

Demand for refinery catalysts rebounds

Desulfurization of fuels, sustainability-related efforts will drive R&D, innovation

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Refinery capacity utilization and demand for refinery catalysts are gradually returning to pre-pandemic levels and they are expected to recover fully in 2023. Supply-chain disruptions and rising costs have affected the refinery catalysts market in a multitude of ways, while boosting the role of regional suppliers. Stringent regulation, especially to desulfurize fuels, and sustainability are driving innovation and R&D in the sector.

The COVID-19 pandemic has hurt the refining industry. “In 2020, we saw around 6 million barrels/day of refining lost. That was the worst impact the pandemic had on refining. Refining throughput capacity utilization has not completely returned yet, but a lot of the demand has come back,” says Chris Dziedziak, sales and project manager at The Catalyst Group Resources, a member of The Catalyst Group (TCG).

However, not every refined product has been impacted in the same way, Dziedziak says. Liquefied petroleum gas (LPG) and naphtha were the least impacted and their demand came back quickly, and were likely back at pre-pandemic levels last year, he says. Demand for diesel will return to pre-pandemic levels sometime this year, and gasoline will take a little longer, most likely until the end of this year or 2023, Dziedziak says. Jet fuel was hit the hardest and demand for the product will be the last to return to pre-pandemic levels, he says.

Honeywell, a producer of refinery catalysts, also says that demand for refined fuel products is still short of pre-pandemic levels. Announced refinery closures for the 2020–25 period are equivalent to 4.7 million b/d, Honeywell says. However, there have also been announcements for 6.6 million b/d of new refinery capacity during the same period, the company says. Smaller, less efficient assets are being rationalized in developed regions and new assets are being built in regions with growing domestic demand for fuels, often paired with expansion into petrochemicals, the company adds.

Demand for transportation fuels has returned to pre-pandemic levels in most of

the major consuming economies, Tom Petti, president/refining technologies at WR Grace tells *CW*. There are still uncertainties surrounding the global recovery, such as different COVID-19 variants, geopolitical



PETTI: Refining sector's sustainability efforts creates new challenges to FCC operations, catalysts suppliers.

issues, inflation, and supply-chain disruptions, but Grace expects transportation fuel demand to remain strong throughout this year, Petti says.

“This will translate into higher refinery utilization rates, and demand for our FCC [fluid catalytic cracking] catalyst and additives. Due to delays in scheduled maintenance turnarounds from the pandemic and a slower recovery in jet fuel demand, on the ART side, we expect that demand won't fully recover until 2023,” Petti says.

The FCC market was the hardest hit with capacity utilization dropping more than for other types of unit in 2020, according to Dziedziak. “As a result, there was a little bit of a catalysts price war, to make up for some lost demand,” he says. Prices are likely back to where they were pre-pandemic, but 2020 was a tough year for FCC catalyst suppliers, he adds.

“We see FCC catalysts returning to pre-pandemic levels in 2022–23 and the real growth in those markets is in catalysts that can process heavier feeds or maximize chemicals production. Crude-oil-to-chemicals production, maximizing propylene production, is a big growth area for FCC catalysts,” says Dziedziak.

Catalysts for FCC units need to be replaced daily, but catalysts for hydroprocessing units are replaced every six months to two years, Dziedziak says. The lower utilization rates in 2020 and 2021 made it possible for refiners to delay changeouts of hydroprocessing catalysts, he says. “Consequently, we anticipate a big spike in hydroprocessing catalysts' demand for the next two years,” Dziedziak says. “That is a cyclical business as it is, but the demand cycle is going to be more insulated, probably starting midway through this year with the bulk of it in 2023 and some even extending into 2024.”

The pandemic has impacted supply chains across the world, and it took “a lot of hard work” for Honeywell's UOP subsidiary to meet the product needs of its customers, Laura Leonard, vice president and general manager/process technologies at Honeywell UOP tells *CW*. “It has not been easy, and the cost of raw materials has gone up. We saw turnarounds being deferred during 2020. As the world learned how to better manage operations amidst the pandemic, needed maintenance and catalysts rebounded in 2021 and are expected to be relatively strong in 2022,” Leonard says.

Grace's operating costs have also risen due to global supply-chain constraints and unprecedented raw material and energy inflation, Petti says. “We are working to offset these costs through productivity in our manufacturing plants and increased efficiencies in our supply chain, but we cannot offset the full impacts of this double-digit inflation,” Petti says. “As a result, we have had to increase prices across the board and impose several surcharge mechanisms. We also have continued our ongoing efforts with our customers on product reformulations that offer improved economics to take advantage of this strong refining margin environment. I expect that demand for refinery catalysts will continue to improve throughout the year, especially for road transportation, driven by the strong summer driving season and increased discretionary travel.”

