

# Water Gas Shift Reaction Over $\text{Au/Ce}_x\text{Ti}_y\text{O}_2$

Cheng Wan

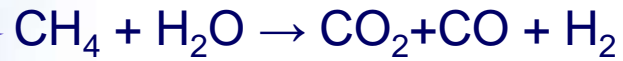
# Objective

*To investigate the structural properties and chemical activity of a potential catalyst (Au supported on  $Ce_xTi_yO_2$ ) for water gas shift (WGS) reaction.*

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# Hydrogen Production

Steam  
Reforming



WGS



*CO removal*  
*H<sub>2</sub> production*

CO  
Oxidation



*Pure*  
*Clean H<sub>2</sub>*

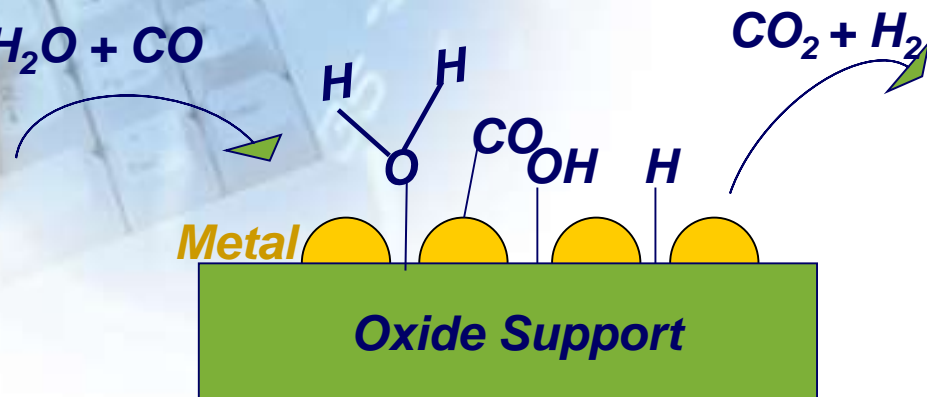
*Fuel Cell*



# Catalysts for WGS

## *Metal Supported on Oxide*

### Reaction mechanism



### Factors Influence the reactivity

- Metal
- Support
- Structure

...

### *Metal / Oxide*

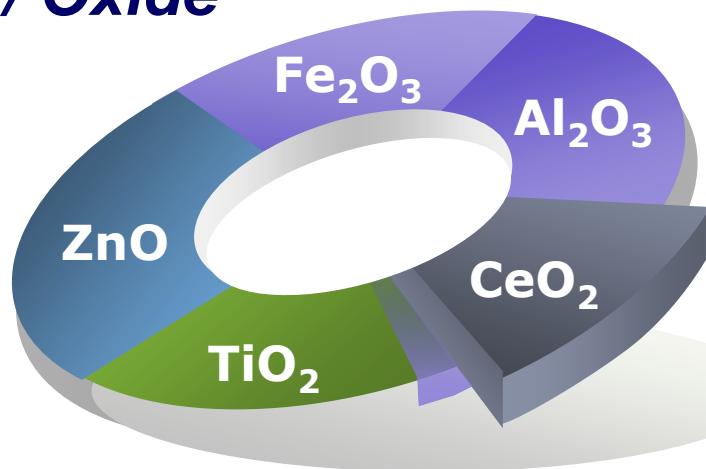
*Au*

*Pt*

*Pd*

*Rh*

...



### *CeO<sub>2</sub>*

- Redox Properties
- Oxygen Storage Capacity

### *Ti-doped Ceria*

Enhance the stability and reactivity.



