



Applied Catalysts

Process Catalysts, Systems & Services
Overview

Catalyst & Technology Solutions that Drive Value

About Applied Catalysts



Established: **1997**

Parent Company: **Applied Ceramics (founded 1970)**

Headquartered: **Atlanta, Georgia, USA**

Manufacturing Sites: **Atlanta & S. Carolina**

Ownership: **Family Run & Operated**

Total Employees: **115 Approx.**

Key Values: **High Quality, Fast Response, Fair Pricing.**



Manufacturing Plant in Laurens, South Carolina

Process Catalysts, Systems & Services Market Offerings



**PROCESS
CATALYSTS**

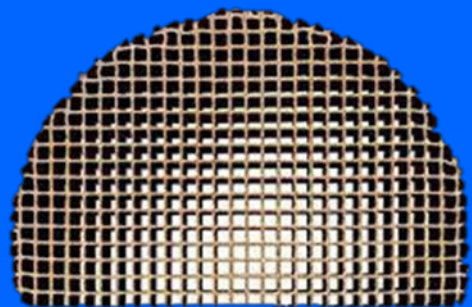


**PROCESS
DEVELOPMENT SERVICES**



**MODULAR PROCESS
SYSTEMS**

Catalyst Portfolio



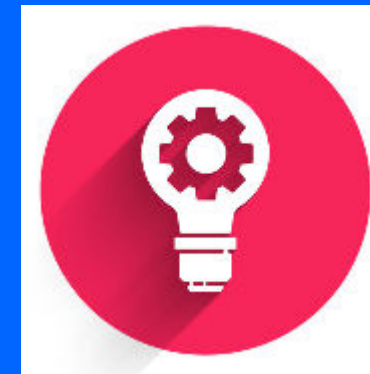
**MONOLITH
CATALYSTS**



SPECIALIZED MONOLITHS



**EXTRUDED, POWDER, &
GRANULAR CATALYSTS**



**CUSTOMIZED CATALYST
FORMULATIONS**



GUARD BED CATALYSTS



**PARTICULATE FILTRATION
CATALYSTS**



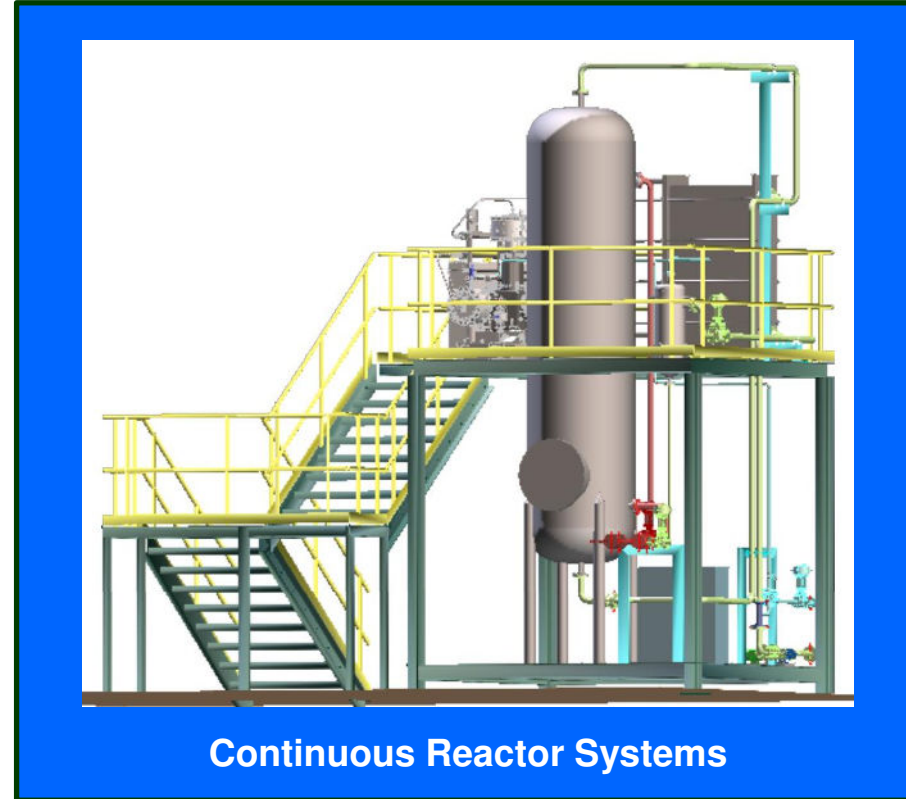
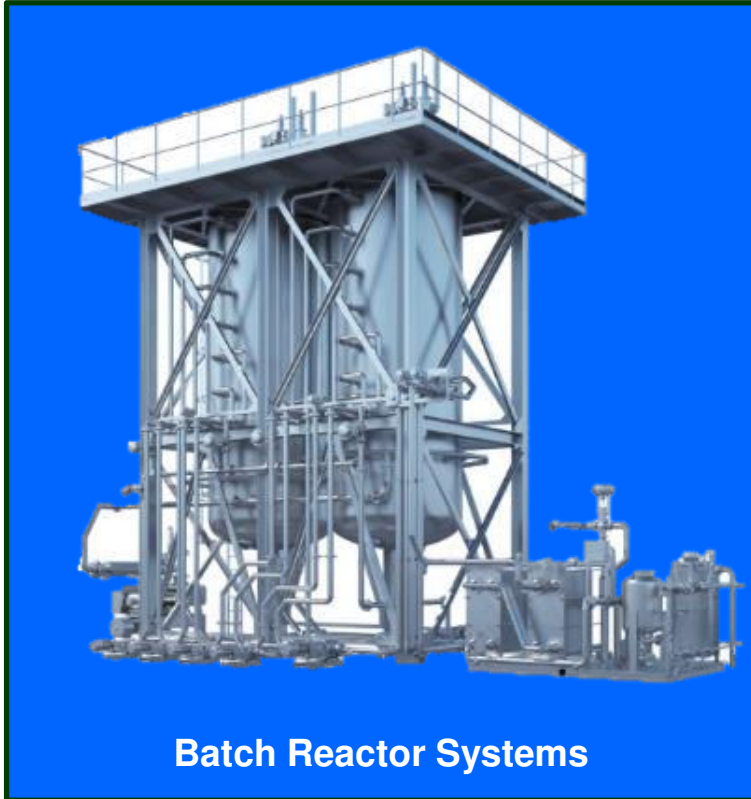
How We Do Services

