

Catalysts, Petroleum and Chemical Process

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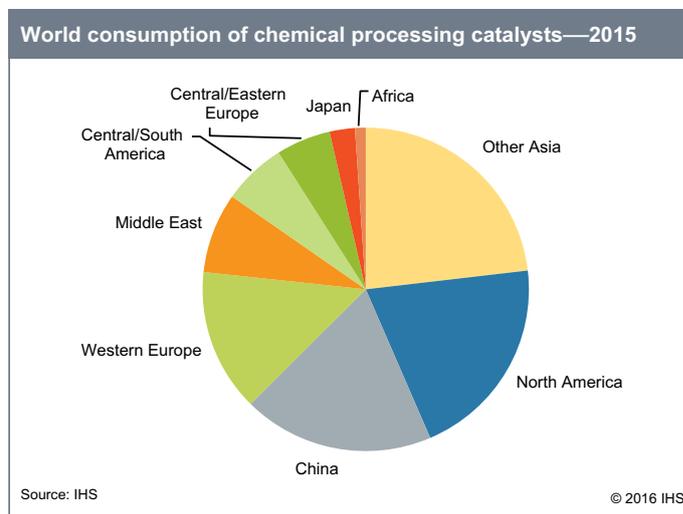
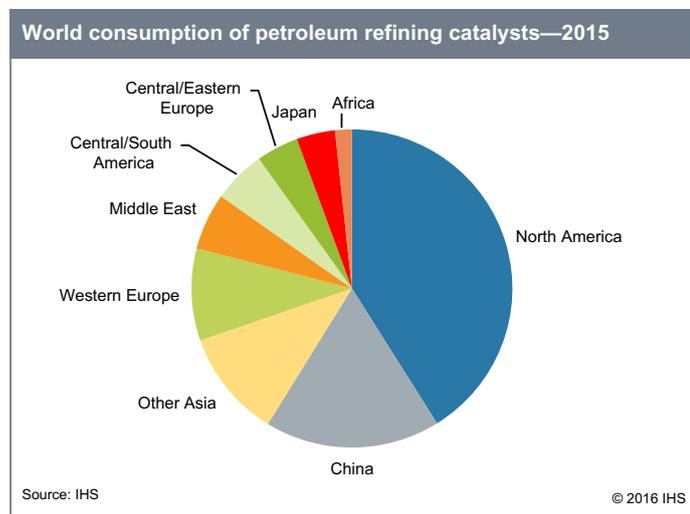
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Abstract

Process catalysts play a vital role in the economy. More than 90% of chemical manufacturing processes and more than 20% of all industrial products employ underlying catalytic steps. Petroleum refining, which is the source of by far the largest share of industrial products, consists almost entirely of catalytic processes.

This report covers two types of catalysts—petroleum refining catalysts and chemical processing catalysts. With petroleum refining catalysts, differences in refinery configurations in each region cause different patterns of catalyst consumption. New refining capacity in China, Other Asia, and the Middle East will contribute to high growth rates during the next five years. With chemical processing catalysts, new capacities contribute to the growth rate. In addition to capacity increases in the Middle East and Asia (excluding Japan), petrochemical capacity in North America is expected to increase because of the utilization of shale gas.

The following pie charts show world consumption of petroleum refining and chemical processing catalysts on a value basis:



For a number of catalysts, the strongest growth in demand through 2021 will occur in regions other than North America, Western Europe, and Japan. Emerging and developing countries such as China, Other Asia, and the Middle East have become important markets for process catalysts and will continue to be in the future. Rising incomes will drive demand for motor vehicles and transportation fuels in Asia. Industrial chemical production, particularly of petrochemicals, is

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growing faster in Asia and the Middle East than in North America, Europe, and Japan. This growth will be reflected in increased demand for a number of catalysts in the refinery segment, such as for catalytic cracking and hydroprocessing. Low-sulfur mandates are also becoming more widespread in these regions.

The largest refinery catalyst segments in terms of value are hydrotreating and catalytic cracking, while the largest-volume products are alkylation catalysts. Refinery catalyst production was traditionally an expanding business, but in recent years it has become a mature market in developed countries; the major growth is occurring in developing countries, especially Asia and the Middle East. Among Asian countries, China is the largest consumer of catalysts, with high growth rates.

Polymerization is the leading chemical processing catalyst market sector, in terms of value and volume. Major polymerization market segments include polyethylene, polypropylene, polyethylene terephthalate, polyvinyl chloride, and polystyrene. Polyolefin catalysts are the largest single market sector, with a 50–60% market share of the total polymerization market.

The catalyst market is driven by technology advances in the petroleum refining and chemical manufacturing industries. Several important factors that will impact the markets during the forecast period include the following:

- Global economic growth remains sluggish, with real world GDP expected to drop to 2.4% in 2016, and to average around 3% or below in the next five years.
- The need for emission control of greenhouse gases will speed up the tightening of fuel regulations, leading to increased utilization of conversion capacities (e.g., alkylation, hydrocracking, hydrotreating) at refineries and increased consumption of corresponding catalysts.
- Increased production of chemicals from shale-derived gas and oil in North America has encouraged and will continue to encourage petrochemical investment in the production of olefins and derivatives. However, the switch to lighter feedstocks has resulted in shortages of some chemical raw materials, such as aromatics and propylene. This new condition is driving the need for “on-purpose” technologies and catalyst development. The availability of shale gas is also boosting production of ammonia and methanol. Coal to olefins and coal to methanol are also under research for future applications.

Additional factors include:

- Minimization of adverse environmental, safety, and health effects of catalysts and catalytic processes
- Combinatorial chemistry and high-throughput screening using miniaturized reactor systems
- The need to adapt to new feedstocks, to shift from oil to natural gas, or to cope with the reduced availability of propylene
- The use of intentionally more sensitive but higher-performing catalysts

Worldwide environmental regulations now mandate the production of cleaner fuels. Consequently, refiners are experiencing severe pressures from market forces that demand a change in the product mix, aside from quality. On the regulatory side, stringent product specifications limit sulfur content and gasoline and diesel composition. Major technological challenges to refining include the achievement of “zero” or heavily reduced sulfur content in all types of fuel in almost all countries around the world.

During 2015–21, the global consumption volume is expected to increase at just over 3% per year. China will be the fastest growing region at almost 7.5%, followed by Central and South America at about 3.5%. The latter, however, is growing from a small base. Western Europe’s market will decline slightly from current levels, while Japan’s will be static. The other regions will grow at annual rates below the world average.

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