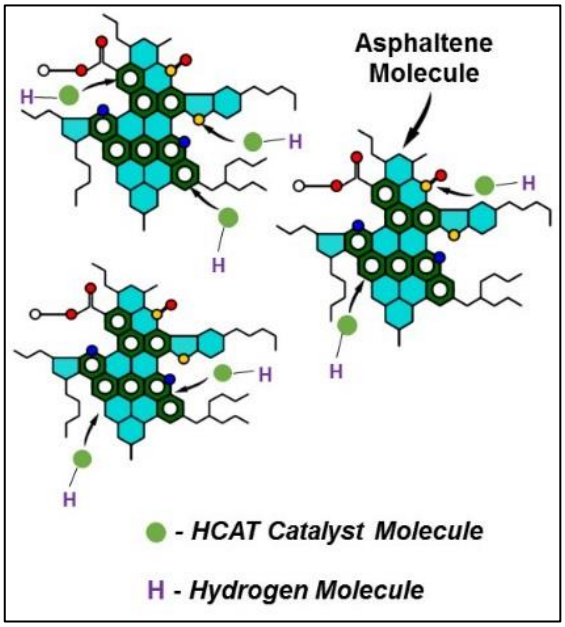
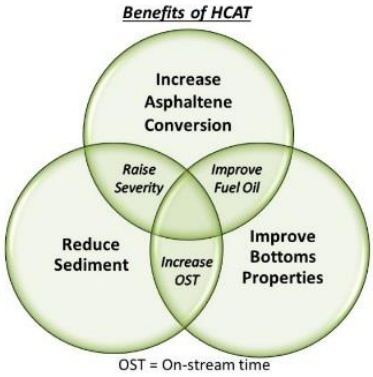
The HCAT® Technology

What is the HCAT® TECHNOLOGY?

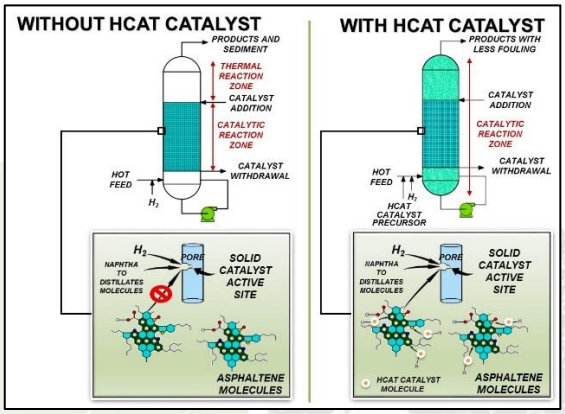
HCAT is a liquid catalyst precursor that is mixed into the residual oil feed of an ebullated-bed hydrocracker or RHC. The HCAT precursor is molecularly dispersed into the feed where it converts into a catalyst before the ebullated-bed reactors. The result is a highly active, dispersed catalyst that works in conjunction with the solid catalyst to improve the hydrogenation of the heaviest portion and more specifically the asphaltenes of the feedstock. Without HCAT, asphaltenic molecules are hydrocracked and converted in the reactor, where they can become hydrogen deficient and tend to form sediment and fouling precursors that foul downstream equipment and limit the conversion of the residual feedstock.
In a conventional residual oil ebullated-bed hydrocracker without HCAT, catalytic hydrogenation is limited to the supported catalyst bed. With the addition of HCAT, the entire reactor becomes catalytically active as the HCAT catalyst is molecularly dispersed throughout the hydrocracker feedstock and is not limited just to the supported catalyst bed.



If we take a closer look at one of the supported catalyst extrudates in the reactor, we find that the active sites where hydrogen is made available to the cracked residual oil in the pores of the catalyst pellet. Unfortunately, some large asphaltenes are diffusion limited in accessing these active sites of the catalyst. HCAT helps the supported catalyst by targeting the large asphaltenes outside of the supported catalyst.



As a result, HCAT enables the refiner to increase process severity while limiting sediment formation and fouling within the ebullated bed hydrocracker. Other benefits include longer unit run lengths and better vacuum tower bottoms qualities. To be clear, HCAT itself does not increase conversion, but its hydrogenation function allows higher conversion, or higher throughput, with less fouling.

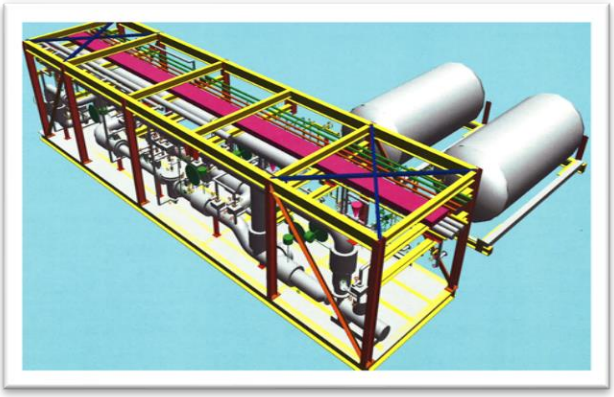


The HCAT Technology only requires a small capital investment and its dosage rate to the ebullated-bed unit can be easily adjusted to match unit operations and product requirements. The technology provides the flexibility of meeting the needs of the refiner when processing a variety of feedstocks, whether they are difficult opportunity crudes or easier lighter crudes.

A total of 37 HCAT Technology patents have been issued or are pending in the United States. Many of those same patents have been issued or are pending in countries around the world

Commercial Proof

Today, the HCAT Technology is currently licensed at six ebullated bed RHC Units at refineries throughout Europe, Asia and North America and will be incorporated in most new H-Oil Units throughout the world. Currently, five refineries have HCAT technology equipment installed and one is planned to have the equipment installed by the end of 2019. Many new H-Oil Units have elected to include the HCAT Technology to allow the refinery operator to achieve higher residue conversion, longer run lengths with enhanced vacuum tower bottoms properties and allow additional feedstock flexibility. The same technology can easily retrofitted into existing ebullated bed upgrading units to improve process economics and unit reliability.



At the Neste refinery in Porvoo, Finland, the HCAT Catalyst has been in use in their ebullated bed hydrocracking unit since January 2011. Over that period, Neste optimized their ebullated bed operation and has observed several benefits from HCAT, including:

- Increased VR throughput by 15%.
- Increased residue conversion 4 to 8W%
- Increased product yield, approximately 22W%
- Decreased sediment, which helped meet product specifications
- Increased operating cycles for heat exchangers, towers, and other downstream equipment
- Decreased unit turnarounds from two per year to one per year
- HTI estimates the upgrading value improvement to be at least 2 USD per feed barrel
- By eliminating 1 turnaround per year, HTI estimates a value improvement of at least 1 USD per barrel
- By requiring less cutterstock for the fuel oil blend and greater flexibility, a product value increase of 0.20 USD per barrel is estimated by HTI

Another European refinery, Slovnaft a.s., located in Bratislava, Slovakia, has also been using HCAT in their heavy oil upgrader since 2014, and they, too, have observed similar value improvements in terms of higher conversion and throughput than previously possible, along with less fouling and longer cycle lengths for downstream equipment.

HTI's staff of experts provide ongoing HCAT technical service and support to licensees. HTI's pilot plant facilities are available to supplement the technical service and support provided by the HCAT technical services team.