

Cormetech

SCR Catalyst Development for Low SO_2 to SO_3 Oxidation



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Governing Reactions



Adverse affects caused by reaction (2):

→ SO_3 plume

→ Increased corrosion

Drivers and Objectives

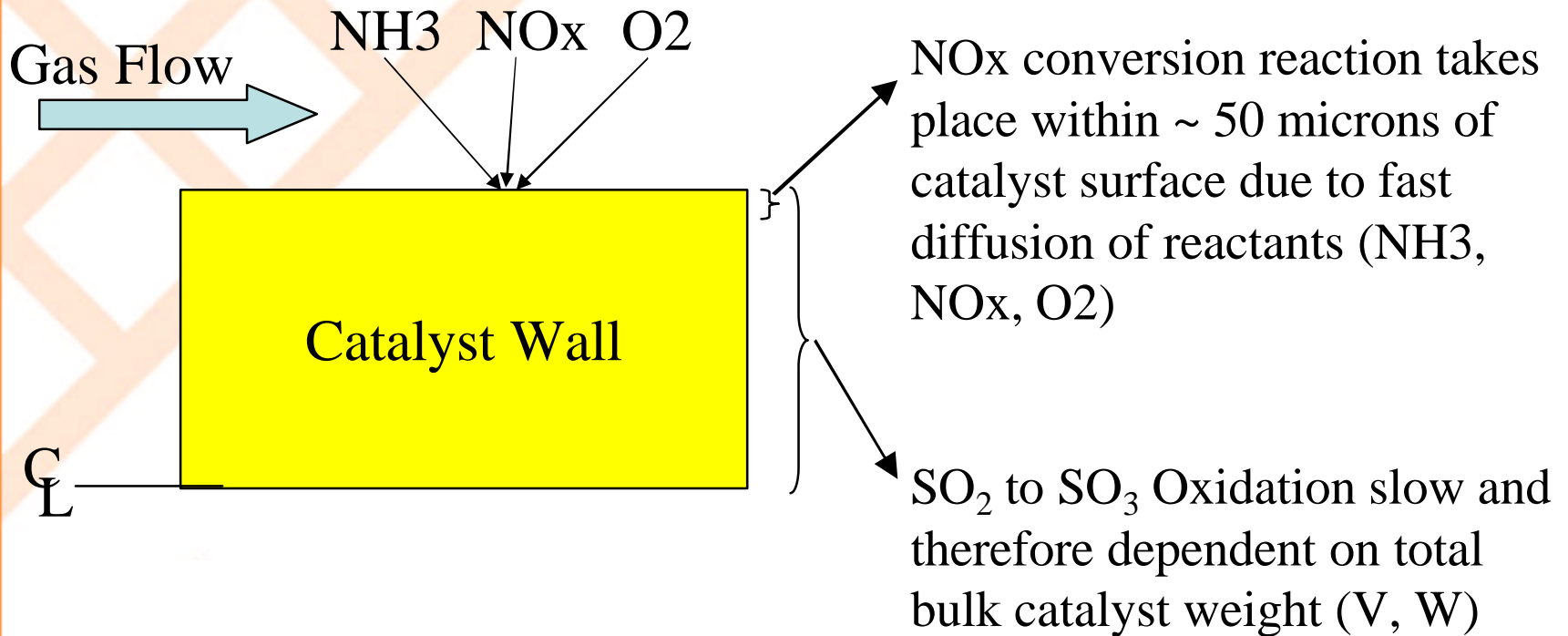
◆ Drivers

- ◆ Reduced contribution to SO₃ plume
- ◆ Reduced corrosion
- ◆ Reduced cost for SO₃ mitigation reagent

◆ Objectives

- ◆ Significant reduction in the formation of SO₃
- ◆ Maintenance of catalyst properties

Catalyst Properties



Catalyst Properties

◆ Homogeneous

- ◆ Catalyst has high poison resistance
- ◆ Delamination – not applicable
- ◆ Erosion is controlled through material hardness
- ◆ SO₂ oxidation is moderate with high open area product

◆ Coated

- ◆ Efficiently utilizes catalytic material
- ◆ Minimizes SO₂ oxidation
- ◆ Delamination potential increased with use of non-similar materials
- ◆ Minimal poison resistance when applied to non-porous substrate

