



Institute for Advanced Studies  
In Basic Sciences

# Synthesis and Characterization of New Multimetallic Catalysts and their Applications in Organic Reactions

By: **Soma Mohammadi**

Soma.m@iasbs.ac.ir

Supervisor:

February 2020



# Content



**Catalysts**

**Nanocatalysts**

**Cross coupling reactions**

**Bimetallic catalysts**

**Synergistic effect**

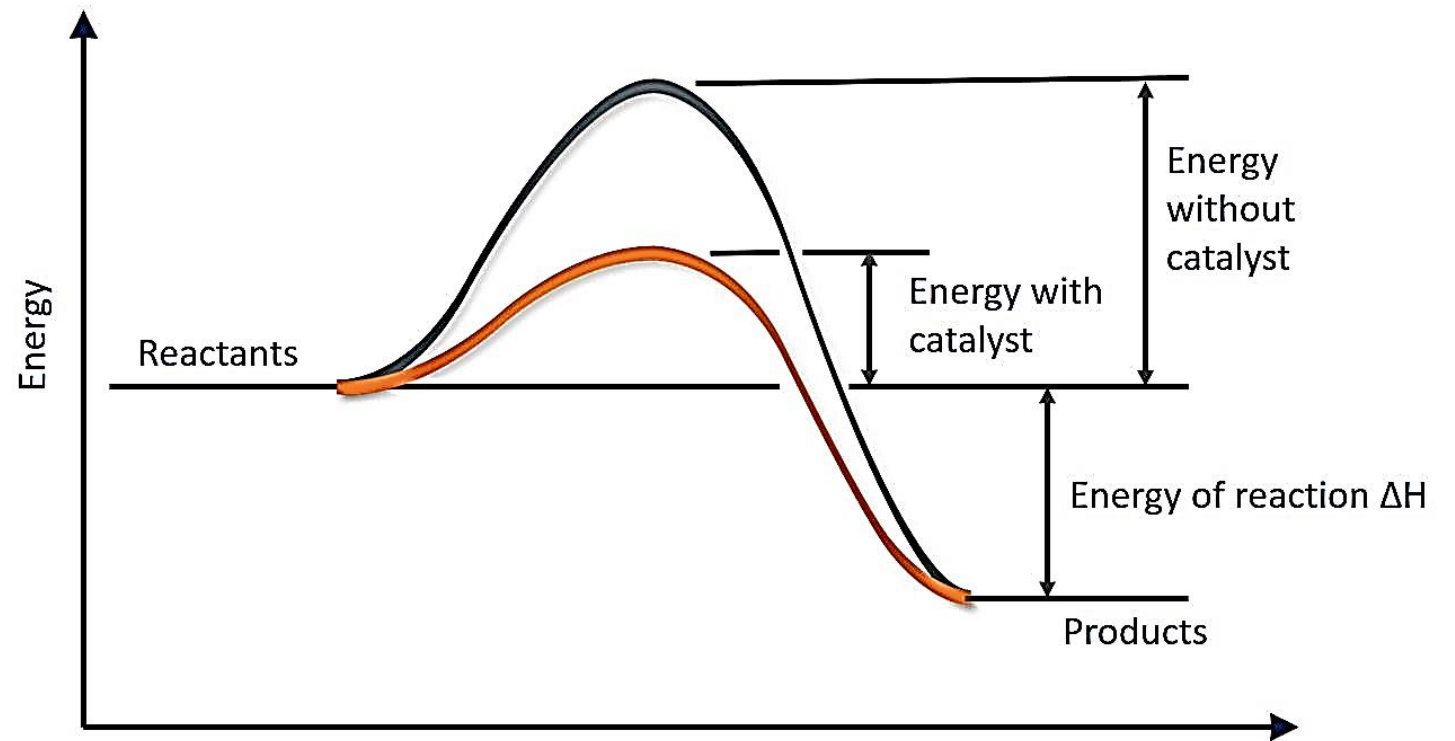