- A / B testing
- The “best available catalysts”, offering proprietary and industry catalysts
- Lab Tests
- Pilot Tests
- Full Scale Demonstrations

Reaction History

- Aromatic Ring Saturation
- Reductive Alkylation
- Ester hydrogenation
- Hydrodehalogenation
- Nitrile Hydrogenation

Modular Process Systems Offerings



Integrated Offerings



Catalysts



Access to the Best Catalysts in the Industry (Not just our catalyst)

Customized Catalyst

Customized Chemistries

Systems

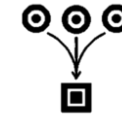


Reactor & Separation Systems

Modular System Sales & Leases

Process Performance Guarantees & Warrantees

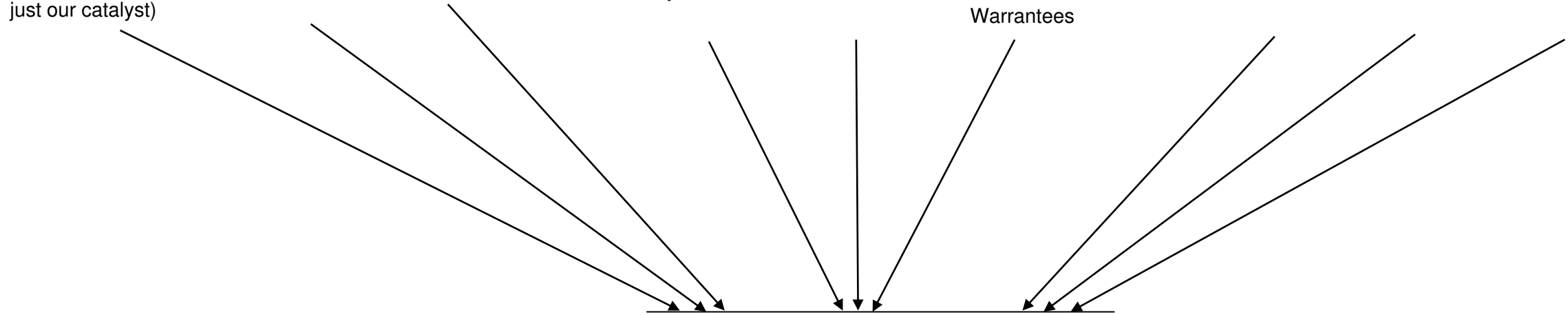
Services



Catalyst Screening Services

Reaction Development Services

Solution Demonstrations at our Factory



Integrated Market Offerings

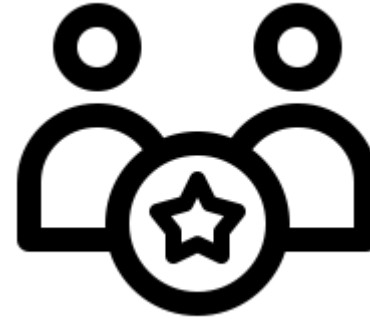
Marketplace Differentiations



**Integrated
Market
Offerings**



**Customized &
Unique
Solutions**



**Proprietary
Catalyst
Technology &
Knowhow**



**Rapid
Development &
Streamlined
Projects**



Case Study

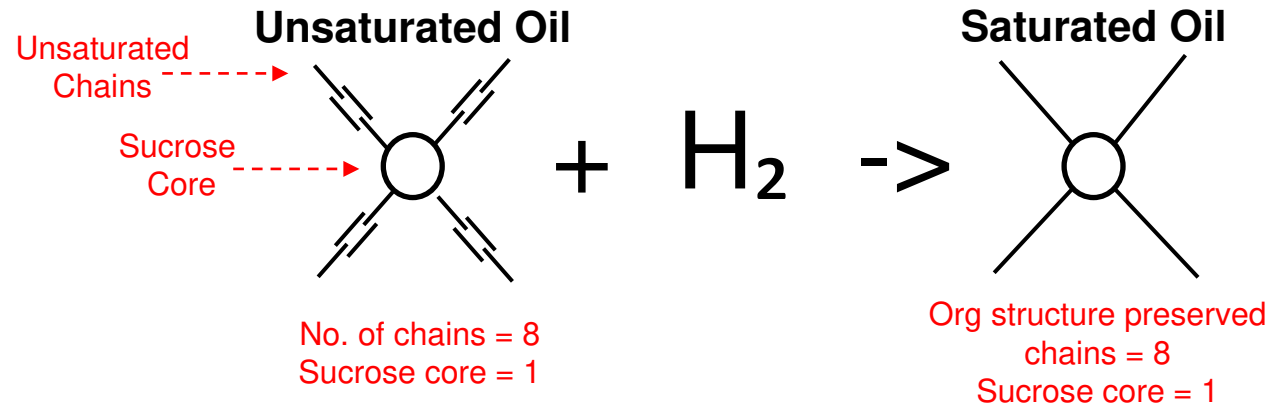
Hydrogenation of a Proprietary Oleochemical Derivative



Oleochemical hydrogenation

Oleochemical -> a chemical derived from animal or vegetable oils / fats.

Feed Molecule -> Sucrose ester with long (C12-C18) unsaturated chains (~ 2100g/mol).



Catalyst	Active Metal
230 CPSI ACMC	Pd
400 CPSI ACMC	Pd
Industry-Pd	Pd
Industry-Ni	Ni
Palladium (Pd) Loadings -> 0.25 – 1.0 wt% metal Nickel (Ni) Loadings -> 10 – 15 wt% metal Industry samples -> Granular Structures	

