Mr. Peter Ferenz

Commercial Director
Univation Technologies LLC
USA

- A Bachelor of Science in Chemical Engineering from Manhattan College and a Masters in Chemical Engineering from the same institution, Mr. Peter Ferenz is primarily responsible for the company’s licensing activities in India and China.

- Mr. Ferenz has been involved in the development and sale of products derived from the UNIPOL™ PE Process since 1984, and has been engaged in licensing the technology since 1997.
UNIPOL™ PE Process Technology Advances for the Dynamic Indian Market

Peter Ferenz* – Commercial Director
Dr. Rakesh Kumar – Product Technology Leader
Univation Technologies, LLC
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Univation Technologies
A Venture between The Dow Chemical Company & ExxonMobil Chemical Company

- Exclusive Licensor of the UNIPOL™ PE Process
- Global Leader in Catalyst Manufacturing - Conventional and Advanced PE Catalysts
- Focused on Innovation and Technology Delivery
- Provider of UNIPOL™ PE Process Technical Services to Licensees

Top 10 Polyethylene Suppliers
Total Capacity (KTA)

- ExxonMobil
- Dow Chemical
- SABIC
- SINOPEC
- LyondellBasell Industries
- Petrochina
- Chevron Phillips
- National Petrochemical
- Braskem
- INEOS

Source: Townsend Solutions Estimate, Jan 1 2012
UNIPOL™ PE Process: The Global Leader in PE Production

Over 100 operating reactor lines:
> 22 million tons PE/yr

~33% global HD/LLD capacity

~50% global HD/LLD Swing capacity
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23 reactor lines in design/construction:  
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23 reactor lines in design/construction:
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20 operating reactor lines:
≥ 400 KTA

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> 22 million tons PE/yr

23 reactor lines in design/construction:  
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6 in design/construction:  
≥ 400 KTA

~33% global HD/LLD capacity

~50% global HD/LLD Swing capacity

Operating Line  Lines in Design or Construction  Lines ≥ 400 KTA capacity
UNIPOL™ PE Process: Ultimate Streamlined Process Provides Reliability at Lowest Cost

- Fewest pieces of equipment; minimizes investment cost (up to 30% advantage)
- No need for cyclone / dust collection
- Cycle gas compressor only rotating equipment in reactor gas loop
- Reactor gas loop optimized to limit fouling and provide stable operation
- Patented Quick Seed Bed technology reduces transition time
- Patented cycle gas turbine design to minimize flare load & size
- Proprietary Advanced Process Control for superior operational performance
- Additional synergies for 2 line / integrated sites
- Easily accommodates grade slate changes to meet swings in market demand at no additional cost
UNIPOL™ PE Process: Largest Operating Lines

- Largest proven UNIPOL™ PE capacity: 650 kta
  - 20 operating lines ≥ 320 kta with >250 reactor-years of experience
  - Largest operating competitive gas phase technology: 320 kta

- LLDPE & HDPE use the same, proven UNIPOL™ PE Process design
UNIPOL™ PE Process: One Reactor for All Products & Applications

UCAT™ Catalyst
ACCLAIM™ Catalyst
PRODIGY™ Catalyst

Unimodal HDPE

UCAT™ Catalyst
XCAT™ Catalyst

LLDPE

Metalloocene

One Single UNIPOL™ PE Gas Phase Reactor Process
### UNIPOL™ PE Process Delivers Unmatched Product Breadth

#### Applications | UNIPOL™ PE
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**Film**
LLDPE C4 | ![Green Circle](Green Circle)
LLDPE C6/C8 | ![Green Circle](Green Circle)
mLLDPE / Single Site | ![Green Circle](Green Circle)
HDPE (unimodal) | ![Green Circle](Green Circle)
HDPE (bimodal) | ![Green Circle](Green Circle)
**Injection Molding**
LLDPE | ![Green Circle](Green Circle)
HDPE | ![Yellow Circle](Yellow Circle)
**Blow Molding**
LLDPE | ![Green Circle](Green Circle)
HDPE HIC (unimodal) | ![Green Circle](Green Circle)
HDPE HIC (bimodal) | ![Green Circle](Green Circle)
Large Part Blow Molding | ![Green Circle](Green Circle)
**Other Applications**
Sheet | ![Green Circle](Green Circle)
HDPE Pipe (unimodal) | ![Green Circle](Green Circle)
HDPE Pipe (bi/multimodal) | ![Green Circle](Green Circle)
LLDPE Tubing | ![Green Circle](Green Circle)
Rotomolding | ![Green Circle](Green Circle)
Tape - Monofilament | ![Green Circle](Green Circle)
Geo-membrane | ![Green Circle](Green Circle)