**Nanoprism structures**

**Our work**

# Catalysts

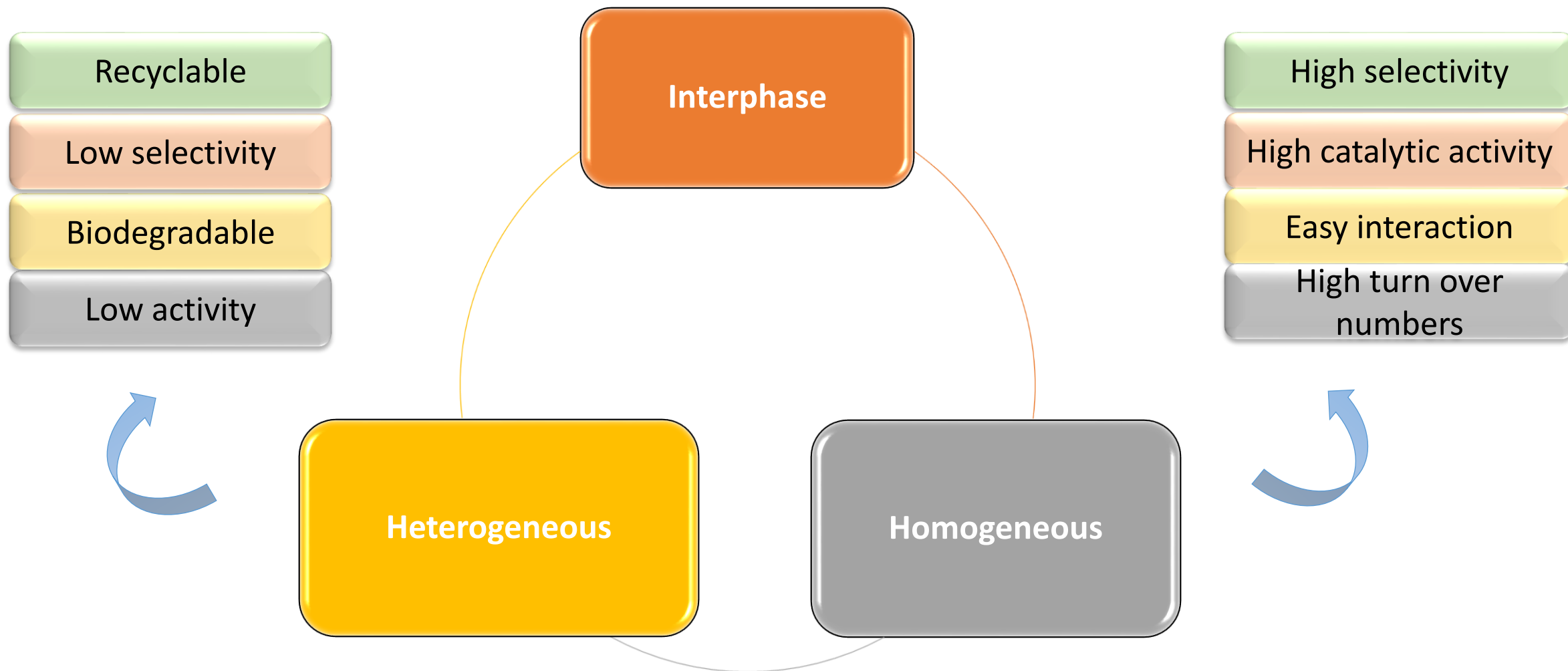


Gottlieb Kirchhoff, 1811



- Ref: Wittmann, S.; Shatz, A.; Grass, R. N.; Stark, W. J.; Reiser, O. *Angew. Chem. Int. Ed.* **2010**, 49,1867

# Types of Catalysts



# Nanocatalysts



High surface to volume ratio



Very high catalytic activity



The low reduction potential

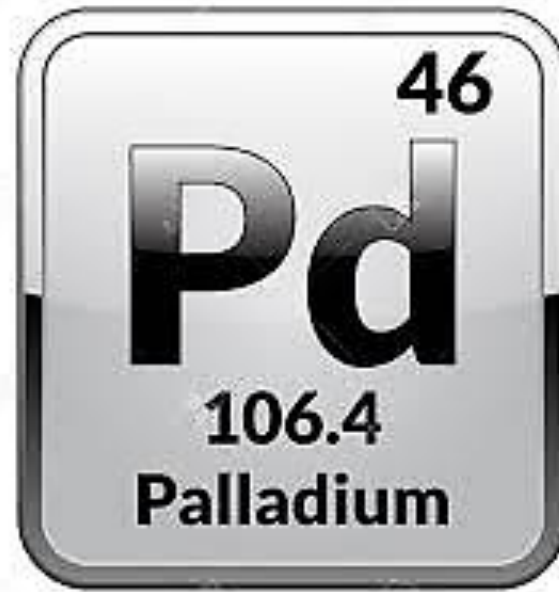
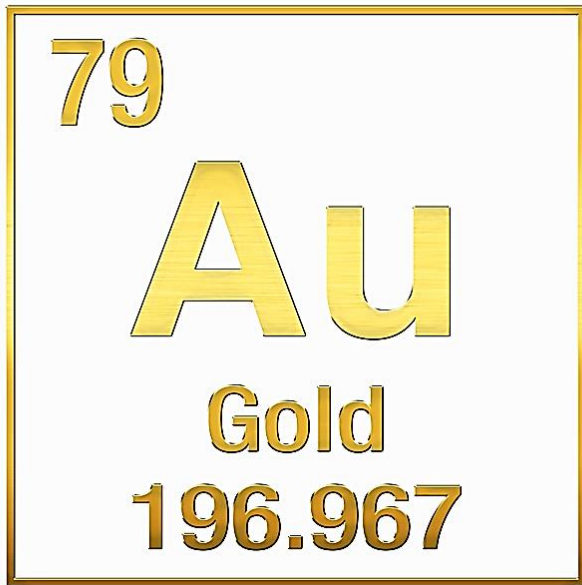