Experimental Setup -> 11-ft Semi Pilot Tube

Bed Height -> 6 ft, 1.18 in ID

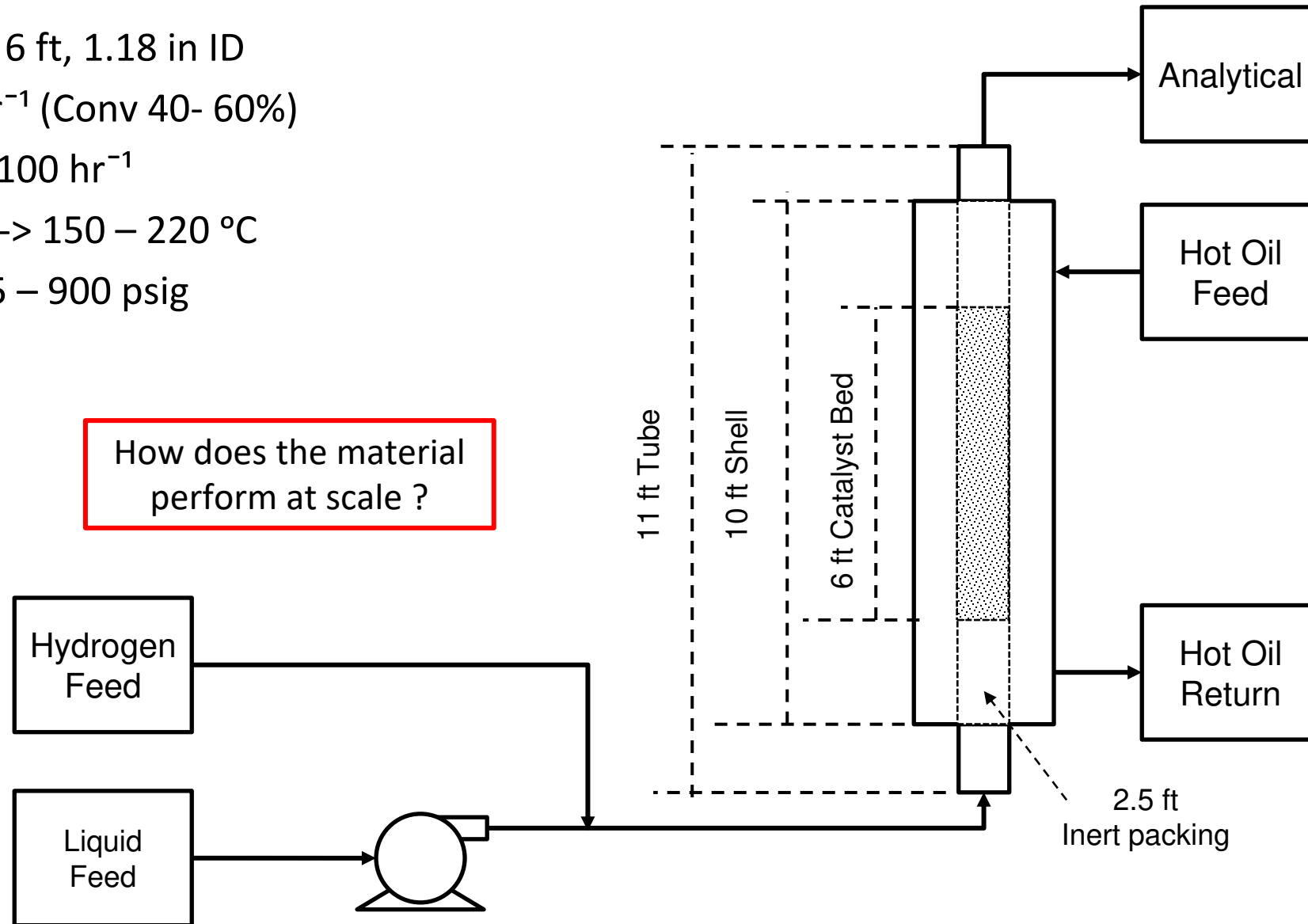
LHSV -> 1.0 hr^{-1} (Conv 40- 60%)

