

UNIT V-Part II

Catalysis by Organometallic Compounds

B.Sc. (H) Chemistry

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SYLLABUS of UNIT V

Catalysis by Organometallic Compounds

Study of the following industrial processes and their mechanism:

1. Alkene hydrogenation (Wilkinsons Catalyst)

2. Hydroformylation (Co salts)

3. Wacker Process

4. Synthetic gasoline(Fischer Tropsch reaction)

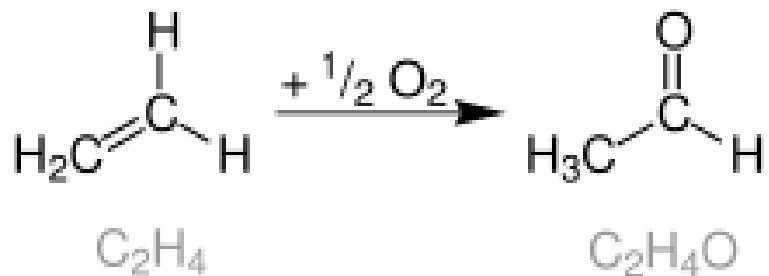
5. Synthesis gas by metal carbonyl complexes

Part I

Part II

3. Wacker Process

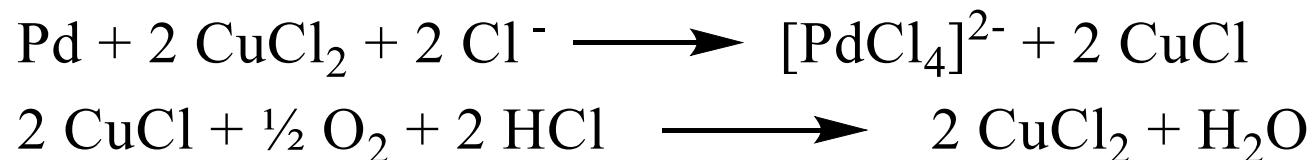
- The oxidation of ethylene to acetaldehyde in the presence of palladium(II) chloride as the catalyst.



