Hydrotreating catalysts with metals in the oxide state are inactive for removing sulfur or nitrogen from hydrocarbon feedstocks. These metal oxides must be converted to metal sulfides to maximize activity. Typically, this can be achieved by:

- In-situ sulfiding, which requires sulfiding agents (e.g. DMDS), heat and H₂ during the activation
- Ex-situ presulfurization (actiCAT*), which requires heat and H₂ during the activation
- Ex-situ preactivation (UltraCAT), which is fully activated and ready-to-use

### UltraCAT Preactivation Advantages

<table>
<thead>
<tr>
<th></th>
<th>In-situ</th>
<th>actiCAT</th>
<th>UltraCAT</th>
</tr>
</thead>
<tbody>
<tr>
<td>Faster and easier start-ups</td>
<td>No</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Exotherm during start-up</td>
<td>Yes</td>
<td>Minimal</td>
<td>No</td>
</tr>
<tr>
<td>H₂ make-up needed during start-up</td>
<td>Yes</td>
<td>Minimal</td>
<td>No</td>
</tr>
<tr>
<td>H₂S release during start-up</td>
<td>Yes</td>
<td>Minimal</td>
<td>Negligible</td>
</tr>
<tr>
<td>Odor release from sulfiding agents</td>
<td>Potential</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td>Handling of sulfiding agents</td>
<td>Yes</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td>Metals reduction during activation</td>
<td>Potential</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td>Temperature required for activation</td>
<td>650°F (345°C)</td>
<td>600°F (315°C)</td>
<td>None</td>
</tr>
</tbody>
</table>

### UltraCAT Preactivation Performance

Extensive testing of UltraCAT technology in Porocel’s pilot plants has confirmed equivalent activity to proven industry standards (see figure 1), namely:

- Ex-situ presulfurization (actiCAT)
- In-situ sulfiding with DMDS introduction
The degree of preactivation after our UltraCAT treatment on hydrotreating catalysts has been assessed by X-Ray Photoelectron Spectroscopy (XPS) to reflect the optimal oxidation state of Molybdenum as MoS2 (Mo+4) and as metal oxy-sulfides (Mo+6). UltraCAT has been compared to competitive preactivation technologies while giving the same degree of preactivation.

UltraCAT Preactivation – European Case Study

A European refinery hydrotreated 100% Coker Naphtha with two reactors in series:

- The 1st reactor operates at low temperature (482°F/250°C) to partially saturate di-olefins and reduce sulfur content prior to the 2nd reactor
- The 2nd reactor is mainly dedicated for HDS purpose

UltraCAT preactivation was applied in the 1st reactor to gently saturate the di-olefins at low operating temperature. Once the refinery reached the Start of Run (SOR) temperature of 482°F/250°C, they gradually introduced full coker Naphtha while getting expected performance. UltraCAT preactivation demonstrated its efficiency for low operating temperature unit without affecting the catalyst activity (see figures 2 & 3).

UltraCAT® Applications

UltraCAT is applicable to a wide range of hydroprocessing units, such as:
- Naphtha, Gasoil, ULSD, Kerosene
- CFH or FCC pretreat units, hydrocracker pretreat units, hydrocracking units
- Lube Oil, 2nd stage of PyGas hydrotreaters

UltraCAT preactivation was developed to provide a broad solution to converting catalysts to the sulfide state while offering the following benefits:
- Provide full activity for temperature limited units (<600°F/<315°C)
- Avoid temperature excursions and metal reduction during the start-up
- Minimize H2S generation for units sensitive to sulfur (noble metal catalysts)
- Avoid the use of sulfiding agents, long dry out steps, and complicated in-situ activation: Ready-to-use solution
- Provide cracked feed protection, which allows introducing the cracked feed immediately after the start-up