![Commercial](Commercial) ![Development](Development)
Univation Technologies: Established Leader in Metallocene Technology

- **Univation XCAT™ >35% of WW capacity**
  - > 17 yrs experience
  - > 12 million metric tons produced since 1995
  - 10 licensed plants producing
  - Production in all major consuming regions

HPR
- Benchmark for highly engineered down gauged film

EZP
- Uniquely positioned for LD penetration

VPR
- Opens new markets with best balance of performance
  - Commercial YE2013
XCAT™ VP-100 Catalyst: Extending Metallocene Platform to the Next Generation

### XCAT™ Versatile Performance Resin (VPR)
- Opens new markets with best balance of performance and extends to HDPE
- Best balance of extrusion, stiffness/toughness, sealing; retains toughness in LD blends
- Films: better competitor to solution MCN with “drop-in” processability
- Injection/Rotomolding: allows access to new applications via cycle time improvements and/or down-gauging

#### Key Points:
- **UNIPOL™ XCAT™** Metallocene Catalyst provides unique market leadership
- Broadest metallocene LLDPE coverage with XCAT™ PE Resin portfolio
**PRODIGY™ & ACCLAIM™ Catalysts: Advanced HDPE Performance**

**PRODIGY™ Bimodal Catalyst Benefits**
- High production rates
- Outstanding reactor continuity and robustness
- Improved resin homogeneity vs. dual reactor for power savings during extrusion
- In commercial production > 5 years

**ACCLAIM™ K-100 Series Catalyst Benefits**
- High production rates
- Comonomer flexibility for blow molding and film
- In commercial production > 2 years

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**Compatible Catalysts**
Easy Bimodal / Unimodal Transitions
PRODIGY™ Bimodal Resins Adds Value to the Entire HDPE Pipe Chain

Demonstrated Production
- PRODIGY™ delivers consistency & performance
- >5 years PE100 production

Reliable Pipe Fabrication
- Up to 20% more throughput
- Reduced energy requirement
- High melt strength: low sag

Flexible Field Installation
- Place around/under structures
- Tolerates rough handling
- Horizontal directional drilling

Reliable, Lasting Service
- Exceeds PE100 requirements
- Dependable pipe solutions for Future Generations

Higher Output

Competitive PE100 Pipe Grades

Competitive grades

Univation’s PRODIGY™ BMC

Superior Melt Strength

Pull-Off speed, mm/s

Melt Temp (°C)

Output (kg/hr/rpm)

Force, N

Pipe images: Qenos Pty Ltd.
PRODIGY™ Bimodal PE Resin: Superior ESCR for HIC Blow Molding

- Competitive single reactor bimodal HPDE film
- Improved film performance with inherently low gel resin

PRODIGY™ Bimodal Film

- Excellent processing characteristics
- Superior ESCR to competitive unimodal & bimodal grades
- Higher Top Load

PRODIGY™ Bimodal Blow Molding
ACCLAIM™ K-100 Series Catalyst Delivers Upgraded ESCR for L-Ring Drums

L-Ring Drum Key Requirements
- Rigidity and toughness
- Melt strength for parison stability
- Environmental Stress Crack Resistance
- Regulatory standards for shipping

ACCLAIM™ L-Ring Drum Grade
- Raises well-proven Cr catalyst resin to next performance level
- Excellent balance of parison stability, ESCR, impact strength & stiffness
- Outstanding ESCR: >2X higher than chromium-based resins & other slurry process resins
UNIPOL™ PE Process

- Simple, streamlined design
- Proven with largest capacity single reactor lines

UNIPOL™ PE Resins

- Leader in LLDPE & well-established in HDPE with broadest product capability
- Leader in Metallocene with New Generation XCAT™ VP-100 Catalyst for HDPE/LLDPE

UNIPOL™ PE Process: Proven value ready for the Indian PE Market
Trademarks

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