GHSV -> 35 – 100 hr^{-1}

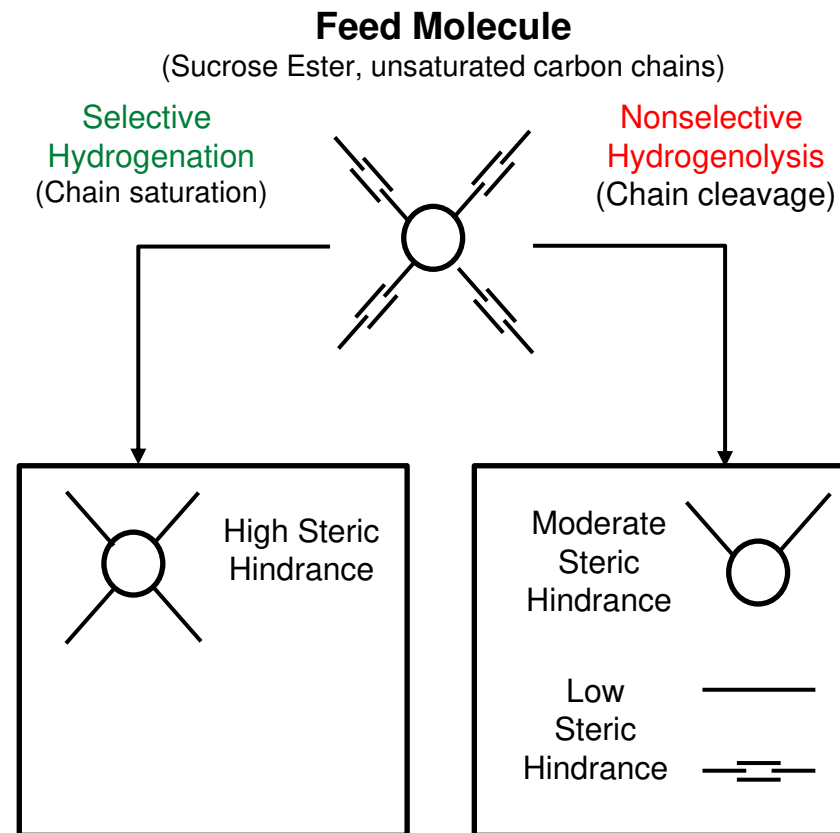
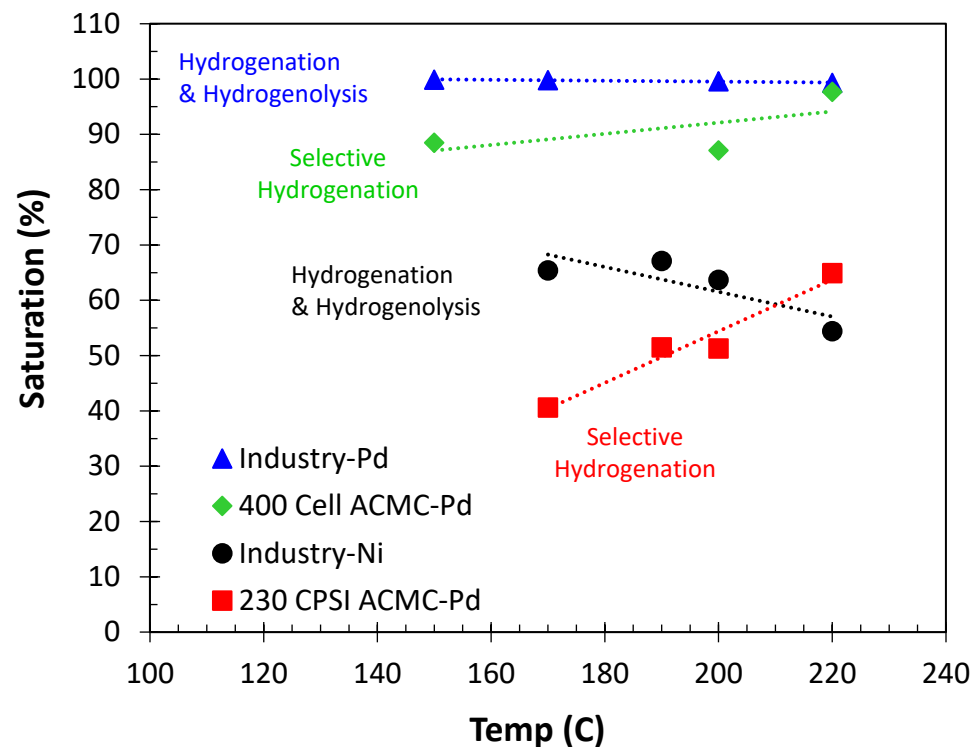
Temperature -> 150 – 220 °C

Pressure -> 25 – 900 psig

How does the material perform at scale ?