Goal – Combine best properties of both catalyst types

Hybrid Catalyst Properties

High activity
catalyst application



Porous Catalytic Substrate

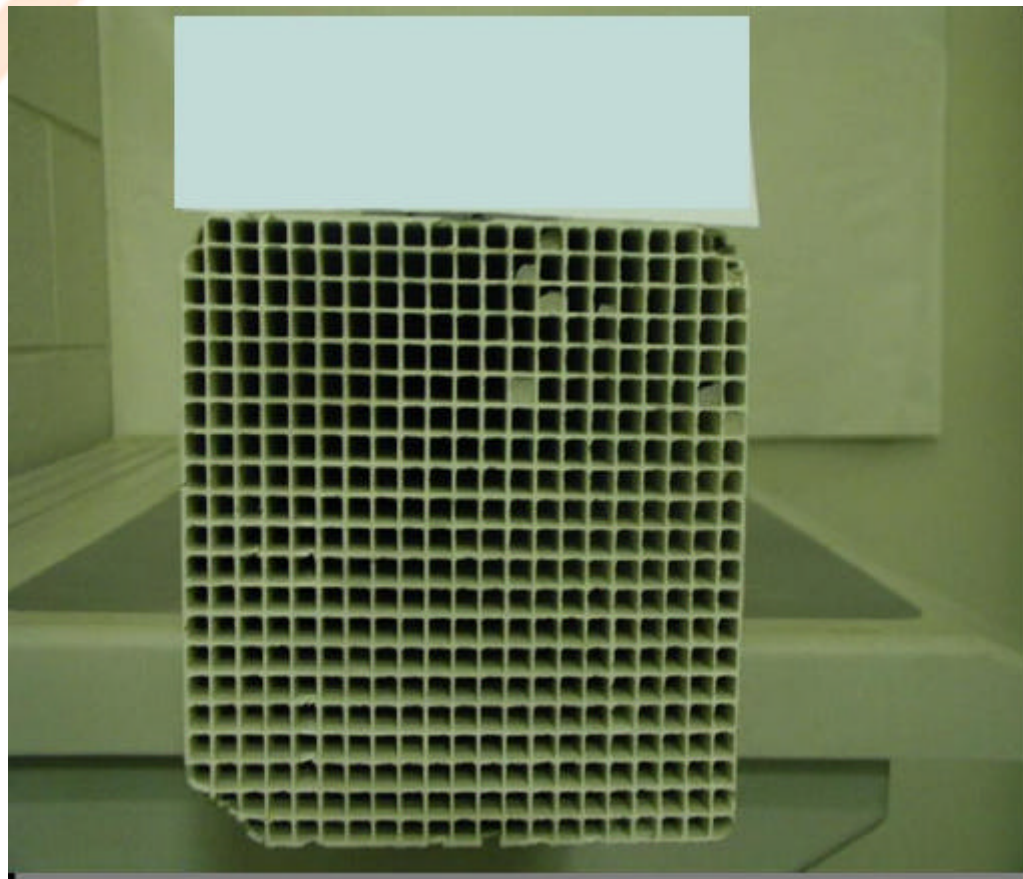
Result: High Performance SCR catalyst with decreased SO₂ oxidation without sacrificing performance attributes

German Plant Demonstration

Unit size/type, MW	705 – wall fired PC
Fuel	Bituminous
Catalyst Description	Hybrid - 7.1 mm pitch – focus on Increase K @ low SO ₂ to SO ₃ oxidation
Gas Velocity, m/s	4.5
Temperature, deg C	380
SO ₂ ppm	Nominal 500 Range 350-1000
SO ₃ ppm	Nominal 10 Range 7 – 20
SO ₂ to SO ₃ oxidation	0.3% single layer
Dust Loading, mg/Nm ³	Design 10,000 Range 5,300 – 25,000