The high reactivity of metal nanoparticles



The separation and recovery of metal nanoparticles

# Catalysts

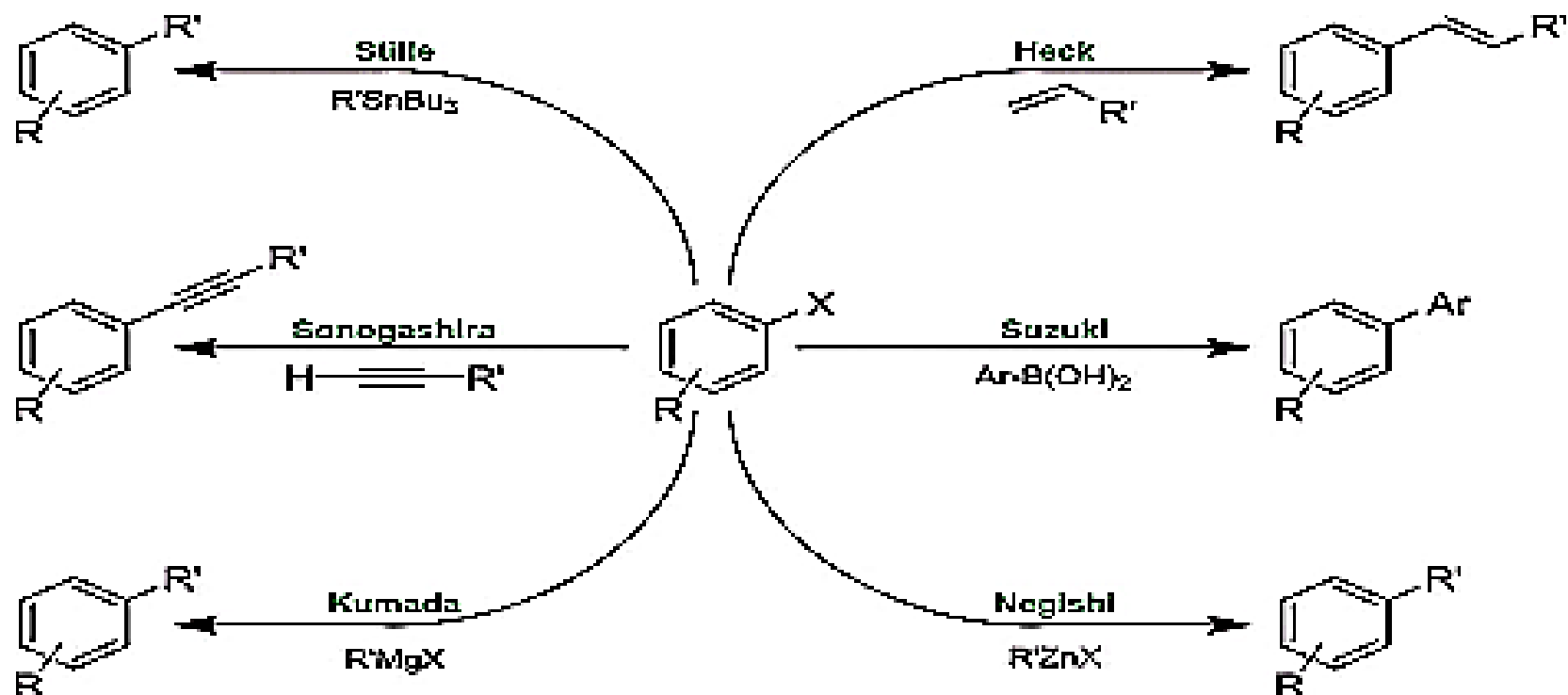


# Catalysts

26  
**Fe**  
**Iron**  
55.845

28  
**Ni**  
**Nickel**  
58.693

# Cross-coupling Reactions



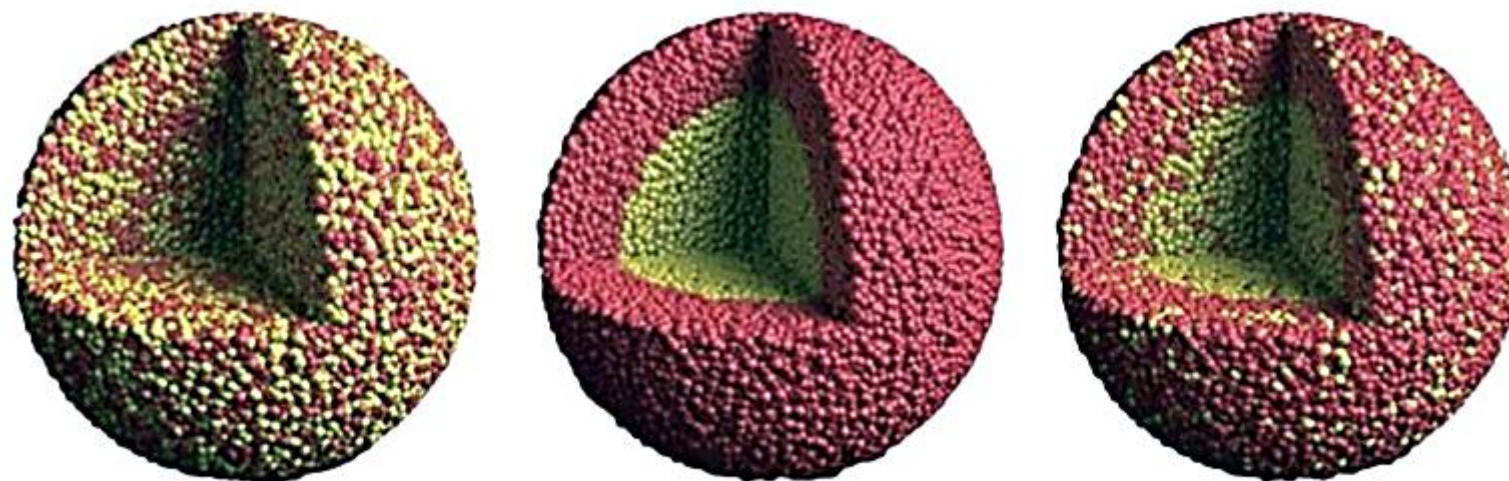


