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Refinery Catalysts

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Marianne Asaro

Director of Chemistry and Catalysis

Narendra Agnihotra

Associate Director, Chemicals



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Marianne Asaro, Director of Chemistry and Catalysis

Narendra Agnihotra, Associate Director, Chemicals

Abstract

This report describes catalysts used in catalytic cracking, hydrocracking, and hydrotreating of petroleum-based refinery distillates, from technical fundamentals through the most recent patent innovations and products on the market.

Technical descriptions and economic analysis are provided for three cracking catalysts:

- A residuum FCC (RFCC) catalyst resembling the Fortress™ NXT Multi-Stage Reaction Catalyst (MSRC) developed by BASF Catalysts
- An FCC catalyst resembling the REpLaCeR™ rare earth-free catalyst developed by W. R. Grace
- A classic hydrocracking catalyst enhanced with formulation and performance upgrades by Shell

Catalyst technologies for FCC, RFCC, hydrocracking, and hydrotreating are reviewed, including characterization of the product and patent portfolios for the following 16 refinery catalyst developers or licensors—Albemarle, ART, Axens, BASF, Catalysts & Chemicals Industries Co. (JGC), Chevron Lummus Global, China National Petroleum Co., China National Offshore Oil Corp., Clariant, Criterion (Shell), ExxonMobil, Grace, Haldor Topsøe, Honeywell UOP, Johnson Matthey, and Sinopec.

The technology review also includes discussion of recent patents by other, less prominent technology developers in the refinery catalyst field.

Catalyst designs, process designs, and process economics are presented for the aforementioned three cracking catalysts. The process economic evaluations include production of 15 key refinery catalyst products or intermediates. Lastly, an interactive module is included, the iPEP Navigator Cracking Catalyst tool, which provides a snapshot of economics for each process and allows the user to select the process, units, and region of interest.

While the processes presented herein represent the IHS Markit Chemical Process Economic Program's (PEP's) independent interpretation of the literature, and may not reflect in whole or in part the actual plant configurations, we believe that the conceptual designs are sufficiently representative of plant configurations to enable Class III economic evaluations.

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IHS Customer Care:

Americas: +1 800 IHS CARE (+1 800 447 2273); CustomerCare@ihs.com
Europe, Middle East, and Africa: +44 (0) 1344 328 300; Customer.Support@ihs.com
Asia and the Pacific Rim: +604 291 3600; SupportAPAC@ihs.com