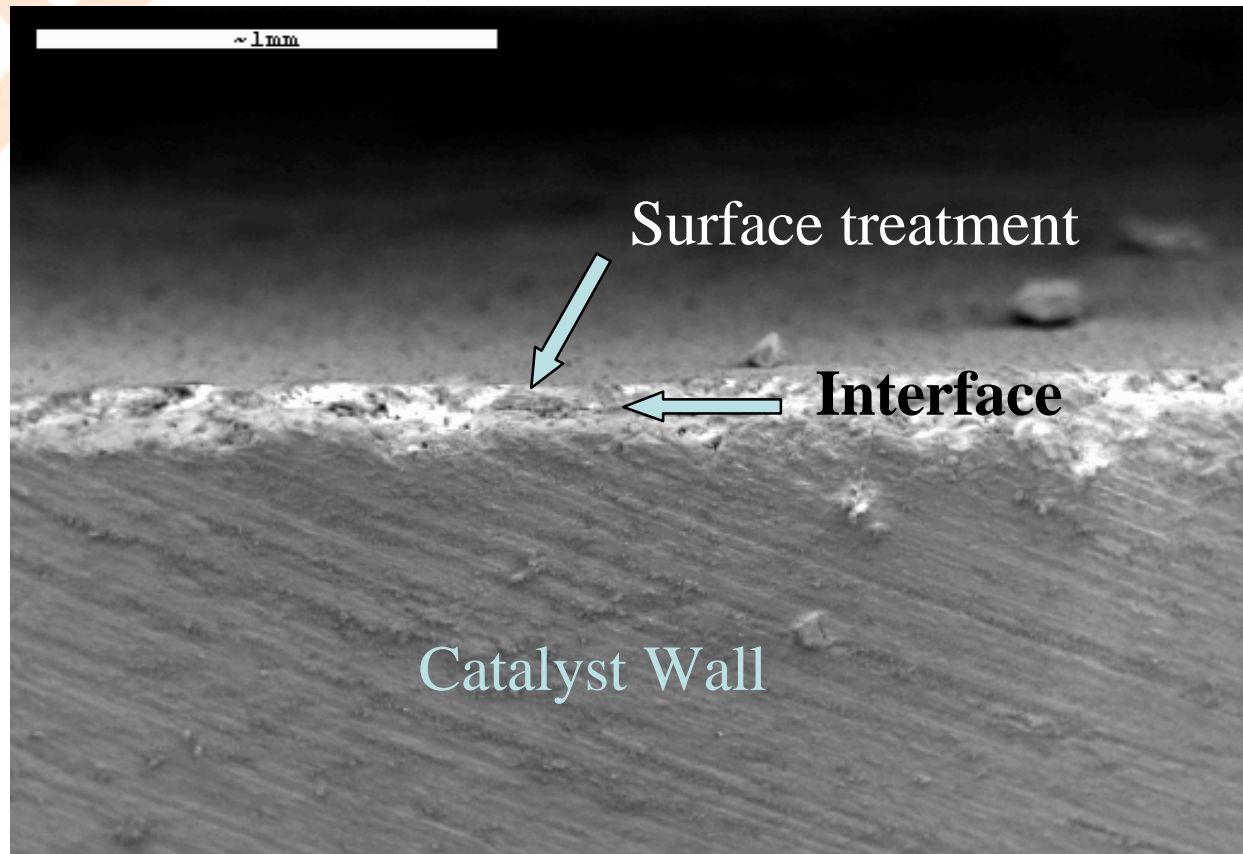
German Plant Catalyst Sample

After ~ 45,000 Operating Hours



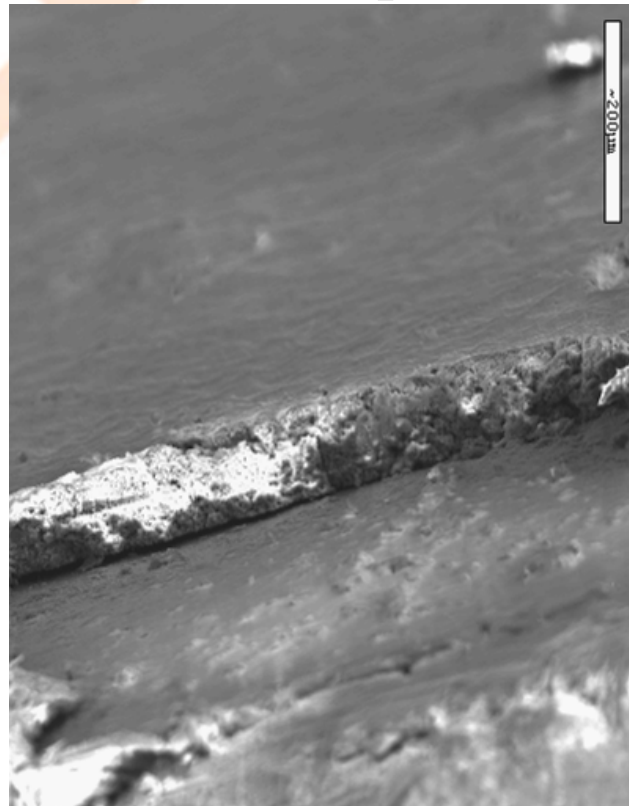
SEM Image - Wall Cross-section

After ~ 45,000 hours Exposure

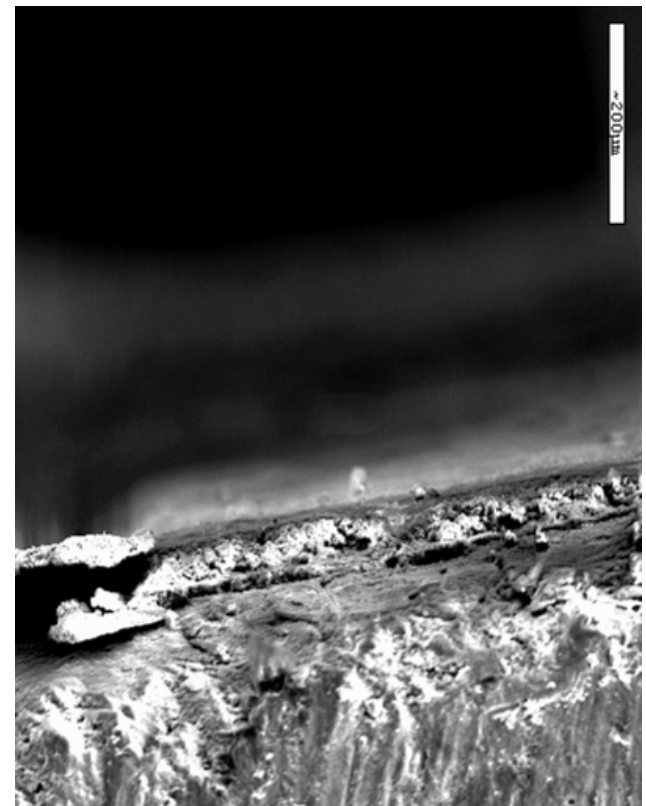


SEM Image - Wall Cross-section @ Front