# Bimetallic Catalysts

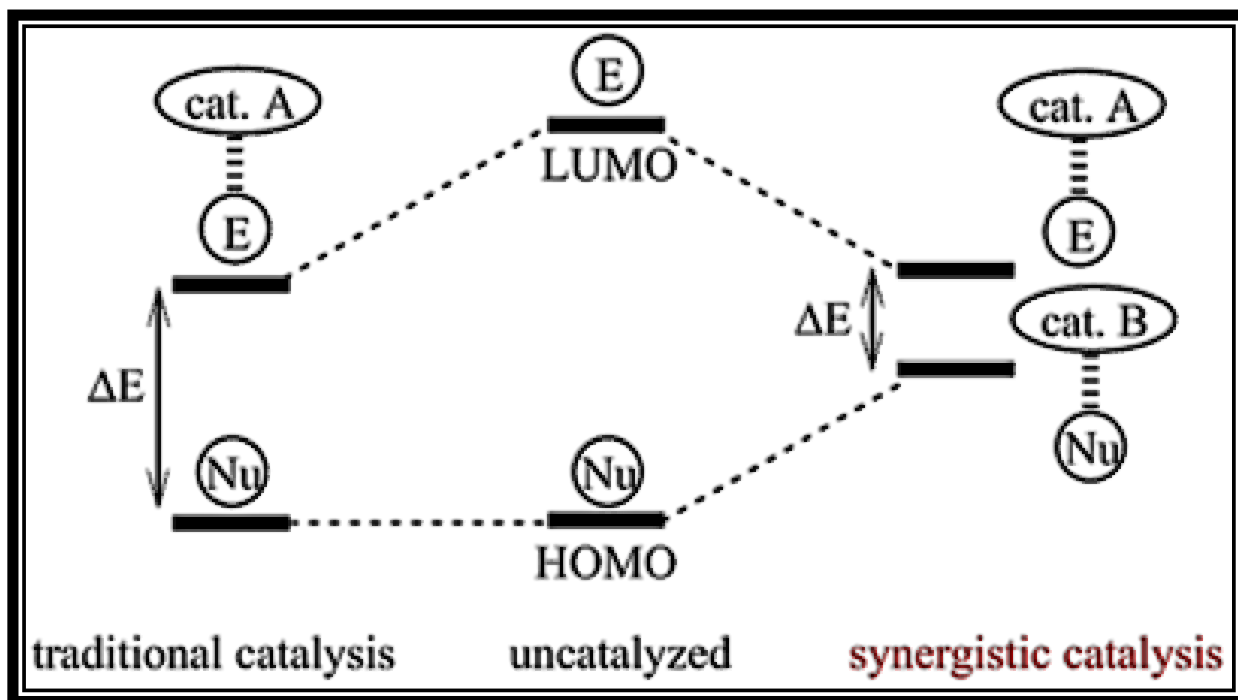
Excellent  
selectivity

Advantages

Superior  
activity



# Synergistic Effects

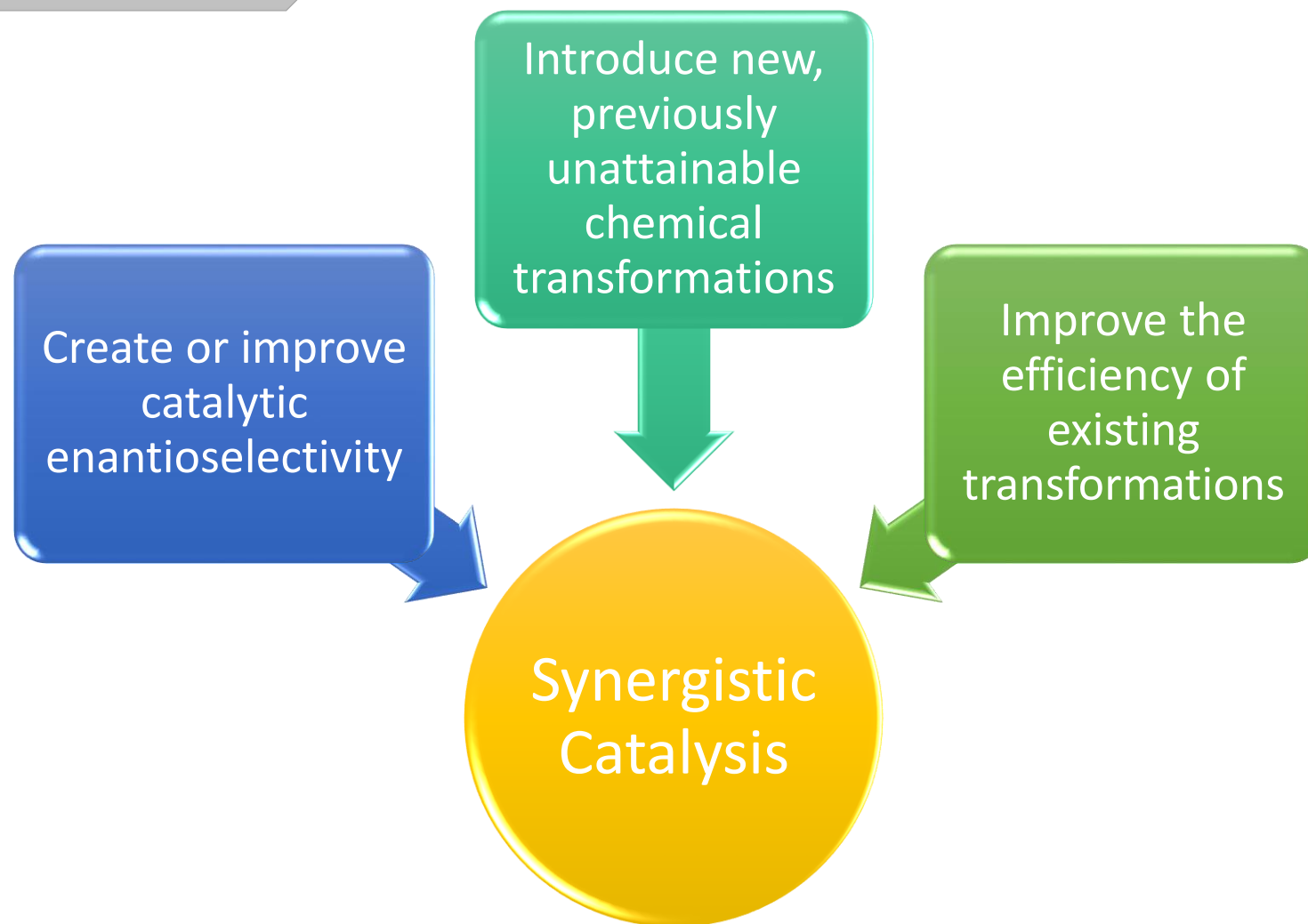


SYNERGY

$1 + 1 > 2$

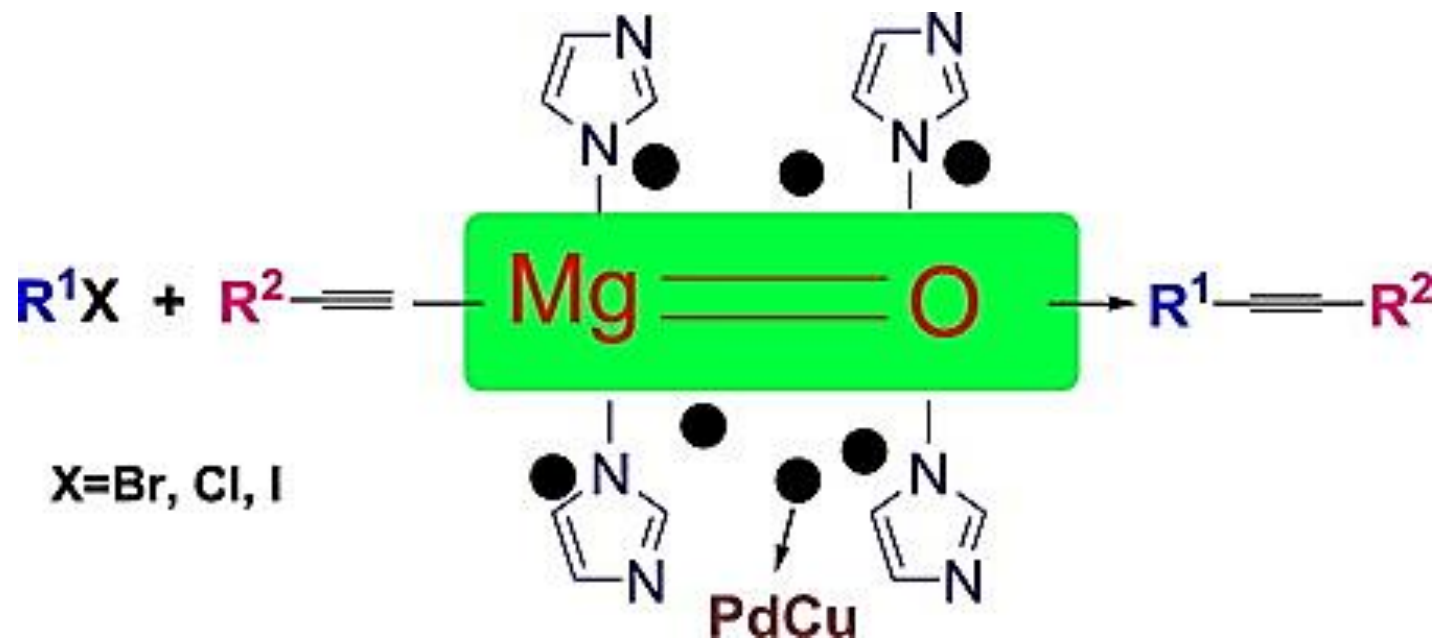


# Synergistic Effects



# Related works

Magnesium