



The Stationary Business of BASF Catalysts LLC is concerned with reducing greenhouse gas through either reducing energy consumption or destroying greenhouse gases after generation using proven catalyst technology. The specific technologies we offer are detailed in the chart below and in the accompanied product line descriptions. If the gas consumption is reduced, the greenhouse gas generation is reduced proportionately.

Technology	Commercial Status	Pollutant	Industry	Impact
VOCat® RCO catalysts	Yes	VOC, Wood products coatings	Process Industry	Reduces natural gas consumption
CHARCat™ Charbroiler catalysts	Yes	VOC, PM charbroilers	Chain driven consumptions	50% lower gas
VOCat 360 PFC oxidation catalyst for halogenated hydrocarbons	Yes	CFC's	Chemical Processes, Soil Remediation, Groundwater Treatment	95-99 %
Methane Catalyst	Development	Methane	N/A	N/A
Oxidation Catalyst	Yes	CO, VOC	Broad range of industries	Pollutants catalytically rather than thermally destroyed, lowering gas consumption ~50%

VOCat[®] 350HC

Oxidation Catalyst for chlorinated hydrocarbons

Product data

Chlorinated hydrocarbons are emitted from a wide variety of industrial processes, as well as many soil remediation and ground water clean-up operations. Most conventional catalysts used to oxidize volatile organic compounds (VOCs) have proven inadequate for dealing with chlorinated compounds because they cannot provide the full combination of activity, selectivity and stability needed for these hard-to-oxidize emissions. VOCat 350 HC catalyst provides high activity, excellent selectivity and outstanding stability required for oxidizing chlorinated hydrocarbons.

Activity

Compared to platinum or transition metal-based catalysts, VOCat 350 HC catalyst shows significantly higher activity. This reduces temperature requirements and can allow fuel savings (Chart 1).

The high activity of VOCat 350 HC catalyst is exhibited over a wide range of chlorinated species making this a versatile catalyst ideal for most situations. The activity increases when going from aliphatic to aromatic chlorocompounds and in going from C₂ to C₁ species (Chart 2).

Selectivity

Selectivity is critical when dealing with chlorinated compounds. VOCat 350 HC catalyst will form predominantly CO₂ and HCl when 1.5% or more water is present in the feed stream. The formation of HCl is preferred over C₁₂ because it is easy to scrub and has minimal effect on catalyst life.

Stability

Aging studies over a period of 1200 hours show that VOCat 350 HC catalyst maintains high activity with no measurable decline. This catalyst effectively operates at temperatures 75°C higher than other catalysts designed for chlorinated hydrocarbon destruction. This high temperature stability makes VOCat 350 HC catalyst suitable for the most demanding applications (Chart 3).

Catalyst Features

The BASF catalysts are supported on ceramic substrates and feature:

- excellent adhesion of catalyst coating to the substrate
- high temperature stability and thermal shock resistance
- low pressure drop
- high strength and excellent durability
- compact design

Typical Operation Specifications

- Temperature range:
 - 225°C to 475°C
- Cell Geometry:
 - 100 to 400 cell/in²
- Activity:
 - up to 99% oxidation

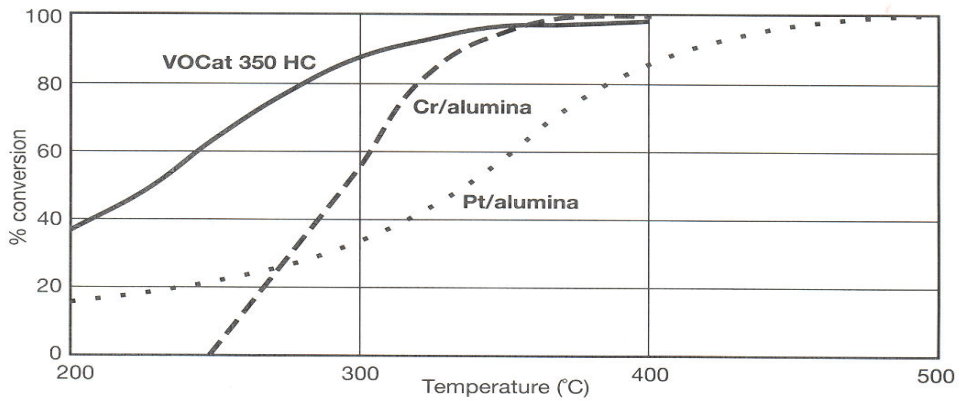
About BASF

As the world's leading chemical company, BASF's portfolio ranges from chemicals, plastics, performance products, agricultural products and fine chemicals to crude oil and natural gas. BASF's intelligent system solutions and high-value products help its customers to be more successful. BASF develops new technologies and uses them to open up additional market opportunities. It combines economic success with environmental protection and social responsibility, thus contributing to a better future.

