

# ASCENT™ DC-2534: Performance that Delivers Greater Value for Your Investment

## ASCENT catalysts for ultra-low-sulphur-diesel (ULSD) production

Refiners who are planning to replace their ULSD catalysts have important decisions to make. The factors they must consider include catalyst performance, hydrogen consumption and catalyst regeneration/reuse options, all of which will have a direct bearing on their costs and the economic value of their operations. Optimising reactor fill cost and evaluating catalyst life-cycle economics can be complex and will depend on each refiner's situation.

Building on the ASCENT technologies' successes in distillates and FCC and hydrocracking pretreatment, Criterion Catalysts & Technologies (Criterion) has developed ASCENT DC-2534, a new cobalt-molybdenum (CoMo) ULSD catalyst for top-tier desulphurisation performance in the low-to-medium pressure range. This flexible catalyst solution is designed for refiners that want to maximise diesel production while managing hydrogen consumption and operating costs (Table 1).

As with the other catalysts in the ASCENT range, DC-2534 offers multi-cycle cost benefits, which are made possible through conventional regeneration and strong physical properties.

Figure 1 shows where DC-2534 fits in the ASCENT ULSD catalyst portfolio with reference to the unit's constraints on pressure, hydrogen, feed severity and desired level of performance. Criterion can customise an ASCENT solution for your specific needs.

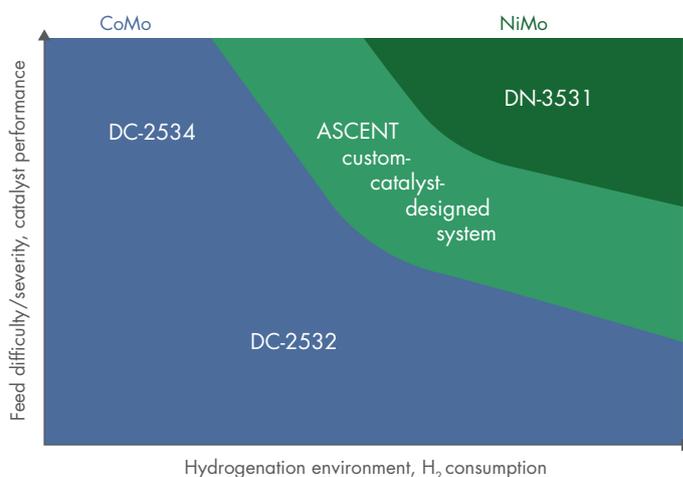


Figure 1: DC-2534's place in the ASCENT ULSD catalyst portfolio.

Table 1: The benefits of ASCENT DC-2534 at a glance

| Customer requirement   | Benefits of ASCENT DC-2534  |
|--|---|
| Highest activity CoMo at low-to-medium pressures                                 | <ul style="list-style-type: none"> <li>Longer runs</li> <li>Process heavier and harder feeds</li> <li>Easier transition to full-time Euro V diesel</li> </ul> |
| Lower density  | <ul style="list-style-type: none"> <li>Reduced fill cost</li> </ul>   |
| Excellent hydrodesulphurisation selectivity (minimum H <sub>2</sub> consumption) | <ul style="list-style-type: none"> <li>Reduce hydrogen operating costs and product giveaway</li> </ul>  |
| Stable start-of-run activity   | <ul style="list-style-type: none"> <li>No hyperactivity or excessive hydrogen consumption</li> </ul>  |
| Regenerable by conventional methods  | <ul style="list-style-type: none"> <li>Improved multi-cycle economics</li> </ul>  |
| High strength  | <ul style="list-style-type: none"> <li>Good regeneration yields, multi-cycle economics</li> </ul>   |
| Normal sulphiding procedures   | <ul style="list-style-type: none"> <li>No long holds at intermediate temperatures, as required for some Type II activations</li> </ul>                        |
| Handling and loading flexibility   | <ul style="list-style-type: none"> <li>No special packaging is required</li> <li>Reactor loading is easily handled in air</li> </ul>                          |
| Flexible delivery form   | <ul style="list-style-type: none"> <li>Can be sulphided in situ or ex situ</li> </ul>   |



## The technology behind ASCENT catalysts

When developing ASCENT DC-2534, Criterion applied enhanced experimentation techniques to study a range of catalyst formulations. This enabled Criterion to optimise promoter metal utilisation through an improved catalyst physical structure. This approach has increased the number of active sites in DC-2534 when compared with previous generations of ASCENT catalyst.

