

# Typical ASAP 2950HP Applications

## HP Applications

### Catalysts

The active surface area and porous structure of catalysts have a great influence on production rates. Limiting the pore size allows only molecules of desired sizes to enter and leave; creating a selective catalyst that will produce primarily the desired product. Chemisorption experiments are valuable for the selection of catalysts for a particular purpose, qualification of catalyst vendors, and the testing of catalyst performance over time to establish when the catalyst should be reactivated or replaced.

### Fuel Cells

Platinum-based catalysts including Pt/C, PtRu/C, and PtRuIr/C are often characterized by temperature-programmed reduction to determine the number of oxide phases and pulse chemisorption to calculate:

- Metal surface area
- Metal dispersion
- Average crystallite size

### Partial Oxidation

Manganese, cobalt, bismuth, iron, copper, and silver catalysts used for the gas-phase oxidation of ammonia, methane, ethylene, and propylene are characterized using:

- Temperature-programmed oxidation
- Temperature-programmed desorption
- Heat of desorption of oxygen
- Heat of dissociation of oxygen

### Catalytic Cracking

Acid catalysts such as zeolites are used to convert large hydrocarbons to gasoline and diesel fuel. The characterization of these materials includes:

- Ammonia chemisorption
- Temperature-programmed desorption of ammonia
- Temperature-programmed decomposition of alkyl amines
- Temperature-programmed desorption of aromatic amines

### Catalytic Reforming

Catalysts containing platinum, rhenium, tin, etc. on silica, alumina, or silica-alumina are used for the production of hydrogen, aromatics, and olefins. These catalysts are commonly characterized to determine:

- Metal surface area
- Metal dispersion
- Average crystallite size

### Isomerization

Catalysts such as small-pore zeolites (mordenite and ZSM-5) containing noble metals (typically platinum) are used to convert linear paraffins to branched paraffins. This increases the octane number and value for blending gasoline and improves the low temperature flow properties of oil. The characterization of these materials includes:

- Temperature-programmed reduction
- Pulse chemisorption

### Hydrocracking, Hydrodesulfurization, and Hydrodenitrogenation

Hydrocracking catalysts typically composed of metal sulfides (nickel, tungsten, cobalt, and molybdenum) are used for processing feeds containing polycyclic aromatics that are unsuitable for typical catalytic cracking processes. Hydrodesulfurization and hydrodenitrogenation are used for removing sulfur and nitrogen respectively from petroleum feeds. The characterization of these materials includes:

- Temperature-programmed reduction
- Oxygen pulse chemisorption

### Fischer-Tropsch Synthesis

Cobalt, iron, etc. based catalysts are used to convert syngas (carbon monoxide and hydrogen) to hydrocarbons larger than methane. These hydrocarbons are rich in hydrogen and do not contain sulfur or nitrogen. The characterization of these materials includes:

- Temperature-programmed desorption
- Pulse chemisorption