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Chart 1:
Destruction of Trichloroethylene

1000 ppm TCE,
1.5% water,
7500 VHSV
For comparison purposes
powder catalysts
were used.



VOCat™ 350 HC OXIDATION CATALYST

Chart 2:
Destruction of Chlorocarbons with VOCat 350 HC Catalyst

1000 ppm TCE,
1.5% water,
7500 VHSV

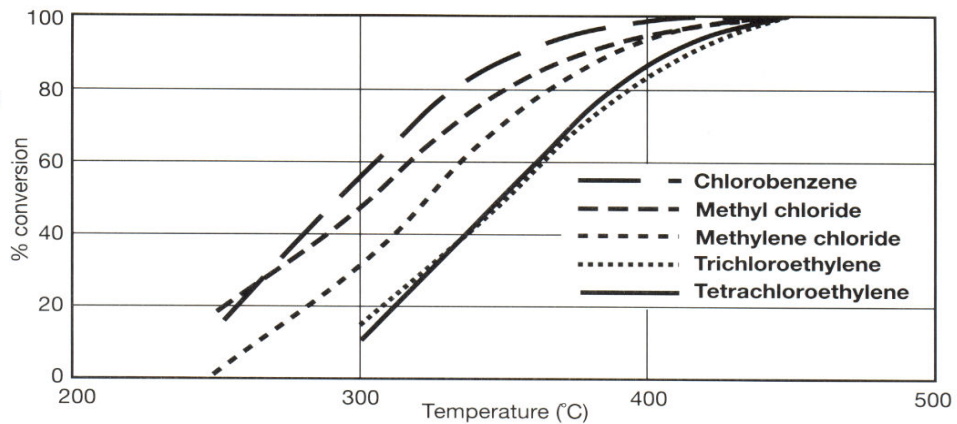
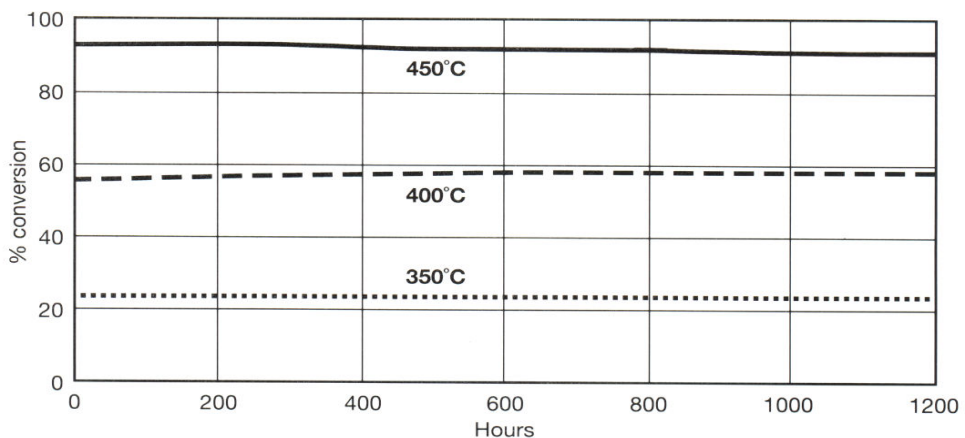


Chart 3:
Stability of VOCat 350 HC Catalyst

1000 ppm TCE,
1.5% water,
7500 VHSV, 450°C



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The Chemical Company

VOCat[®] RCO Catalyst

For regenerative catalytic oxidation

Product data

Regenerative catalytic oxidation (RCO) technology combines the benefits of the rugged, proven reliability of regenerative thermal oxidizers (RTO), with the energy efficiency of catalytic technology. The result is a more cost-effective RCO system that can result in significant operating cost savings, lower CO and NOx emissions, and less maintenance than other systems. VOCat[®] RCO catalysts provide the highest activity, stability and durability of any RCO catalyst. Consequently, there are more VOCat RCO catalysts in more applications, treating more process flow, than all the other RCO catalysts combined. BASF currently has four commercial RCO catalyst formulations: RCO-5000, RCO-6000, RCO-7000, and structured block. Refer to the table for a summary of suitable applications.