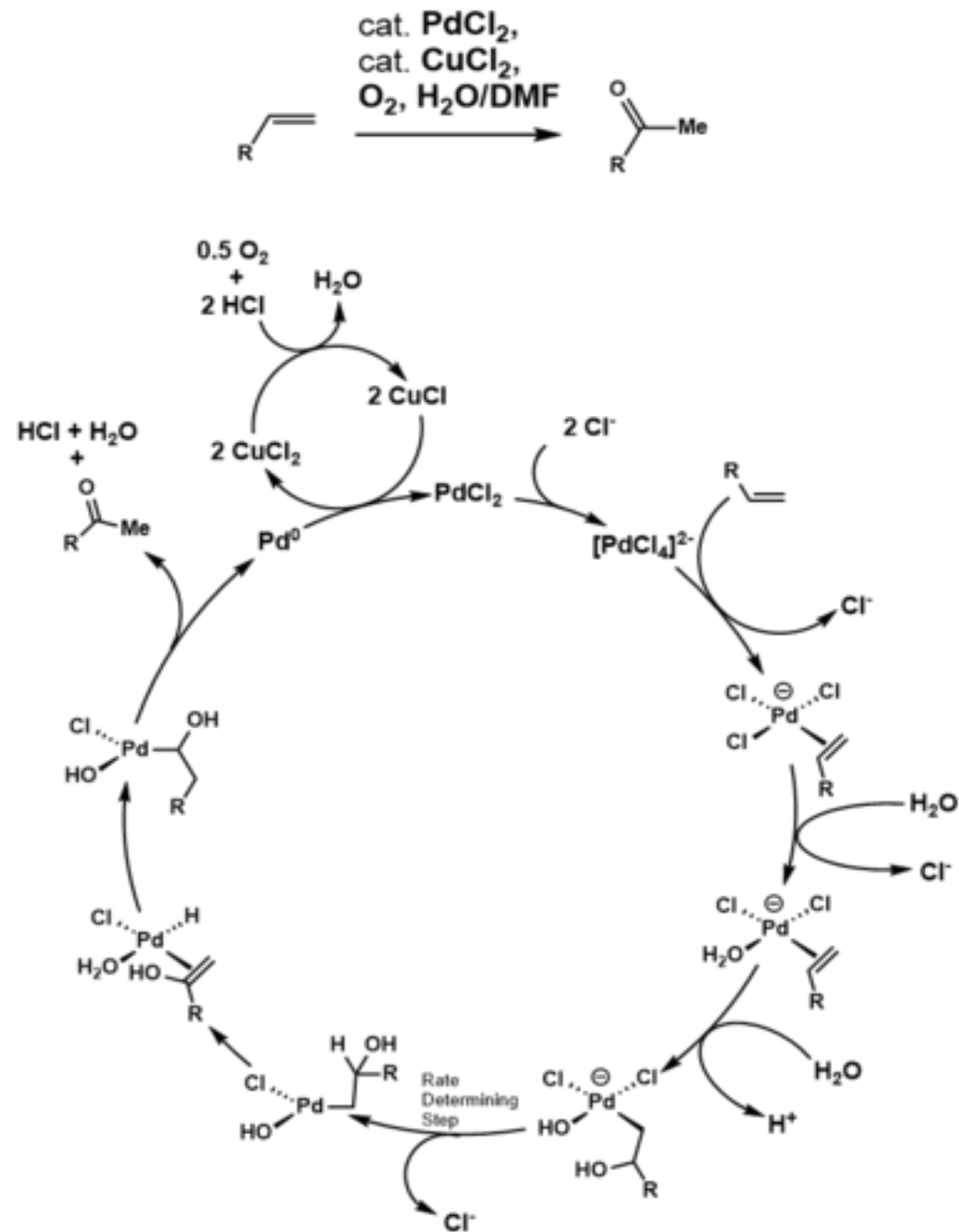
- The net reaction can also be described as follows



- This conversion is followed by reactions that regenerate the Pd(II) catalyst:



