Chemisorption is an interaction in which a gas molecule is chemically adsorbed on the surface of a catalyst. Unlike physical adsorption, chemisorption involves the sharing of electrons between the molecule and the surface, resulting in a much stronger interaction than physical adsorption. Chemisorption occurs at lower temperatures than physical adsorption and is characterized by the formation of covalent bonds between the adsorbate and the surface atoms.

Applications

Catalysts

The active surface area and porosity of catalysts can be characterized to determine:
- Metal surface area
- Metal dispersion
- Average crystal size

Isomerization

Catalysts such as small pore zeolites (zeolite Y) and (ZSM-5) containing noble metals (typically platinum) are used to convert branched paraffins to linear paraffins. The isomerization reaction will proceed only at a measurable rate above a certain temperature, such that reaction will proceed only at a measurable rate above a certain temperature.

Catalytic Reforming

Catalysts used in catalytic reforming are characterized by the production of gases, aromatics, and olefins. The characterization of these materials includes:
- Temperature-programmed oxidation
- Temperature-programmed reduction
- Heat of desorption of oxygen
- Heat of dissociation of oxygen

Catalytic Cracking

Acid catalysts such as silica are used to convert lower hydrocarbons to gasoline and diesel fuel. The characterization of these materials includes:
- Temperature-programmed oxidation
- Temperature-programmed reduction
- Desorption of aromatic amines
- Desorption of nitrogen from nitrobenzene

Hydrocracking, Hydrodenitrogenation, and Hydrodesulfurization

Hydrocracking catalysts typically consist of metal sulfides ( nickel, tungsten, cobalt, and molybdenum) on a porous alumina support. The hydrogenation and dehydrogenation steps are not carried out by the same catalyst material and are catalyzed by different catalysts. The characterization of these materials includes:
- Temperature-programmed reduction
- Temperature-programmed oxidation
- Heat of desorption of oxygen
- Heat of dissociation of oxygen

Summary:

- Catalysts are evaluated for their ability to convert a feedstock into a desired product.
- The characterization of catalysts is critical for understanding the performance and life of the catalyst.
- Catalysts can be used to convert lower hydrocarbons to gasoline and diesel fuel.

Most medicinal, chemical, and petroleum-derived items in common usage are dependent at some stage in their manufacture on a heterogeneous catalytic process. High octane gasoline, plasticizers, and herbicides would either be prohibitively expensive or unobtainable without them. Likewise, fuel cell control would be almost nonexistent were it not for catalysts.

Physical and Chemical Adsorption Differentiated

Physical adsorption is the result of a relatively weak interaction between the solid surface and the gas - a physical attraction. Physically attractive forces include the van der Waals forces of attraction and electronic forces of a kind that are common to many substances. Physical adsorption does not affect the structure or texture of the adsorbent, nor affect the structure or texture of the adsorbent, nor affect the structure or texture of the adsorbent, nor affect the structure or texture of the adsorbent, nor affect the structure or texture of the adsorbent, nor affect the structure or texture of the adsorbent, nor affect the structure or texture of the adsorbent, nor affect the structure or texture of the adsorbent, nor affect the structure or texture of the adsorbent, nor affect the structure or texture of the adsorbent.

Chemical adsorption is a much stronger interaction than physical adsorption. Physical adsorption is characterized by the adsorption of gases on the surface of solids. The molecules remain intact, and can be freed easily (the forces are small, and short-range).

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