Benefits:

- Significantly lower operating costs
- High CO and VOC destructive efficiency
- Long catalyst life and minimum maintenance
- Lower NOx emissions due to lower fuel consumption
- Durability
- Washability
- Lower operating temperature can extend life of oxidizer

Lower operating costs

The operating temperatures for VOCat RCO catalyst are typically 600 to 800°F for an RTO.

Therefore, most gas streams require about 50-70% less fuel to destroy the VOCs.

With VOCat RCO catalyst in an RCO, electrical consumption is less because the combustion temperature is much lower than in an RTO. This lowers the air volume and pressure drop through the system. Also, electrical costs to operate the fans are reduced by 15-40% depending upon the design of the system.

High VOC destruction efficiency

With over 20 years experience in air pollution abatement of VOCs, BASF has developed a strong history of reliability and performance. BASF has a complete understanding of your processes and what catalyst will work best to achieve the highest VOC destruction. Depending on the application, BASF VOCat RCO catalyst can allow the regenerative oxidizer to reach destruction efficiencies of 95-98%. For typical performance in automotive and forest product applications, please refer to the following table.

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VOCat [®] RCO Catalyst Applications				
Catalyst	VOCat RCO-5000	VOCat RCO-6000	VOCat RCO-7000	VOCat RCO Structured Block
Catalytic ingredients	PM	PM	Base Metals	PM
Shape	1" Saddle	1" Saddle	_ " ring	5.91" cube
Temperature for oxidation				
Low	Aromatics, Alkenes, Alkynes	Aromatics, Alkenes, Alkynes, Oxygenated VOC \leq C6 Paraffins	Oxygenated VOC	Alkynes, Alcohol, Aromatics
Medium	Oxygenated VOC \leq C6 Paraffins	Oxygenated VOC \leq C6 Paraffins	Aromatics \leq C6 Paraffins	Oxygenated VOCs \leq C5 Paraffins
High				
CO removal	Excellent	Excellent	Poor	Excellent
Poisons	Organo Silicates	Organo Silicates, Sulfur	Organo Silicate	Organo Silicates, Sulfur
Alkaline/acid washing	Yes	Yes	No (water wash only)	Yes
Typical applications	Spray Booths & Forest Products	Automotive	Automotive	Various
Recommended minimum catalyst temperature °C	370	370	450	370

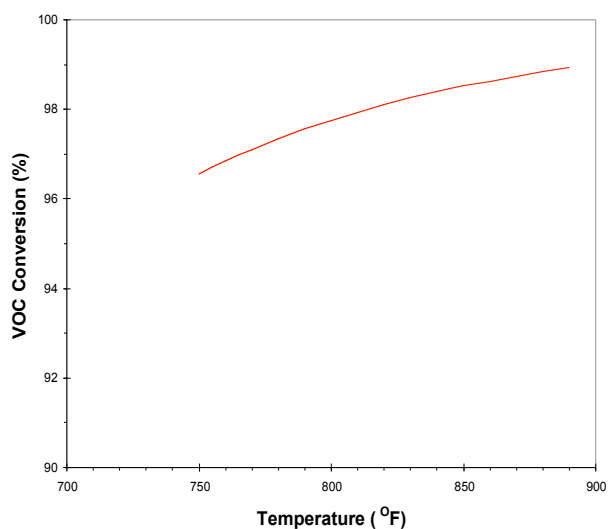
NOTE:

Aromatics VOC: Toluene, xylene, benzene, ethylbenzene, etc.