By delivering a balance of Type I and Type II active sites, DC-2534 provides reaction pathways for direct and indirect desulphurisation. The balance of site types, combined with a higher number of active sites, is very effective at low-to-medium operating pressures. Consequently, DC-2534 provides stability throughout the run by preventing hyperactivity or excessive hydrogen consumption at the start of run and providing desulphurisation in the poor hydrogenation environments found at end-of-run conditions where indirect desulphurisation is difficult. The mix of active sites also improves the selectivity for sulphur removal over aromatics saturation when compared with Type II catalysts. This results in lower hydrogen consumption through reduced polynuclear aromatics saturation (Figure 2).

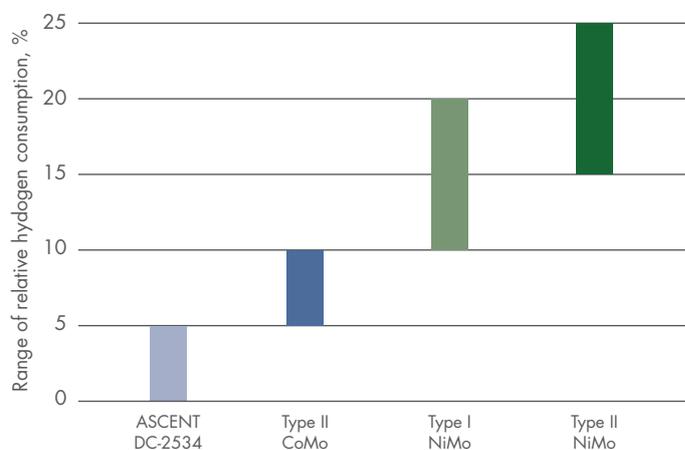
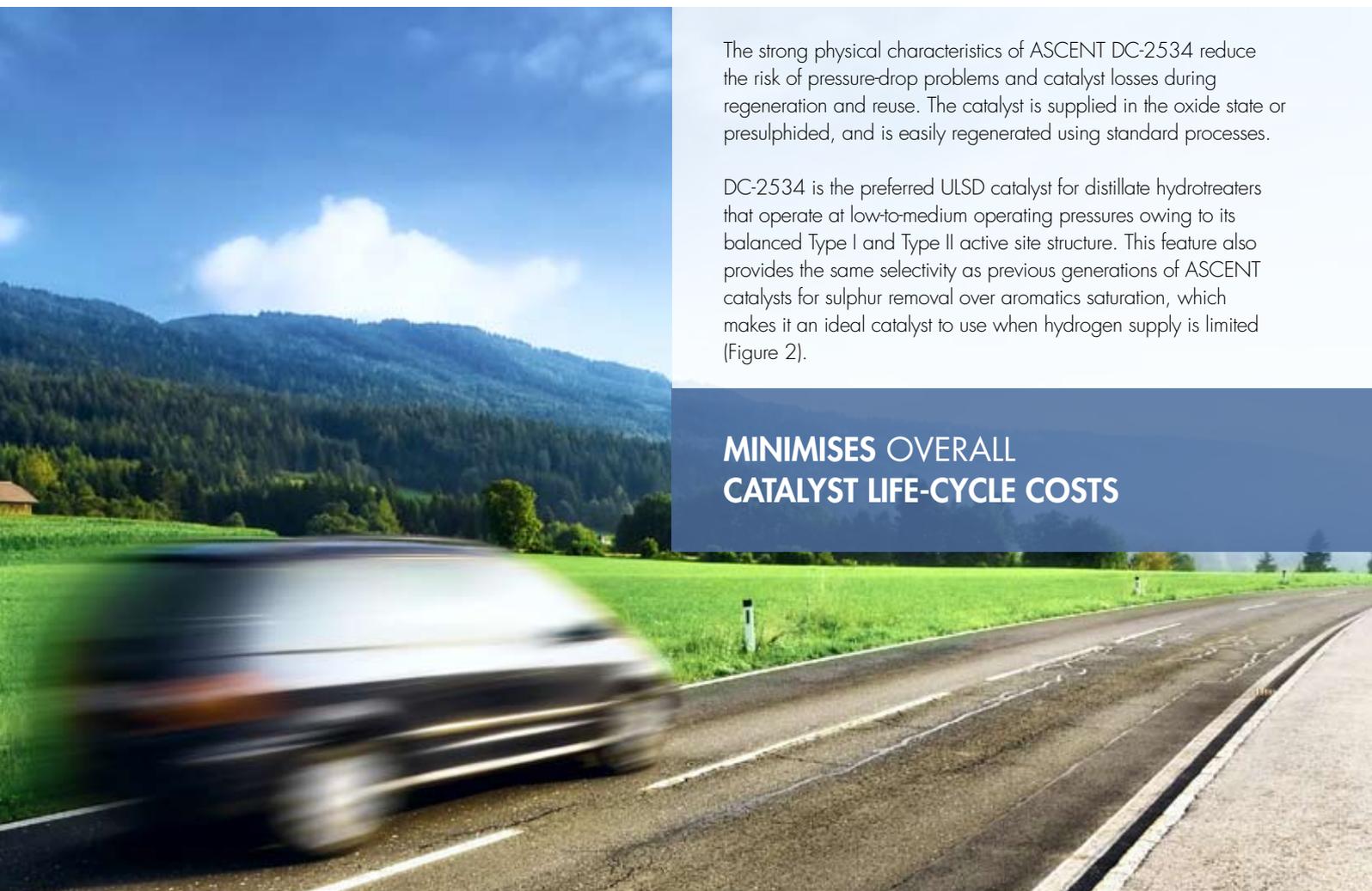


