

# HEADWATERS HCAT™ Technology

HYDROCARBON TECHNOLOGIES

## Innovative Process & Catalyst for Heavy Oil Upgrading

Headwaters Heavy Oil, LCC (HHO), a subsidiary of Headwaters Incorporated (NASDAQ: HDWR), has obtained the exclusive worldwide license to develop, market and sublicense an innovative catalytic heavy oil upgrading technology known as HCAT.

The HCAT technology is a breakthrough process that converts low quality feedstock (heavy oil, bottom of the barrel and oil sands bitumen) into value added, high quality synthetic crude oil. The process uses a moleculesized catalyst, chemically generated within the reactor system through a proprietary conditioning process, to achieve high conversion of oil, especially its difficult to handle asphaltenic fraction. The technology can be installed in new refineries or retrofitted into existing refineries as an additive. HCAT significantly improves the conversion of heavy oil as well as reduces sediment formation.

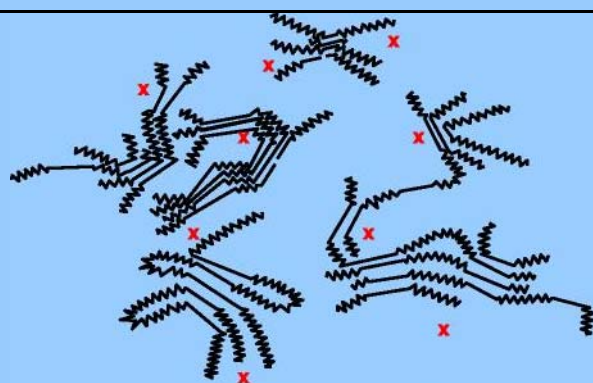
HCAT technology offers several significant advantages over processes using supported catalysts. These include:

- Non-deactivating molecular catalyst
- Constant product quality
- Feedstock flexibility
- Flexible conversion (up to 95%)
- Higher reactor throughput
- Simple, two-phase gas-liquid reactor
- Safer plant operation

These unwanted byproducts not only lower the value of the net product, but often cause equipment fouling and other maintenance problems.

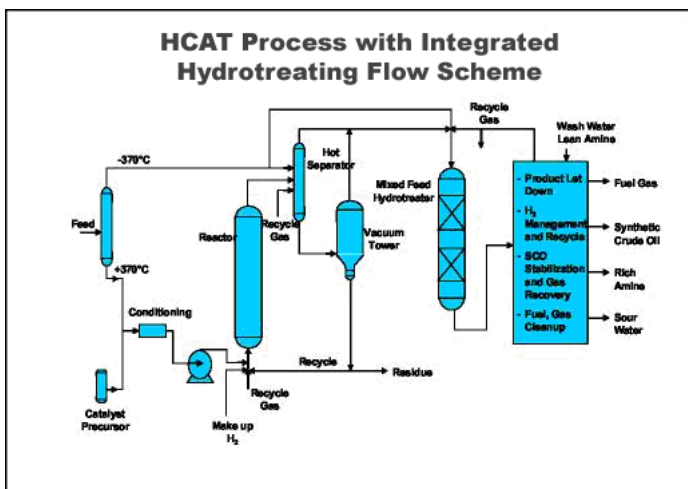
The HCAT technology uses a radically different approach to catalyze hydrocracking. Vast numbers of individual molecules of catalyst are dispersed onto the large feedstock molecules, easily enabling catalytic upgrading reactions to proceed without any geometrical restrictions. Product leaving the HCAT reactor is stable and free of coke precursors.

### Individual HCAT Catalyst Molecules [x] Disperse Intimately Within Large Asphaltene Molecules



← About 20 Nanometers →

### HCAT Process with Integrated Hydrotreating Flow Scheme



Supported catalysts, used in current commercial hydrocracking processes, depend on clusters of catalytic sites located within the many channels (pores) of the support material to catalyze the upgrading reactions. Most heavy oil feedstock contains a significant portion of asphaltene molecules that are either too large to enter the pores of the catalyst support, or get trapped within the pores, thus deactivating the catalyst. Without the active catalyst clusters to transfer hydrogen, noncatalyzed upgrading reactions tend to produce hydrocarbon fragments with strong tendency to form coke precursors and sediment.

HHO continues to expand its HCAT database in pilotplant tests, and in 2005 HHO is working with several major oil refining companies applying the HCAT technology in their commercial hydrocrackers around the world.

HHO provides technologies and services that maximize the value of fossil fuels – while creating new sustainable energy technologies for the future. One of HHO's core competencies is developing innovative catalysts and catalytic processes. HHO's staff of professional engineers, scientists and technicians provides expertise in the development, scale-up, design and engineering of petrochemical and refining projects.

For more information, please contact HHO directly.

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