Experimental Setup -> 11-ft Semi Pilot Tube

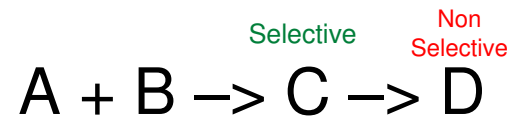
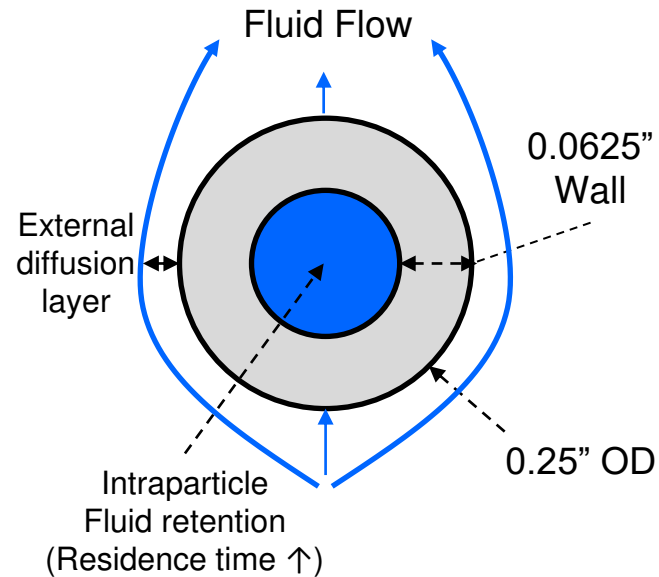
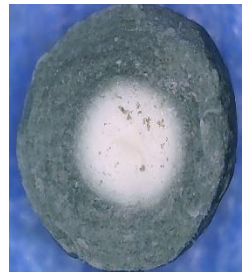


Catalyst	Rates of Saturation	Selectivity
Industry-Pd	98+ % Saturation @ 150 °C	Visual -> Heptadecane
400 CPSI ACMC	98+ % Saturation @ 220 °C	Target molecule, no pyrolysis T = 220
Industry-Ni	Mass Transfer Limited	Target molecule, heptadecane + esters (NMR)
230 CPSI ACMC	Temperature Controlled	Target molecule, no pyrolysis T = 220

Internal Mass Transfer -> Packed Bed vs ACMC

Granular Packed Bed

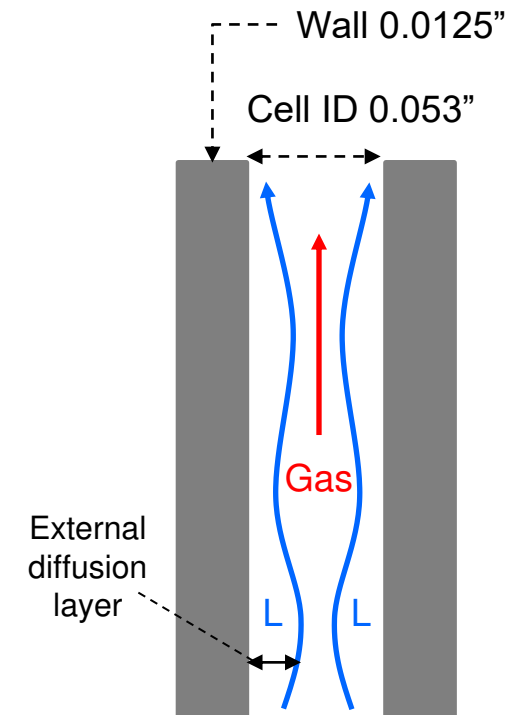
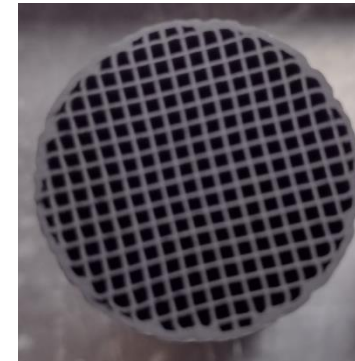
Egg Shell