Figure 2: ASCENT DC-2534 delivers the lowest possible hydrogen consumption for ULSD production.

The strong physical characteristics of ASCENT DC-2534 reduce the risk of pressure-drop problems and catalyst losses during regeneration and reuse. The catalyst is supplied in the oxide state or presulphided, and is easily regenerated using standard processes.

DC-2534 is the preferred ULSD catalyst for distillate hydrotreaters that operate at low-to-medium operating pressures owing to its balanced Type I and Type II active site structure. This feature also provides the same selectivity as previous generations of ASCENT catalysts for sulphur removal over aromatics saturation, which makes it an ideal catalyst to use when hydrogen supply is limited (Figure 2).

**MINIMISES OVERALL  
CATALYST LIFE-CYCLE COSTS**



## How can you benefit from ASCENT catalysts?

The ASCENT range reduces overall catalyst life-cycle costs, as it requires simple regeneration rather than the more costly rejuvenation option. The fill costs for ASCENT and Type II catalysts may be comparable for the first fill, but with DC-2534 greater than 90% of the fresh activity is recovered through conventional regeneration. This means that a larger proportion of the catalyst can be retained in the second cycle fill. Using DC-2534 helps refiners to minimise the costs associated with purchase of fresh catalyst. In subsequent cycles, the result (see Table 2) is a saving of up to 15% of the total two-cycle costs.

ASCENT DC-2534 can be used as a full or partial fill in many distillate hydrotreaters to help increase sulphur removal, extend run length, expand capacity and/or upgrade more low-value feeds. The catalyst delivers an excellent performance advantage over a wide range of feed types (Figure 3) when compared with the previous generation CoMo ULSD catalyst, ASCENT DC-2532.

Analysing catalyst life-cycle costs is a complex process. It is important to work with a catalyst provider that can evaluate and analyse these. Criterion can help, as it has been helping refiners with the complex evaluation of the relationship between life cycle and performance for many years.