Cost inflation is a major issue, Dziedziak says. A catalysts supplier based in Europe is going to be dealing with lower margins than one in the US due to Europe's higher natural

gas costs, he says. Other raw materials also cost more than they did a couple of years ago and catalyst suppliers cannot immediately pass through the higher costs, Dziedziak says. “It could take between 12 to 24 months before pricing per catalyst catches up with general inflation. There may be some surcharges, but there is definitely a delay.”

However, John Murphy, CEO of TCG, tells *CW* there is now a higher probability of catalyst suppliers increasing prices because the current situation across the supply chain makes the need for price hikes better understood than in the past. “The pushback the producers are getting in response to their prices is mitigated because everybody is currently being affected and not just a particular metal or raw material. So, it is less of a challenge to make a price change stick because of the current situation,” he says.

Meanwhile, the supply-chain disruptions caused mainly by the pandemic have showcased the capabilities or brightened the prospects of some smaller/regional catalyst producers and suppliers, Murphy says. “The regional suppliers and producers have become more important as they can offer a higher degree of reliability, primarily due to the logistics of supply being closer to demand, than overseas producers. Whether or not this trend stays it remains to be seen,” he adds.

Desulfurization and sustainability

Tighter environmental and regulatory standards for fuels are drivers of innovation that lead to the development of more advanced refinery catalysts with improved performance. This includes the desulfurization of fuel products, which has been driving innovation in the refinery catalysts industry. Albemarle’s portfolio and suite of hydroprocessing catalysts and solutions is helping refiners meet the latest sulfur specifications for gasoline, middle distillates, and marine fuels, says Bob Leliveld, vice president/R&D at Albemarle’s catalysts business. “Our R&D programs are aimed at developing new generations of hydrotreating catalysts that can handle the toughest of feedstock while meeting the latest of fuel sulfur specs,” Leliveld tells *CW*. “Our FCC research programs have successfully resulted in FCC catalyst technologies that maximize the octane number of FCC gasoline. This helps refiners in managing the phase out of MTBE [methyl tert-butyl ether] while at the same time the market demand for octane is high as newer generations of ICEs deliver optimal

performance when running on high octane fuels.”

Grace supplies a range of desulfurization catalysts that are used in the production of cleaner burning fuels, Petti says. “Through our joint venture with Chevron, we have an industry-leading product portfolio designed for residue upgrading into more useful products and the cleaning up of distillate and gasoline streams,” he says.

The international maritime organization’s



LELIVELD: Albemarle’s R&D aims at developing hydrotreating catalysts meeting latest fuel sulfur specs.

IMO 2020 regulation, which aims to cut marine fuels’ sulfur oxide emissions, has sharpened the focus on “minimizing the bottom of the barrel and deeper desulfurization of the heavy ends,” Petti adds.

Desulfurization regulations are mature in most developed economies, says Leonard. Much of the future challenge for desulfurization is in lowering the carbon footprint of the operating unit, she says. “Process design will change to better manage the molecular precision of which molecules are processed in which units. Heavy fractions contain more sulfur. Catalysts’ design will focus on these heavier fractions and will progressively become more active to reduce reactor temperatures for a lower-carbon footprint,” according to Leonard.

Sustainability is another major trend that, together with regulation, is shaping the refinery catalysts industry. This is mainly through the efforts of the refining sector to minimize carbon dioxide emissions, including changes in operating practices; the production of renewable-based fuels; and co-processing of a range of bio-derived feedstocks, Petti says.

“These new feedstocks introduce new and often unique challenges to refinery operations,” Petti says. “We have acquired substantial know-how over a decade of R&D on the

production of renewable-based fuels and the impacts of co-processing bio-derived feeds on FCC operations. Our sales, technical service, and R&D teams are continuing the work to overcome these unique challenges and collaborating closely with our customers to support their sustainability initiatives.”

Electric vehicles and the incorporation of bio-derived feedstocks are among the main trends that will affect the growth of FCC and hydroprocessing catalysts, says Murphy.



LEONARD: COVID-19 has impacted global supply chains, but demand for catalysts rebounded in 2021.

The growth of EVs will reduce refining catalyst demand, but will not have a major impact this decade, Dziedziak says. “If projections are correct, we may start seeing single-digit demand drop for refining catalysts from 2030 and that can go in a whole multitude of directions in the 2030s and 2040s. As companies will try to achieve sustainability targets in line with the Paris Agreement, we will start seeing less demand for oil and petroleum-based transportation fuels,” Dziedziak says.

The use of bio-based feedstocks in refining will not necessarily take away catalysts demand, Dziedziak says. “It will just shift to needing different technologies to treat bio-based feedstock versus petroleum-based feedstock,” he says.

Catalyst technology developments are currently focused on co-processing pyrolysis oils and plastic waste streams, as well as “second-generation” type bio-derived feeds in standard refining assets as opposed to units that are dedicated solely to bioprocessing, says Murphy.

He adds that there is ongoing R&D by major refinery catalyst producers to address heavier feeds or increase the chemical component of refinery output to include propylene and butylene rather than pure liquid fuels. ■