- Retention time ↑
- Selectivity ↓
- ΔP Limited
- Narrow operating range

ACMC

230 CPSI -> 230 tubes

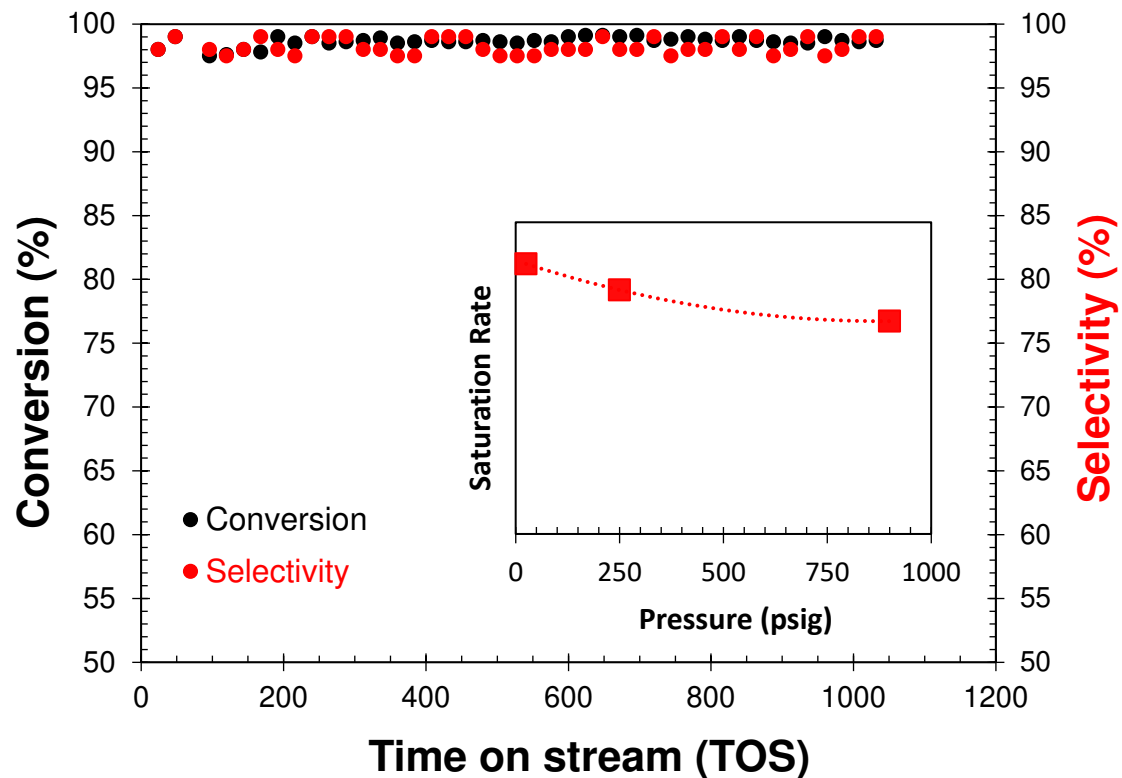


Packed beds -> A + B external mass transport limited



- No dead spots
- Selectivity ↑
- ΔP ~ 0
- Wide operating range -> Unique fluid properties