Table 2: Relative fill cost.

|                               | Cycle 1 | Cycle 2 | Cycle 1 + 2 | Avg. two-cycle fill cost savings, % |
|-------------------------------|---------|---------|-------------|-------------------------------------|
| Type II CoMo (+ regeneration) | 100     | 82      | 91          | Base                                |
| Type II CoMo (+ rejuvenation) | 100     | 75      | 87          | 4                                   |
| DC-2534 (+ regeneration)      | 100     | 55      | 77          | 15                                  |



**AN IDEAL CATALYST TO USE WHEN HYDROGEN SUPPLY IS LIMITED**

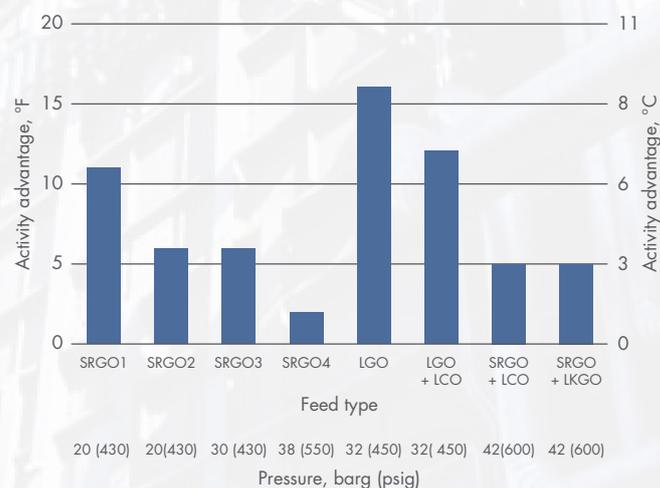


Figure 3: ASCENT DC-2534's performance advantage over ASCENT DC-2532 extends to wide range of feeds and conditions.

Table 3: Typical properties of ASCENT DC-2534

|  |                         |
|--|-------------------------|
| Chemical composition   | Co/Mo oxides on alumina |
| <b>Physical properties</b>   |                         |
| Shape  | Trilobe                 |
| Nominal size, mm   | 1.3 or 2.5              |
| Compacted bulk density, g/cm <sup>3</sup> <sup>(1)</sup>   | 0.73                    |
| Flat plate crush strength, N/cm  | 275                     |
| Attrition index <sup>(2)</sup>   | 99                      |
| <small>(1) Sock loading is estimated at 90% of compacted bulk density and dense loading is typically 103–105% of compacted bulk density. Please contact your Criterion representative for customised reactor loading quantities.</small> |                         |
| <small>(2) Wt% retained on 20-mesh screen after tumbling 1 h at 40 rpm</small>   |                         |

#### ASCENT catalyst applications

ASCENT catalysts are available for multiple hydroprocessing applications, including ULSD, FCC and hydrocracker feed hydrotreating and reformer feed pretreatment.

#### Availability and packaging

ASCENT DC-2534 is available in 1.3- and 2.5-mm trilobal extrudates. Oxide catalyst can be packaged in steel drums and standard super-sacks. Presulphided catalyst is available in steel drums or flow bins.

#### Health, safety and environmental precautions

Criterion has evaluated the hazards of ASCENT DC-2534 as required by OSHA Hazard Communication Standard 29 CFR 1910.1200. Full attention to these hazards and to the appropriate health, safety, and precautionary information is essential. Before handling, testing or using this catalyst, a material safety data sheet must be obtained by contacting your Criterion catalyst sales representative.

#### Additional information

All catalyst information supplied by Criterion is intended to be general in nature and is furnished with the express understanding that the customer receiving such information shall make its own assessments to determine the suitability of such information for the customer's particular purpose. All purchases of catalyst from Criterion are subject to Criterion's standard terms and conditions of sale (including Criterion's product warranties) set forth in a sales proposal, a sales contract, an order acknowledgement and/or a bill of lading.

If you would like your local representative to contact you, please email [criterionpublicaffairs@cri-criterion.com](mailto:criterionpublicaffairs@cri-criterion.com).

Visit our website at [www.criterioncatalysts.com](http://www.criterioncatalysts.com) for more information.



**TOP-TIER DESULPHURISATION  
PERFORMANCE IN THE LOW-TO-  
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