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Gold-Antimony Nanoclusters for Oxidation Catalysis

Introduction

Gold Nanoclusters

Molecular chemistry

Size of metal nanoclusters

Nanoparticles

1 nm

10 nm

100 nm

Different packing structures, electron-energy quantization and optical properties.

Scheme 1. Catalytic reactions of Metal Nanoclusters

Applications:
- Optoelectronics
- Sensing
- Biomedicine
- Catalysis

Bimetallic Nanoclusters

Synergism between the different metal atoms enhances activity and selectivity.

Au-M bimetallic NCS (M = Ag, Cu, Pt or Pd) showed exceptional catalytic properties.

Re-Sb NCS shown to be highly effective catalyst for ammoniation of 3-picoline to nicotinonitrile.

Methodology

(i) Synthesis of Au(I) complexes stabilized with stibines

\[ \text{HAuCl}_4 + \text{Me}_2\text{S} \rightarrow \text{Me}_2\text{SAuCl} \]

\[ \text{Me}_2\text{SAuCl} + \text{SbPh}_3 \rightarrow \text{Ph}_3\text{Sb-AuCl} \]

(ii) Reduction

\[ \text{Ph}_3\text{Sb-AuCl} + \text{NaBH}_4 \rightarrow \text{Au-Sb NC} \]

Results & Discussion

Me\textsubscript{2}S-AuCl

DCM, r.t. 1.5h

SbPh\textsubscript{3} (1 equiv)

DCM, r.t. 3h

NaBH\textsubscript{4} (0.25 equiv)

Structure of product confirmed by X-ray Crystallography

Reduction?

Applications:
- Optoelectronics
- Sensing
- Biomedicine
- Catalysis

Distinct peaks at 352 nm and 450 nm

Future Works

- Optimize conditions for synthesis
- Study effect of varying concentration of NaBH\textsubscript{4}
- Effect of different reactant ratio - nanoclusters with different Au:Sb ratio.

References