Experimental Setup -> 11-ft Semi Pilot Tube



Reactant -> Liquid @ 25 °C



Product -> Solid @ 25 °C



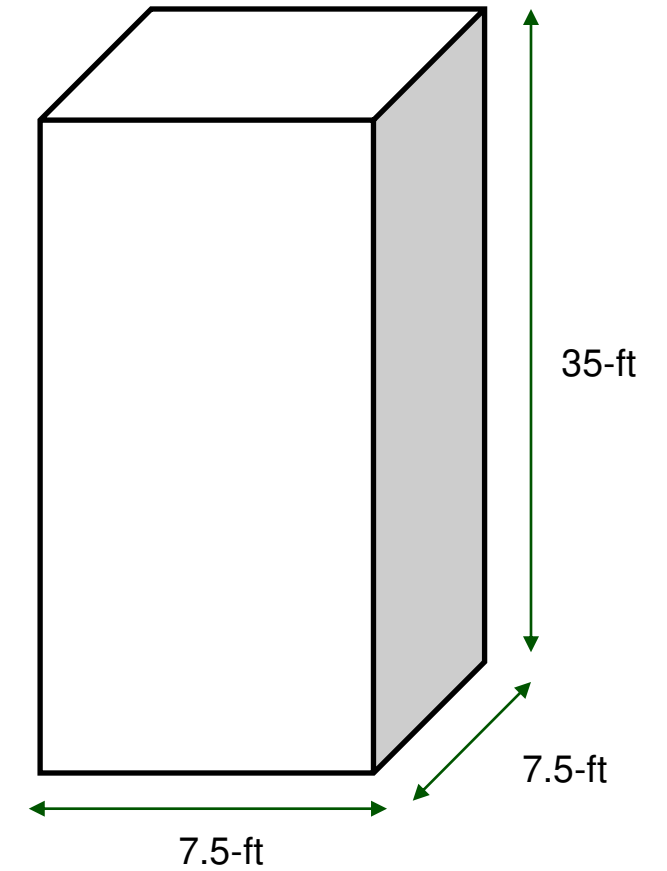
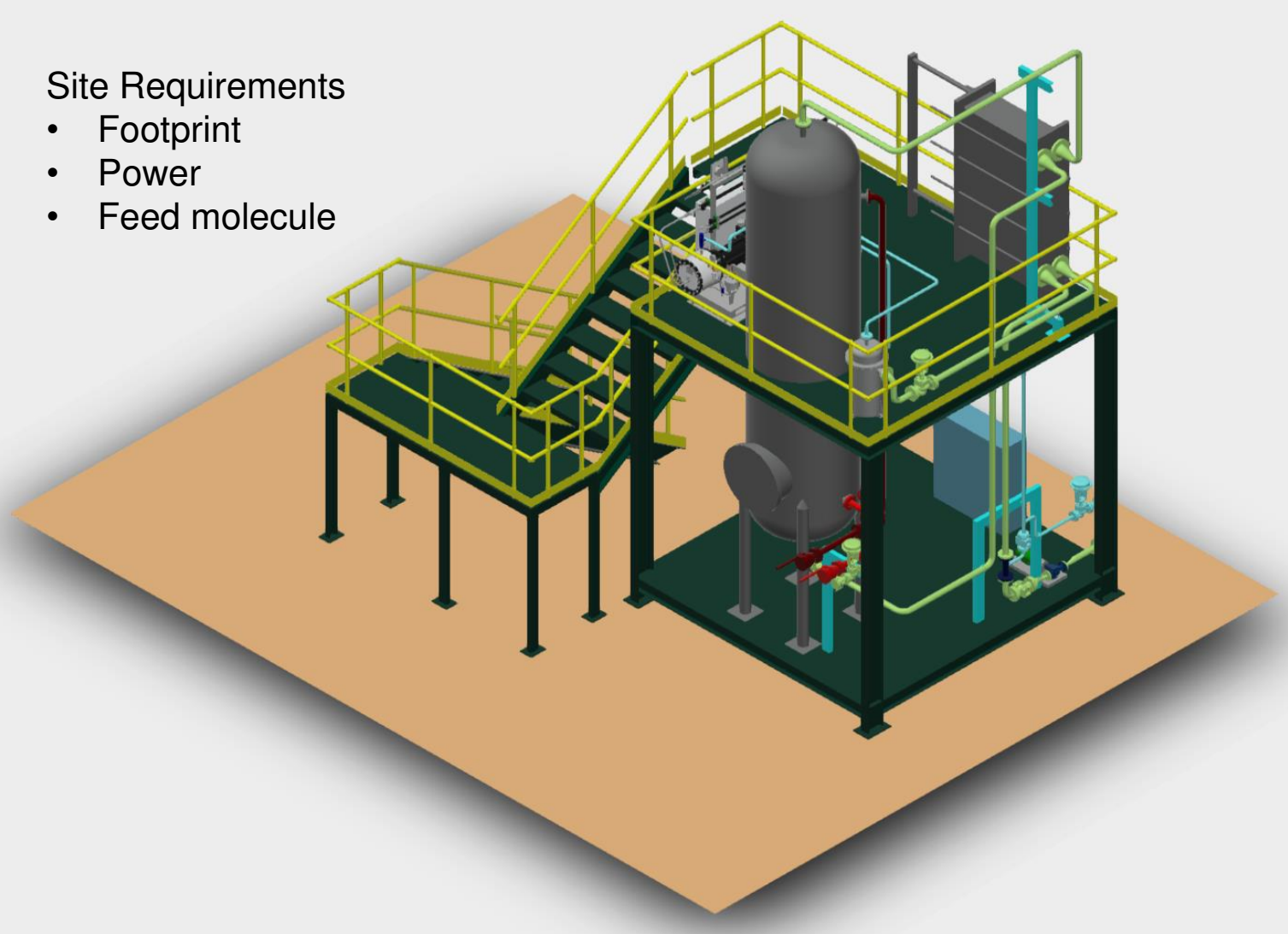
Conclusions

- Activity & selectivity constant @ 98+%
- 1000 hours -> 2400 lbs of product @10 kg/day
- No Pd leaching in product (PIXE)

Next Steps -> 5MM lb/yr Scale-Up

Site Requirements

- Footprint
- Power
- Feed molecule



Questions?