# Approach

***Catalysts  
Synthesis***

*Sol – Gel  
Deposition Precipitation*

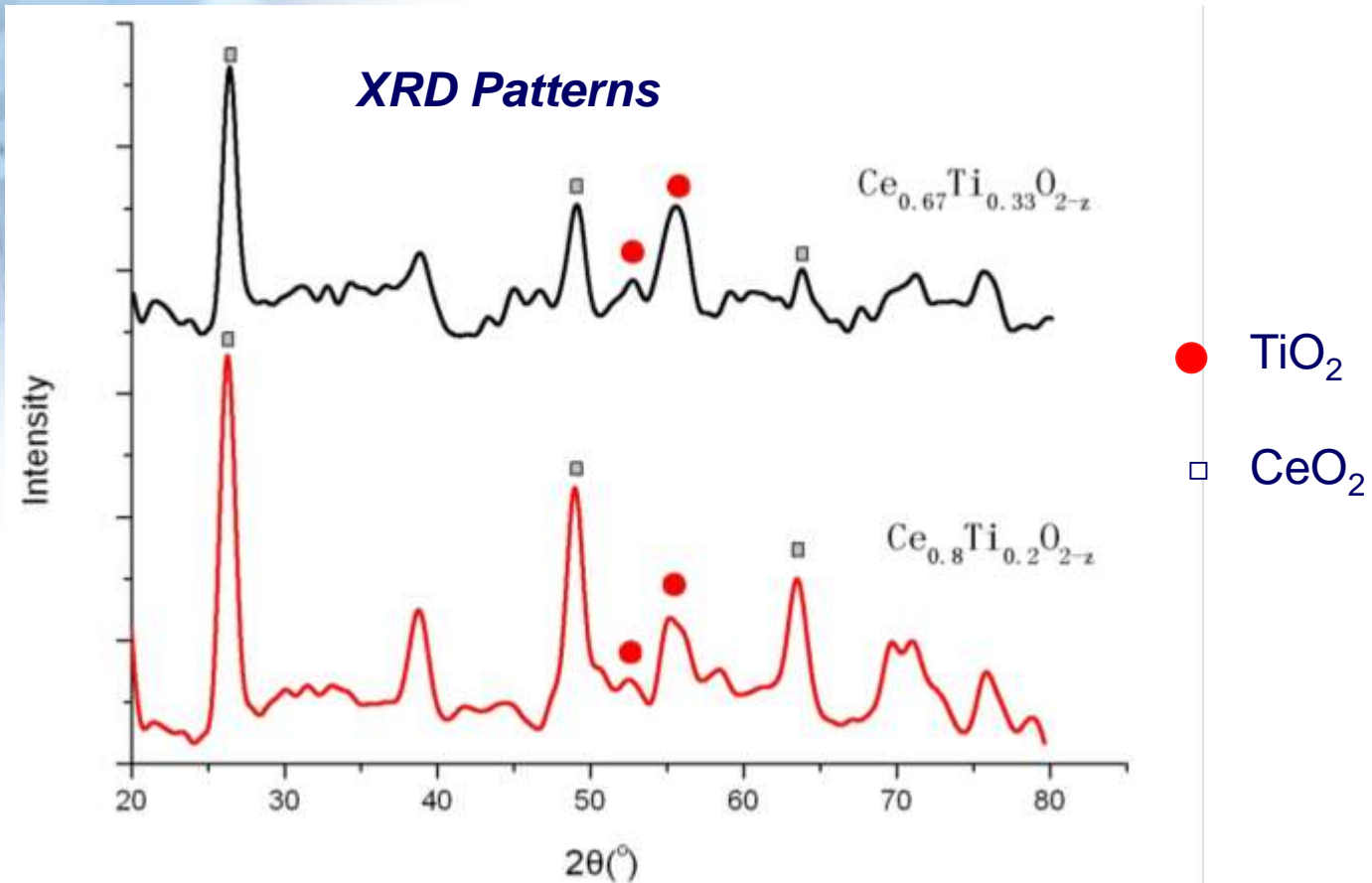
***Structure  
Study***

*X-ray Diffraction (XRD)*

***Catalytic  
Activity  
Test***

*GC-MS  
MS:Mass Spectrometer  
GC:Gas Chromatograph*

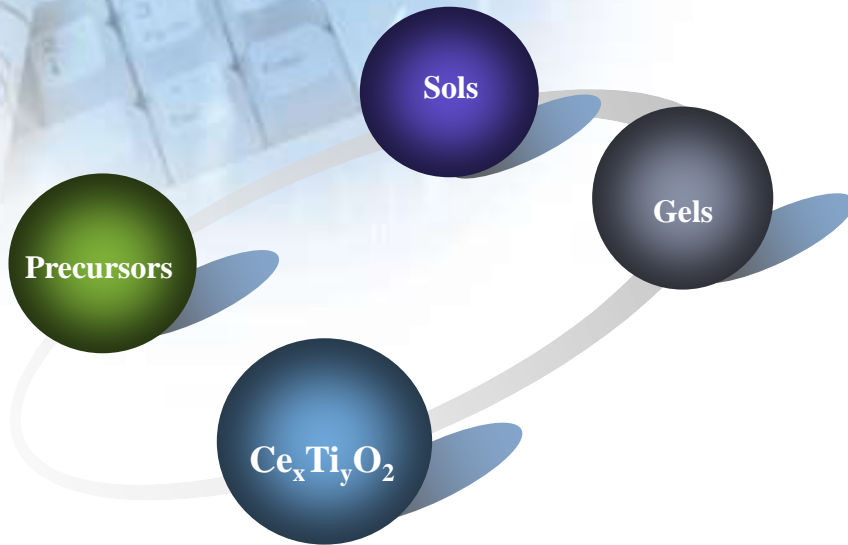
# Structure Characterization



- Mixed oxides  $Ce_xTi_yO_{2-z}$  have been synthesized successfully.
- Composition of metals in the mixed oxides affects the oxides' structures.