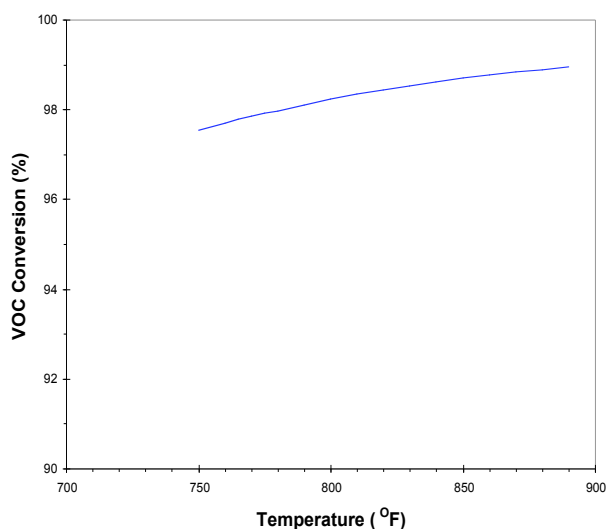
Oxygenated VOC: Ketones, acetates, etc.

Paraffins: Methane, ethane, propane, butane, pentane, hexane

Typical VOCat RCO Performance in Automotive Application



Typical VOCat RCO Performance in Forest Products Application



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VOCat[®] 360 PFC

Oxidation Catalyst For Halogenated Hydrocarbons

Product data

Chlorinated/Fluorinated Hydrocarbons

Chlorinated and fluorinated hydrocarbons are emitted from a wide variety of industrial processes, as well as many soil remediation and ground water clean-up operations. BASF's VOCat 350 HC catalyst has been used successfully for many years to destroy chlorinated hydrocarbons. BASF has now developed VOCat 360 PFC catalyst to destroy both fluorinated and chlorinated VOC compounds. Unlike many other catalysts, VOCat 360 PFC provides high activity, excellent selectivity and outstanding stability required for oxidizing fluorinated and chlorinated hydrocarbons.

Activity

The activity of VOCat 360 PFC is much higher than platinum and transition metal-based catalysts. This activity is exhibited over a wide range of chlorinated and fluorinated hydrocarbons, and especially when both are present in the same process stream. This makes VOCat 360 PFC ideal for most halogenated VOC process streams.

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Selectivity

When controlling the emissions of VOC's it is also critical for complete oxidation to prevent the formation of secondary products. VOCat 360 PFC catalyst is very selective over a wide range of chlorinated and fluorinated hydrocarbon species. VOCat 360 PFC catalyst will form primarily CO₂, HCL and HF. The formation of HCL is preferred over Cl₂ because it is easy to scrub, and HF and HCl have a minimal effect on catalyst life.

Typical Process Applications

VOCat 360 PFC is ideally suited for a wide variety of applications, including:

- Chemical processes
- Soil remediation
- Groundwater treatment

Typical Operating Specifications

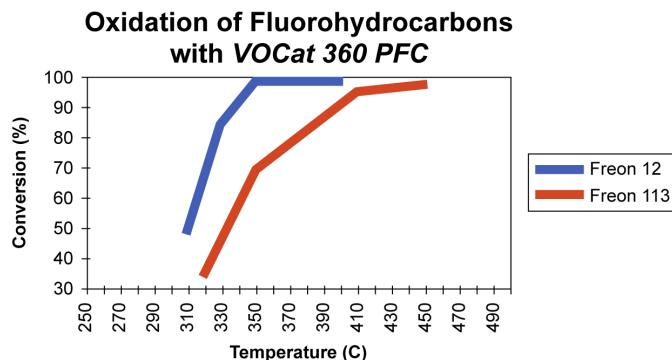
Temperature Range: 850°F to 950°F
(45°C to 510°C)

Cell Geometry: 100 to 400 cpsi

Performance: Up to 99+%

About BASF

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CHARCat™ 910

Charbroiler catalysts

Product data

In charbroilers, large amounts of organic compounds in the form of smoke and gases, are released during the cooking process. CHARCat allows for the destruction of these compounds and at the same time lowers gas costs by evenly radiating the heat in the broiler.

Operation

The catalyst shroud is designed to evenly distribute the heat from the

broiler exhaust into the catalyst. Once the catalyst temperature reaches 450°F, smoke and gases from the charbroiler are burned or oxidized to carbon dioxide or water.