oxide supported bimetallic Pd/Cu nanoparticles as an efficient catalyst for Sonogashira reaction



- Ref: Gholinejad, M., Bahrami, M., Nájera, C., & Pullithadathil, B. *J.Catal.* **2018**, *363*, 81-91.

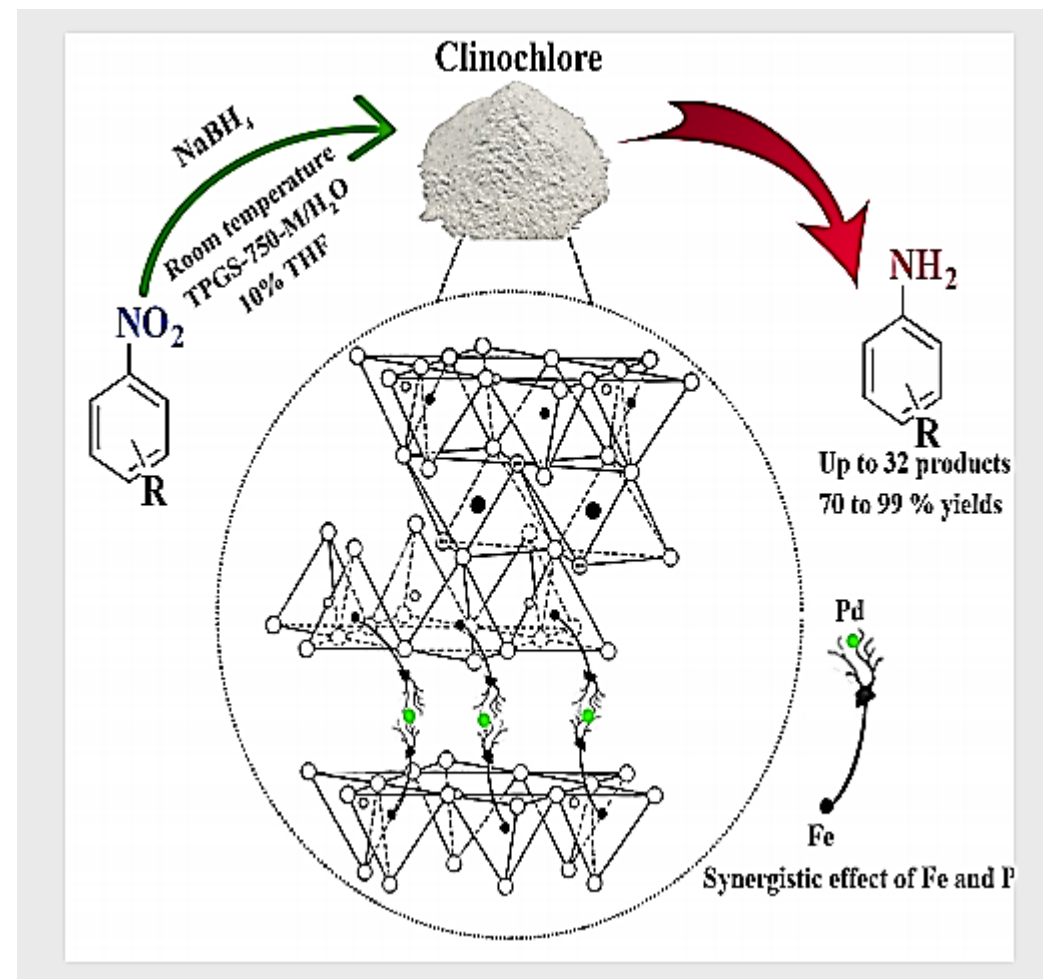
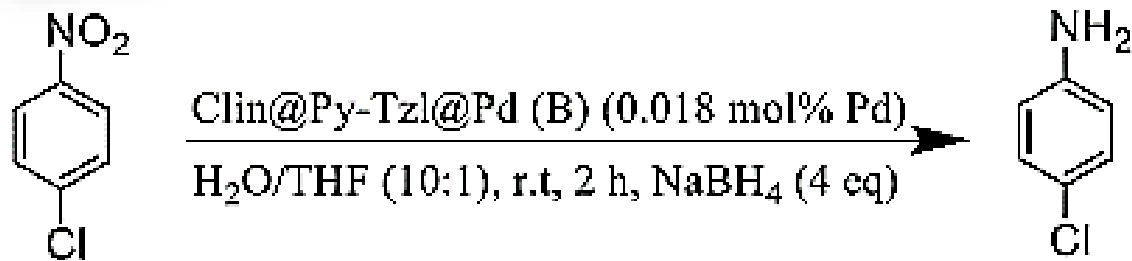
# Related works