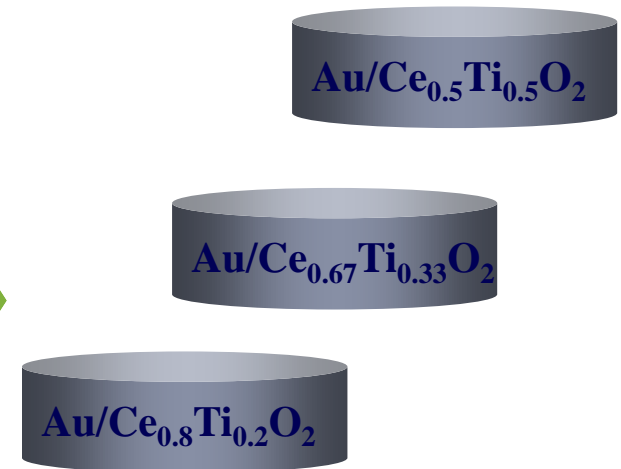
# Catalysts Preparation

## 1. Sol-Gel Method Preparation for $Ce_xTi_yO_2$ Mixed Oxides



## 2. Deposition Precipitation Method

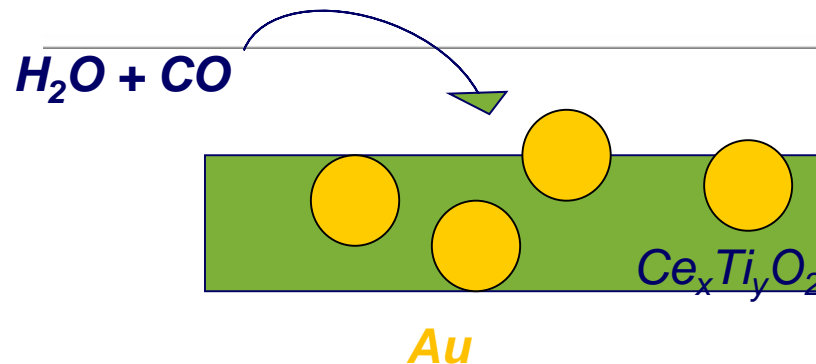
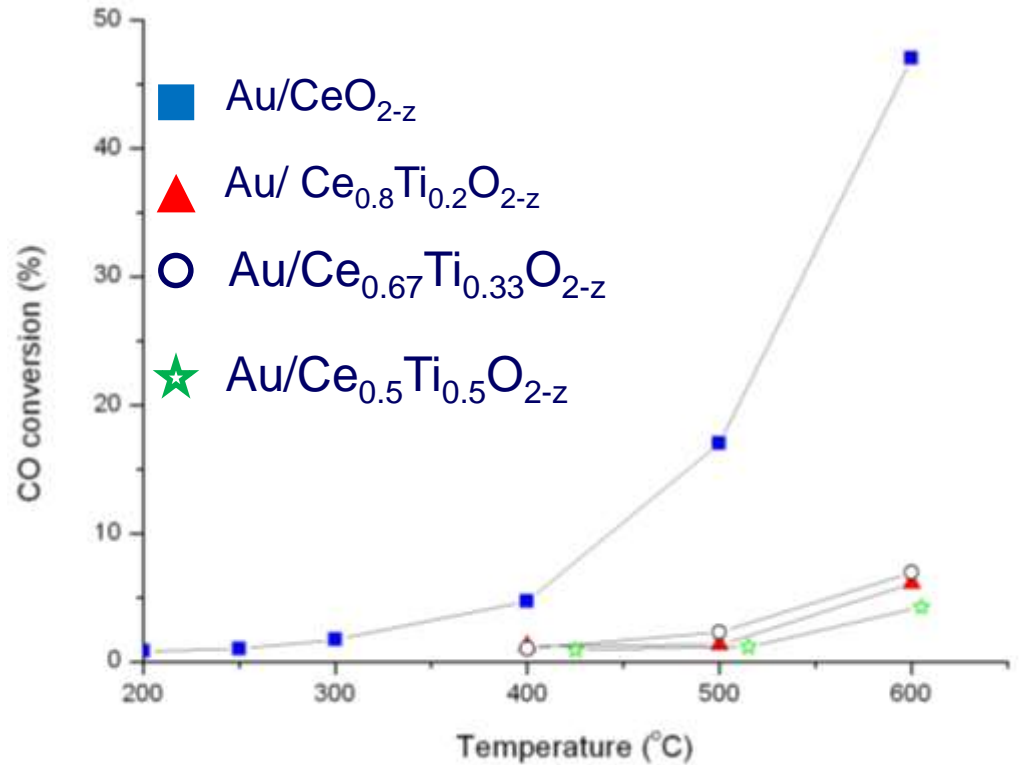
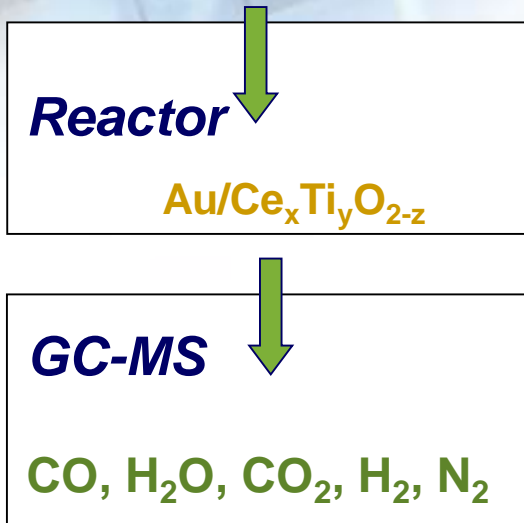
Preparation for  $Au/Ce_xTi_yO_2$  Catalysts



# Catalytic Activity

## Flow diagram of WGS test

CO 23.2%, H<sub>2</sub>O 61.8%, N<sub>2</sub> 15%





# Conclusions

- ***$Au/Ce_xTi_yO_{2-z}$  catalysts were prepared.***
  - ***Composition of metals in the mixed oxides affects the structures of oxides.***
  - ***$Au/Ce_xTi_yO_{2-z}$  shows catalytic activity in WGS reaction.***
  - ***Method of mixed oxides preparation need be improved in the future research.***
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# Accoknowledge

