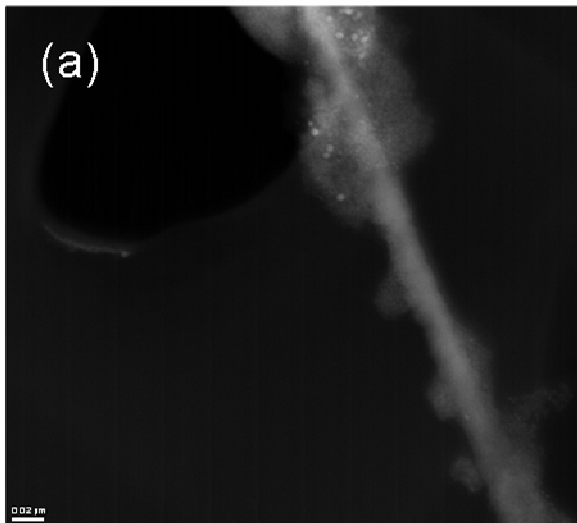
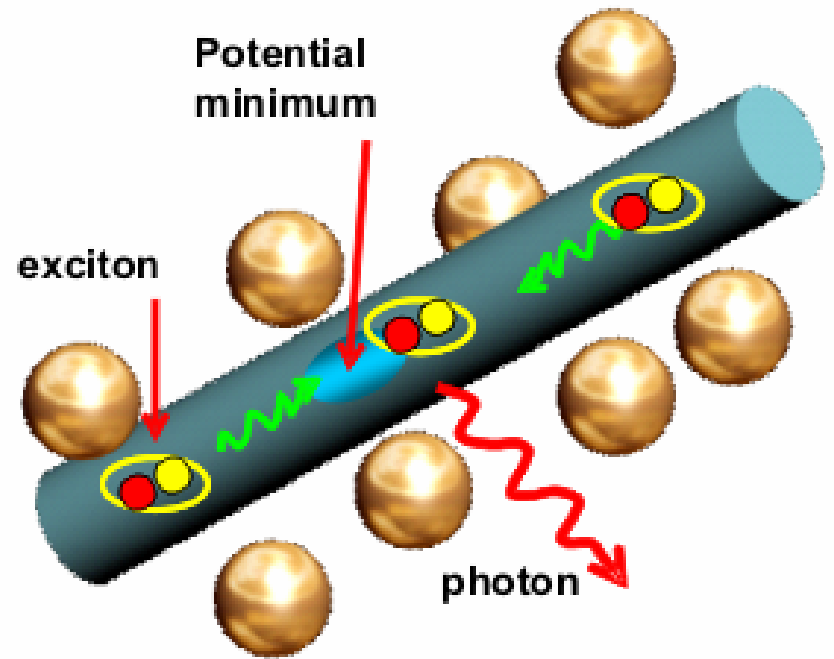
Tunable wavelengths

Litmus paper technology for biosensors

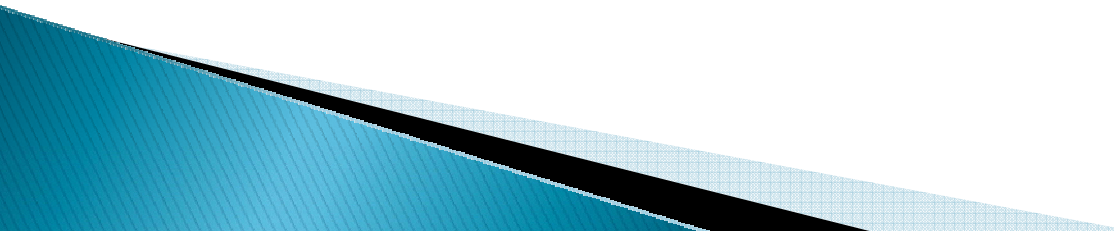
One probable reason:



The local surface of NW is not flat, inducing **different band gaps**.



Conclusion

- ▶ Interdisciplinary study is necessary to develop novel nanoscale biomedical sensing/imaging devices
 - ▶ The superstructures using polymer/ bio-affinity and nanomaterials have strong potential for future sensing/imaging devices
- 

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Nanomaterials Dept.
Nanosystem & Proc. Dept.
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- Fluorescent NP detector in PCR, IGB fraunhofer JRC
- 3rd IT research center, MKE
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