FULL PAPER  
 WILEY-VCH

## Synergistic Effects of ppm Levels of Palladium on Natural Clinochlore: a New Reagent for Reductions of Nitroarenes

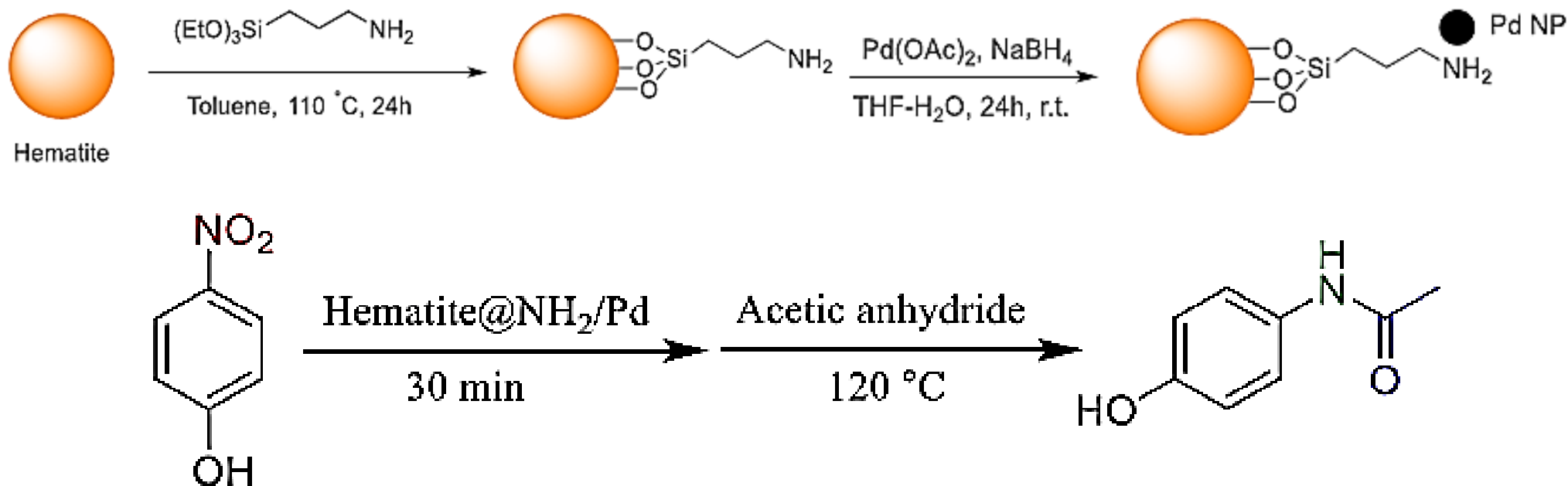
Mohammad Gholinejad<sup>\*,[a],[b]</sup>, Erfan Oftadeh,<sup>[a]</sup> Mohammad Shojafar,<sup>[a]</sup> José M. Sansano,<sup>[c]</sup> and Bruce H. Lipshutz<sup>\*,[d]</sup>

Dedicated to Professor Carmen Nájera on the occasion of her retirement.