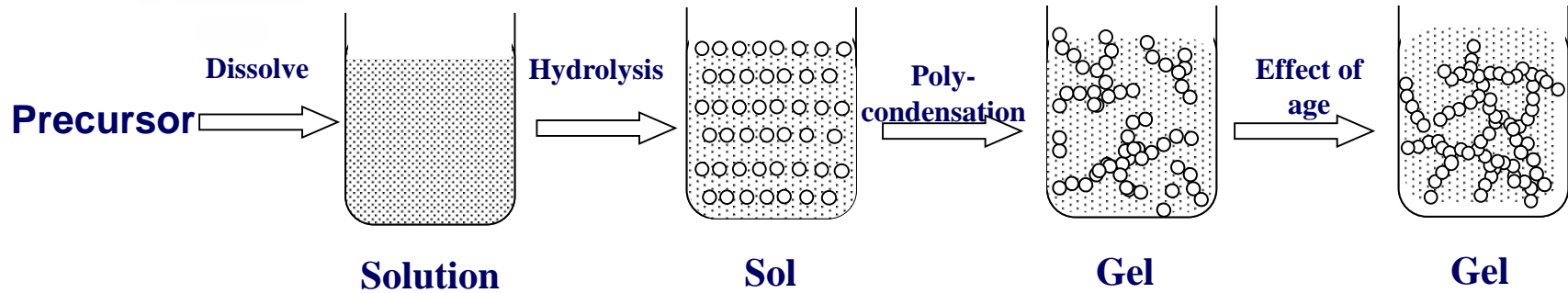
- ❖ EPSCoR
  - ❖ Dr. Jing Zhou
  - ❖ Dr. Tang and Dr. Shao Jiu
  - ❖ Dr. Fan and Ms. Ying Li
  - ❖ Dr. Yinghui Zhou and Mr. Rajendra Kumar Mahat
-

EPSCoR

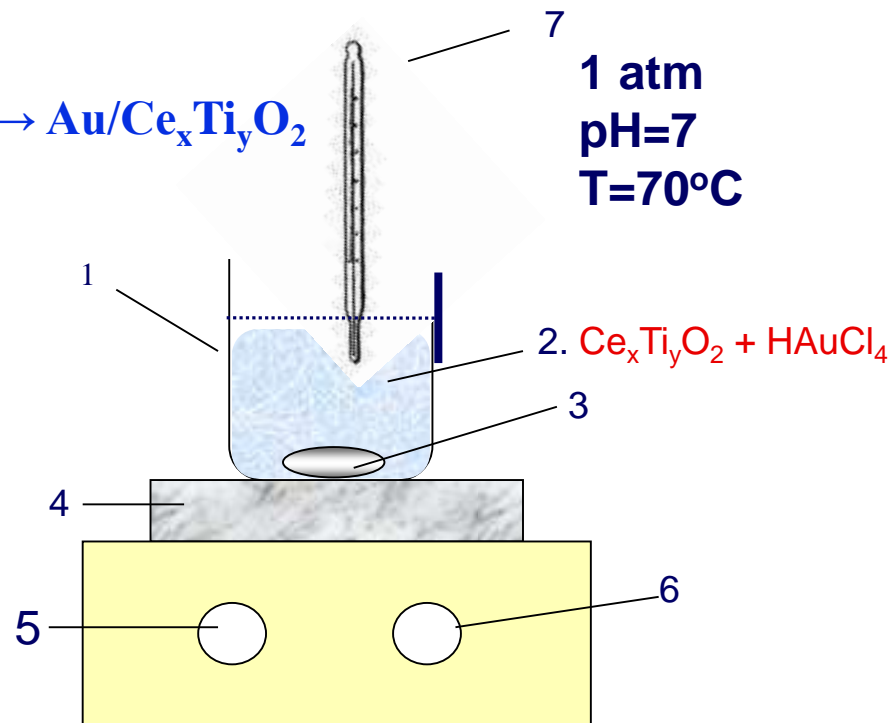
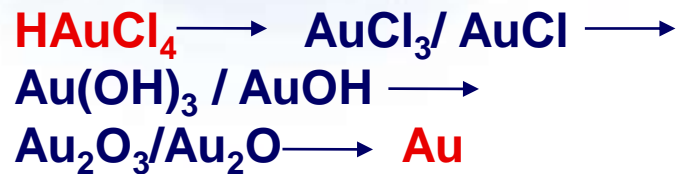
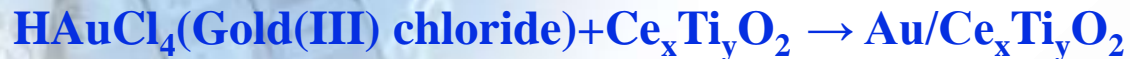
*Thank You!*



## Sol - Gel Method:



## Deposition Precipitation Method



1. Beaker
2. Solution
3. Stir bar
4. Magnetic stirring apparatus
5. Temperature controller
6. Stirring speed adjustor
7. Thermometer