Fresh - Unexposed

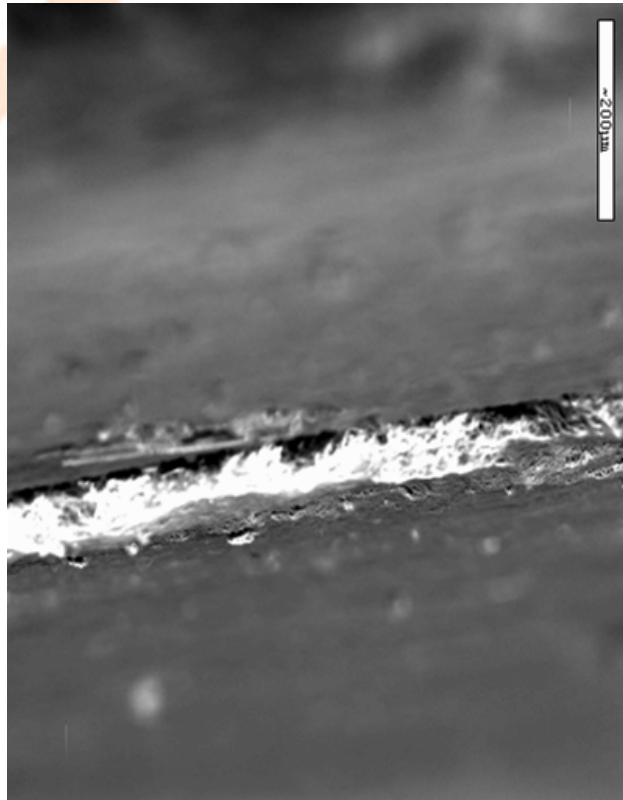


After ~ 45,000 hours



SEM Image - Wall Cross-section @ Rear

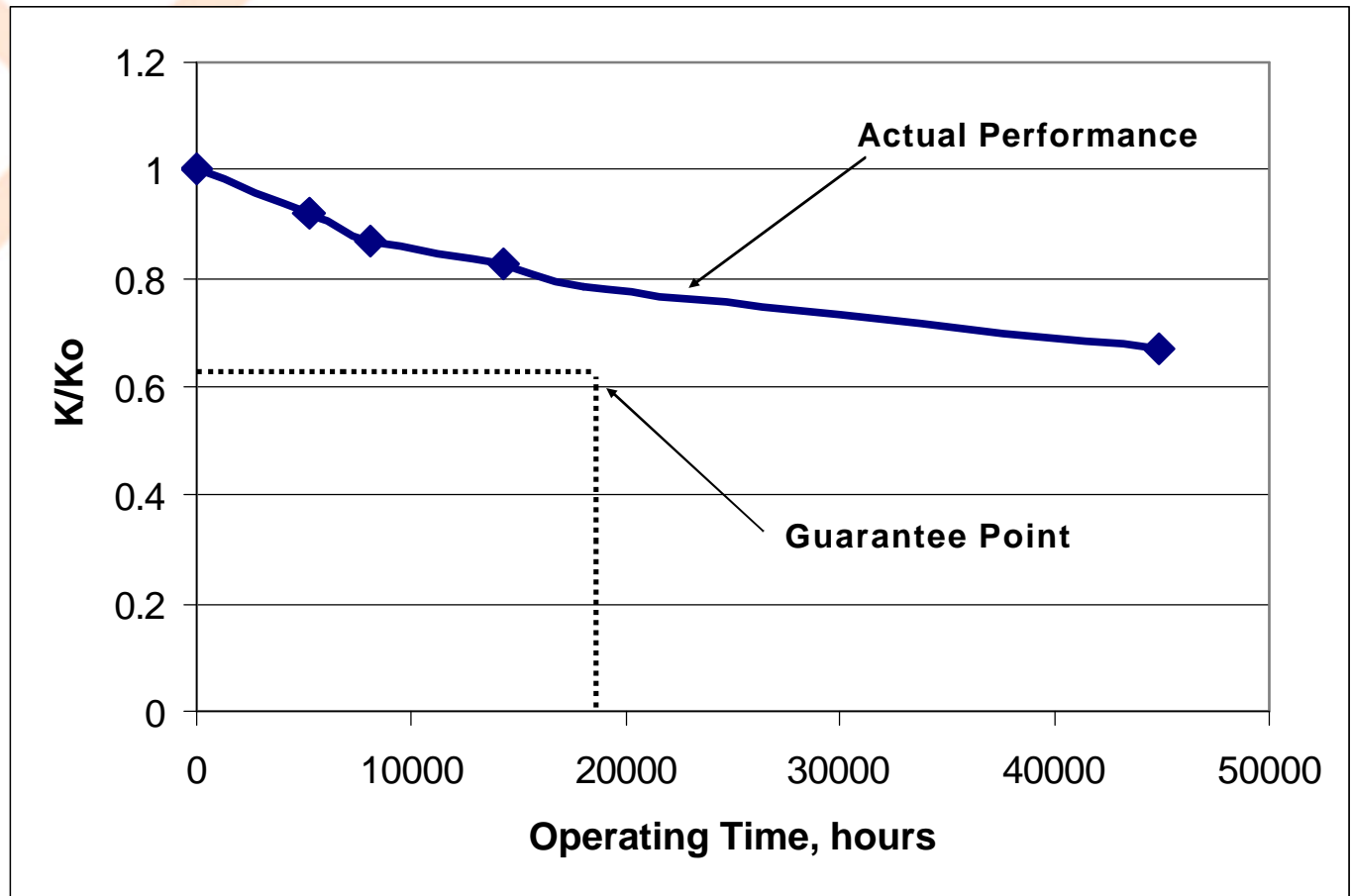
Fresh - Unexposed



After ~ 45,000 hours



German Reference Plant - K/Ko vs. Time



Innovative Products to Meet Customer Needs

- ◆ Advanced Extrusion Techniques alone or in Combination with Surface Treatments Results in:
 - ◆ Increased NO_x Activity
 - ◆ Decreased SO₂ to SO₃ Conversion
 - ◆ Decreased impact on SO₂ to SO₃ conversion caused by vanadium deposition.