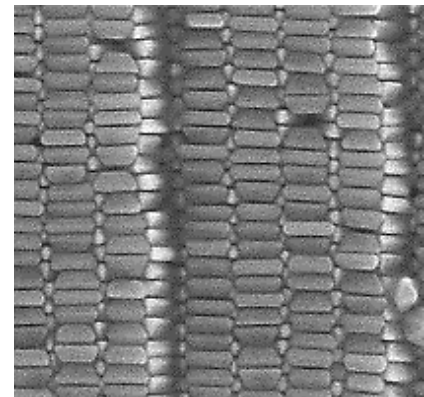
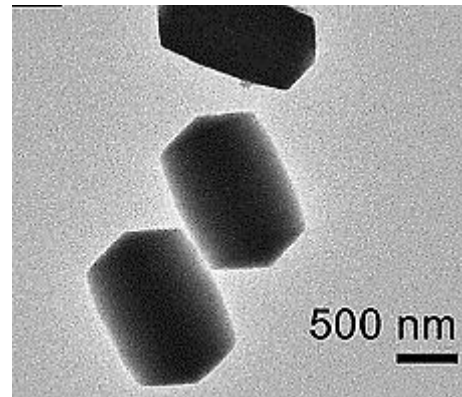
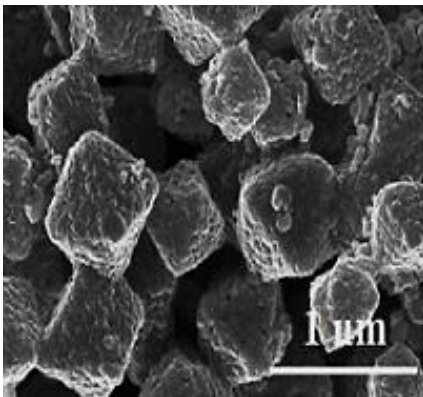
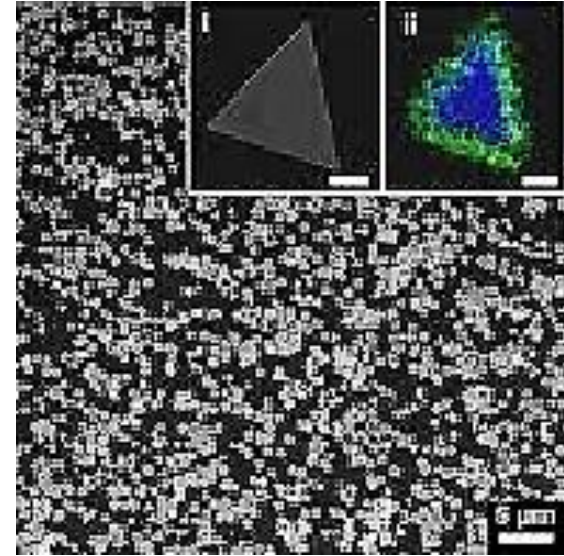
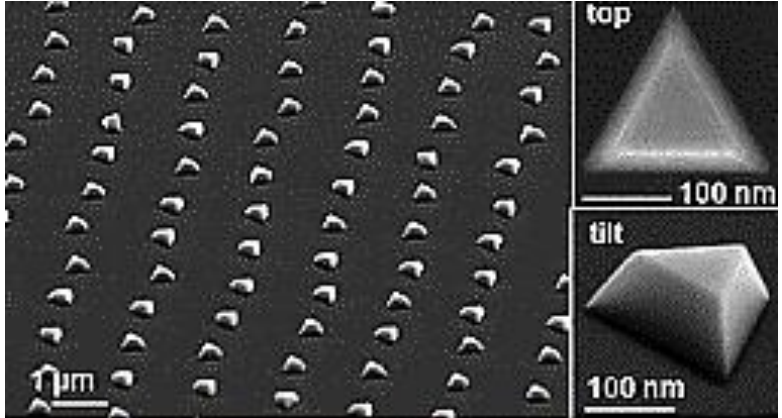
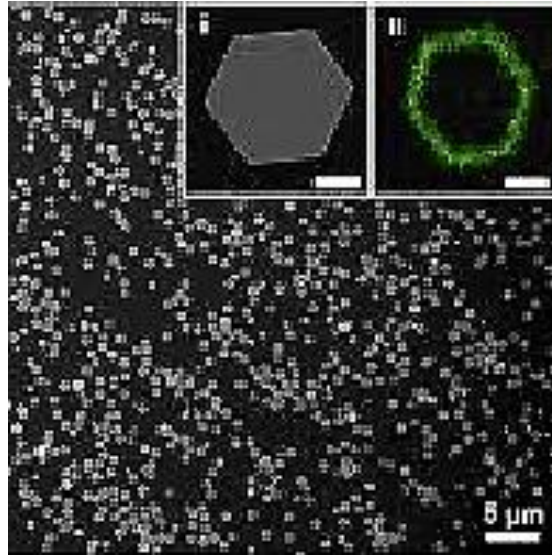


# Related works

Enhanced catalytic activity of natural hematite-supported ppm levels of Pd in nitroarenes reduction