3. Wacker Process Mechanism



4. Synthetic Gasoline (Fischer Tropsch Reaction)

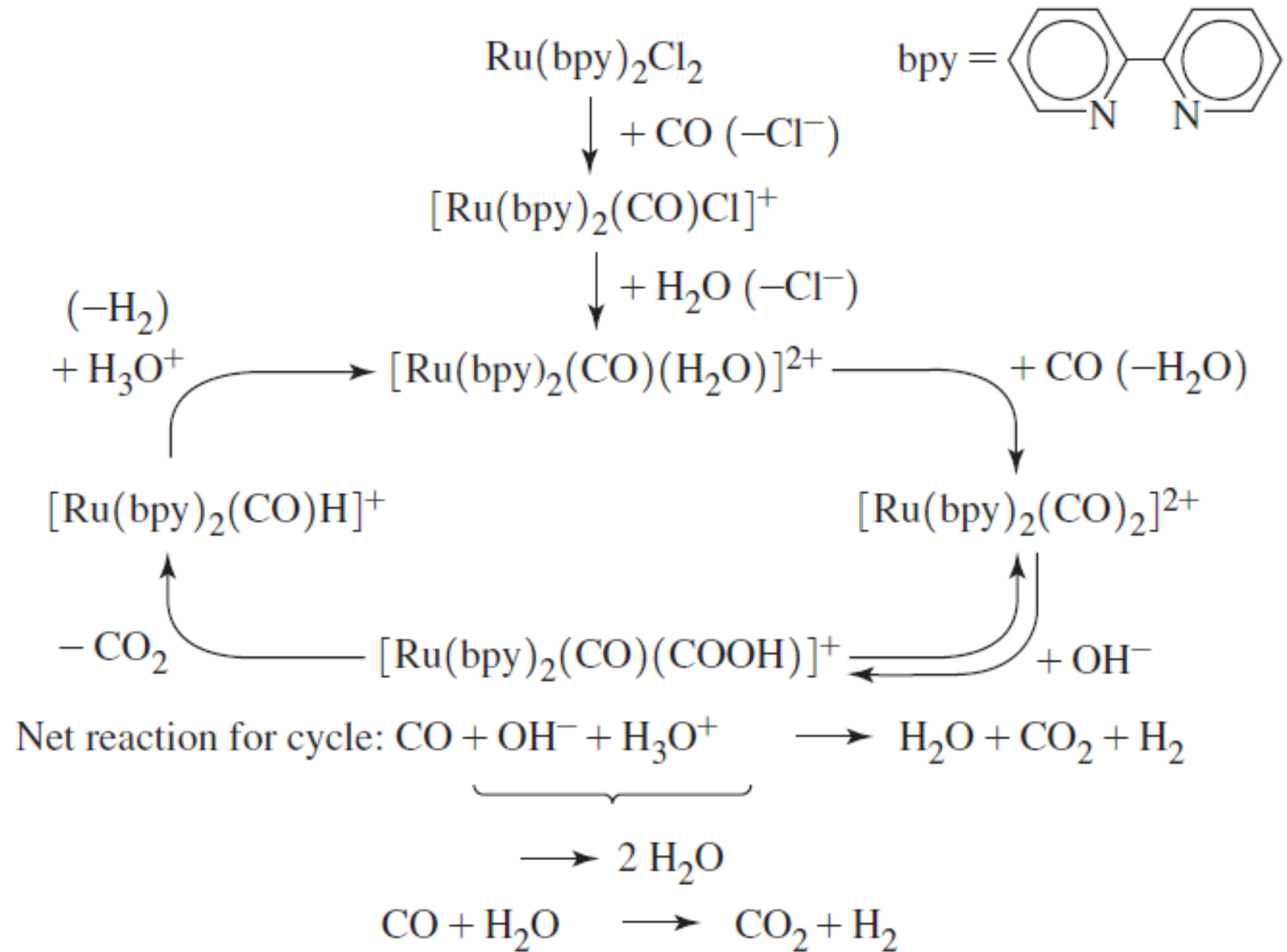
- Conversion of mixture of carbon monoxide and hydrogen into liquid hydrocarbons.
- The Fischer–Tropsch process is an important reaction in both coal liquefaction and gas to liquids technology for producing liquid hydrocarbons.

Reaction of the Process

- In the process, carbon monoxide (CO) and hydrogen (H₂) in the syngas are converted into hydrocarbons of various molecular weights according to the following reaction.
- $(2n+1) \text{H}_2 + n \text{CO} \rightarrow \text{C}_n \text{H}_{(2n+2)} + n \text{H}_2\text{O}$
- There are other side reactions taking place in the process, among which the water-gas-shift reaction is important.
- $\text{CO} + \text{H}_2\text{O} \rightarrow \text{H}_2 + \text{CO}_2$

These reactions occur in the presence of metal catalyst, typically at temperatures of 150–300 °C (302–572 °F) and pressures of one to several tens of atmospheres.

4. Fischer Tropsch Reaction



5. Synthesis gas by metal carbonyl complexes

- Syngas, or synthesis gas, is a fuel gas mixture consisting primarily of hydrogen, carbon monoxide, and very often some carbon dioxide.
- The name comes from its use as intermediates in creating synthetic natural gas (SNG) and for producing ammonia or methanol.
- Syngas is usually a product of coal gasification and the main application is electricity generation.

References:

- Shriver & Atkins' Inorganic Chemistry, 5th Edition
- Miessler, Gary L. Inorganic chemistry. — Fifth edition / Gary L. Miessler, St. Olaf College, Paul J. Fischer, Macalester College.
- Wikipedia

THANK YOU