

# PropyleneMAX™ Catalytic Cracking - PMcc™

PMcc™ is an advanced high propylene fluidized catalytic cracking process with a unique integration of process and catalyst technologies



**The demand for transportation fuels is flattening, while petrochemical demand is increasing.** Refinery units can improve profitability by producing more petrochemicals while reducing gasoline production. PropyleneMAX Catalytic Cracking (PMcc) is a commercially proven fluid catalytic process for selectively cracking a variety of hydrocarbon feedstocks to light olefins, particularly propylene, isobutylene, aromatic naphtha and ethylene. Typical feedstocks include distillates, vacuum gas oils and residual oils. PMcc offers a reliable, low-cost route to propylene production and allows the refiner to extend the market range into higher margin petrochemicals.

## PMcc Process

While the PMcc flow scheme and operation are similar to our conventional Fluid Catalytic Cracking (FCC) or Residue Fluid Catalytic Cracking (RFCC) unit, there are key design features that help to produce higher yields of petrochemicals:

- Higher severity operation
  - Higher reactor temperature
  - Higher catalyst to oil ratio
- Lower hydrocarbon partial pressure
  - Higher steam rates
  - Lower reactor pressure
- Higher residence time to convert naphtha to propylene
- Potential to recycle C4's, LCN and Oligomer recycle to maximize propylene
- Light olefins catalyst with dual zeolite functionality from USY and pentasil zeolites
  - Integral metals traps as required
  - Optimal coke selectivity and activity with low slurry yield via high diffusivity alumina
- Single or two-stage regeneration depending on feedstock
- Reliable proprietary components

PMcc is an advanced fluidized catalytic cracking (FCC) process with a unique integration of process, hardware and catalyst technologies, resulting in higher propylene yields than other currently available technologies. The PMcc process focuses on providing greater feedstock flexibility, higher conversion and maximum propylene yield. In addition, PMcc can easily be tailored to meet a client's needs for ethylene or gasoline. PMcc selectively cracks a variety of hydrocarbon feedstocks to light olefins, particularly propylene (demonstrated up to 22 wt% FF), isobutylene, ethylene along with aromatic naphtha. Typical feedstocks include distillates, vacuum gasoils and residual oils. Technip Energies has a proven background and footprint in providing high propylene units. We have licensed 23 high propylene units with a wide range of feedstocks and with propylene yields greater than 9wt%, including 7 units that are producing propylene greater than 18wt%. Our FCC research and development program ensures that our licensees continue to have state-of-the-art high olefin FCC technology, capable of handling a wide range of feedstock and achieving higher propylene targets than current industry standards. The process is suitable for grassroot applications as well as revamps.

## PMcc Yields

The PMcc produces significantly more light olefins and increases octane level of naphtha. The increased yields are accompanied by reductions in the naphtha, light cycle oil and decant oil production, thereby providing deeper level of conversion of feedstock through the PMcc process.

The typical product yields (wt% fresh feed) are

- Fuel gas: 7.6 – 11.5
  - Ethylene: 3.5 – 5.9
- LPG (C3's – C4's): 35 – 45
  - Propylene: 16 – 20
- Gasoline: 25 – 35
- LCO: 8 – 14
- DO: 0 – 5
- Coke: 6 – 8

## Key Proprietary Components in the PMcc Process

- Our proven Feed Injection Technology to provide effective atomization and vaporization
- Riser Termination Device to maximize light olefins yields
- High efficiency packed stripping technology to maximize product recovery at high catalyst circulation rates
- Specially designed combustion air and catalyst distributors
- Reliable catalyst cooler, if required

Using key design features, the proprietary components described above and our experience in design of RFCC units, PMcc offers the following advantages in operation, maintenance and installed cost:

- Excellent feedstock conversion efficiency to propylene, ethylene and other valuable petrochemicals
- Low delta coke design to maximize conversion and minimize coke make
- Robust, proven mechanical design with high reliability and low maintenance costs
- Flexibility of performance over a wide range of feedstocks and operating modes
- Inherent process safety design
- Ease of normal operation, startup and shutdown
- Stable and maintainable operation
- High energy efficiency

## Integration of PMcc with a Petrochemical Complex

Including a PMcc in a refinery integrated with a petrochemicals complex offers several advantages. PMcc or high propylene FCC can be designed to be a bridge between the refinery and a petrochemical complex. The integrated complex, consisting of a steam cracker for ethylene production and PMcc for propylene production, can provide the maximum yields of premium value petrochemicals utilizing the lowest cost feedstocks at reduced capital and operating costs.

Integration provides streamlined handling of both FCC dry gas, C3/C4 streams and naphtha. As a leading licensor of the steam cracking process, Technip Energies has leveraged this know-how to offer an integrated refinery and petrochemical complex design that meets flexibility and operating requirements. We currently have one such integrated complex, operating successfully for the last 10 years, where both the high olefins FCC and steam cracker were licensed by Technip Energies.

References:

Dharia D. et al., "Increase light olefins production," Hydrocarbon Processing, pp. 61-66, April 2004.

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