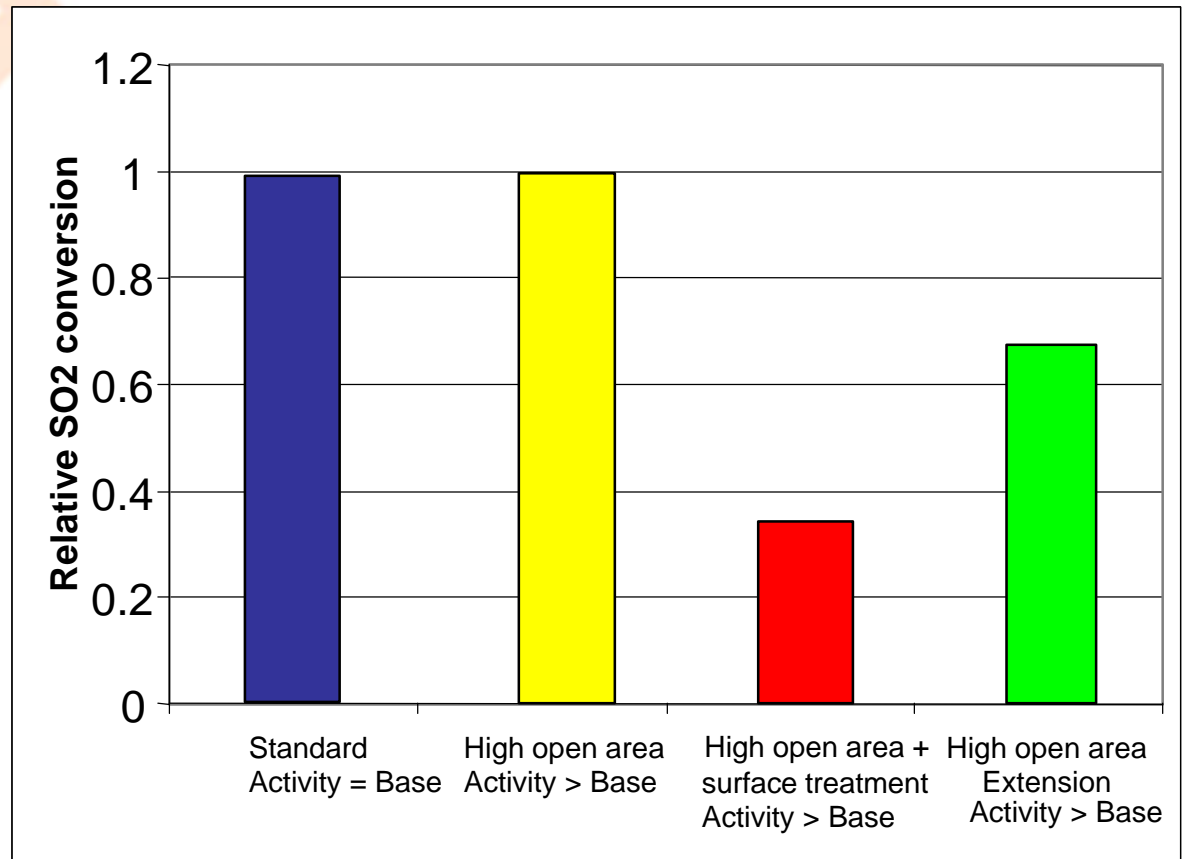
SO₂ to SO₃ Oxidation vs. Product

Design Reference

Inlet NO_x = 0.5 lb/mmbtu

Removal Efficiency = 90%

NH₃ slip = 2 ppm



Conclusions

- ◆ Durability was commercially demonstrated for an extruded, surface-treated, SCR catalyst.
 - ◇ Chemical – activity was maintained
 - ◇ Physical – high integrity of surface
- ◆ Lower SO_2 to SO_3 oxidation is achievable.
 - ◇ 65% decreased rate with advanced products
 - ◇ <0.2% oxidation possible in some cases

What Next?

- ◆ What are the Customer Requirements?
 - ◇ Oxidation rates
 - ◇ Schedule
 - ◇ Economic Impacts
 - ◆ Reagent reduction
 - ◆ Reduced corrosion