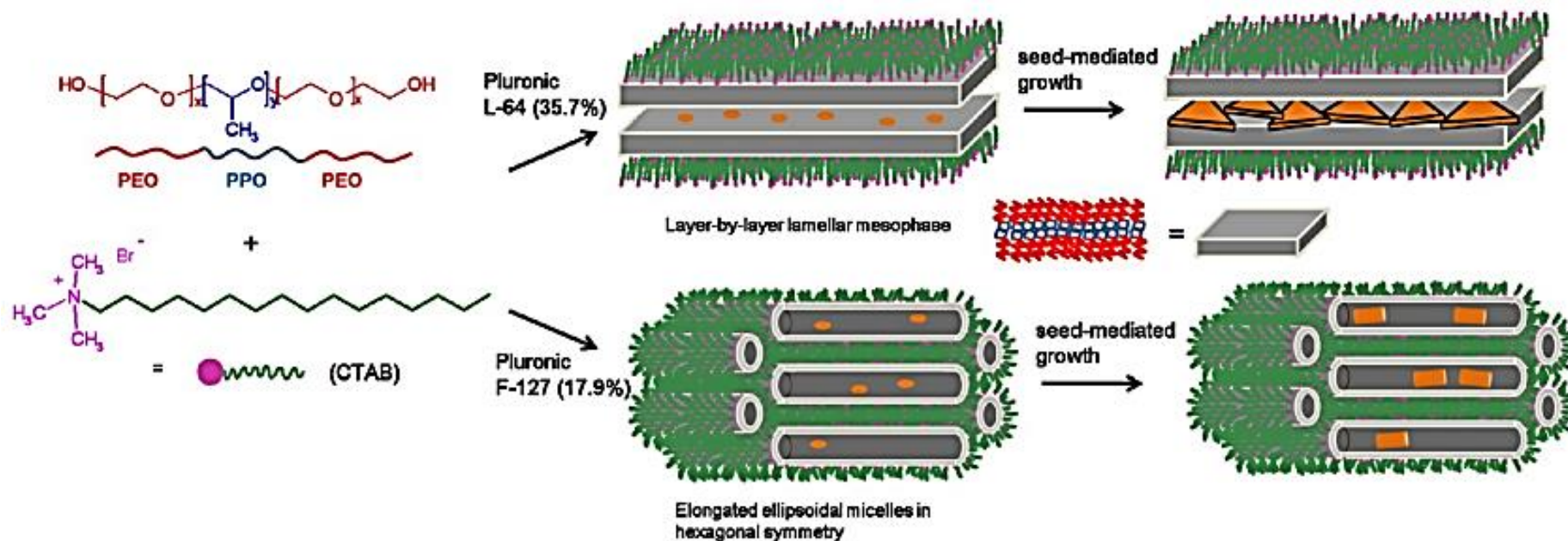


# Nanoprisms



# Nanoprisms

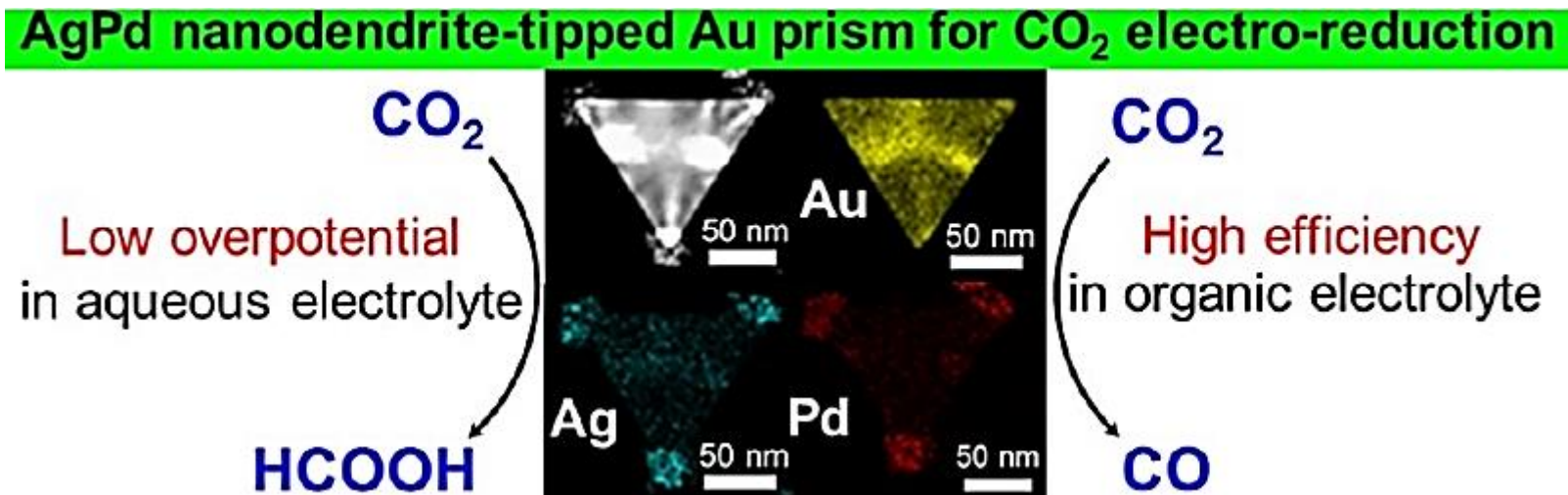
## Synthesis of Prolate-Shaped Au Nanoparticles and Au Nanoprisms and Study of Catalytic Reduction Reactions of 4-Nitrophenol





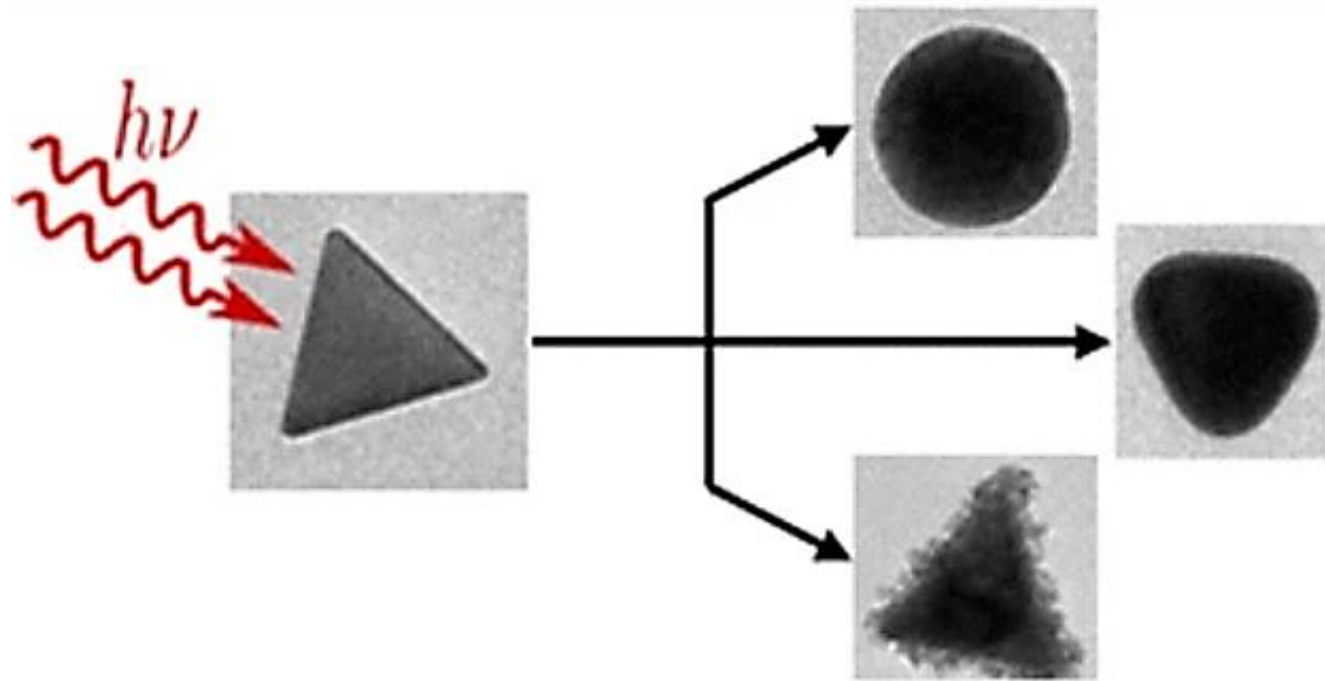
# Nanoprisms

## Site-Selective Growth of AgPd Nanodendrite-Modified Au Nanoprisms: High Electrocatalytic Performance for CO<sub>2</sub> Reduction



# Nanoprisms

Photothermal stability of biologically and chemically synthesized gold nanoprisms



Thank  
you