Efficiency

BASF's CHARCat meets or exceeds all the removal requirements for odor producing gases and smoke producing particulates as measured by the

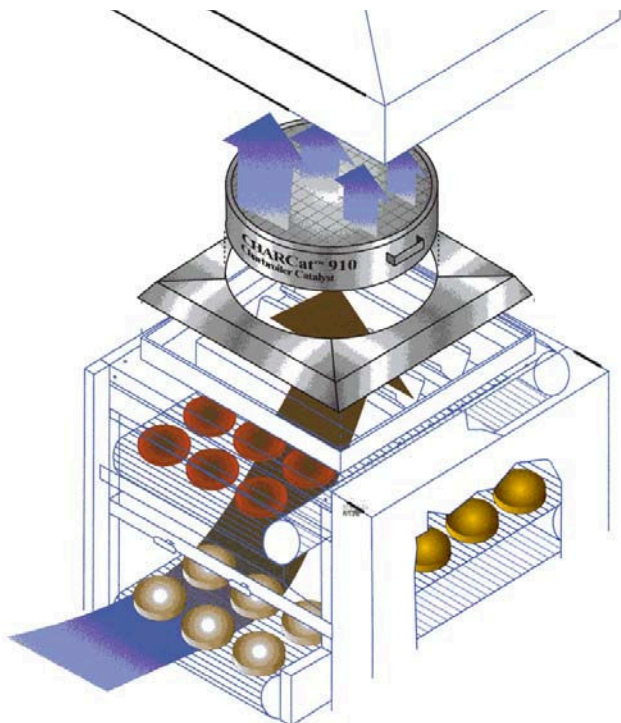
South Coast Air Quality Management District's approved independent lab in California. Efficiencies will vary slightly with exhaust hood ventilation rates and cooking rates.

Benefits

- Saves money by lowering fuel use
- Reduces grease build-up and lowers duct cleaning costs
- Easy installation
- Controls smoke and odors
- Runs on broiler exhaust heat
- No moving parts
- No utility hookup needed

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The Chemical Company

CHARCat™ Specifications	
Size	22.38" outside diameter by 2.86" high
Weight	Approximately 14 pounds
Construction	Coated metal alloy foil in a food grade stainless steel frame with heavy duty stainless steel protective screen on both faces.
Cleaning and maintenance	Cleaning with certain materials may damage the catalysts. Soaking the catalyst in a warm water bath should remove most residues that have built up on the catalyst. Use only approved cleaning materials when washing any portion of the catalysts. A list of approved materials is available from your local distributor.
Handling and storage	Always allow the catalyst to cool to room temperature before removing. Remove the catalyst using heat gloves by means of the side handles. The catalyst element is sensitive to shock and should not be dropped. If not in use, store in a safe place.

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CHARCat™ 900

Charbroiler catalysts

Product data

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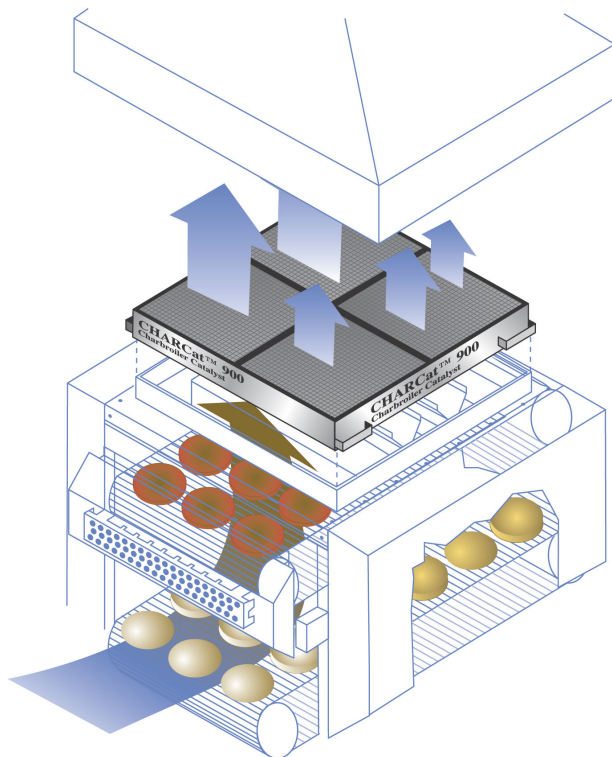
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CHARCat™ Specifications	
Size	Nominally 24.5" length x 24.5" width, 2-4" inches high. These dimensions can be adjusted to fit specific applications.
Weight	Approximately 35 pounds
Construction	Coated metal alloy foil in a food grade stainless steel frame with heavy duty stainless steel protective screen on both faces.
Cleaning and maintenance	Cleaning with certain materials may damage the catalysts. Soaking the catalyst in a warm water bath should remove most residues that have built up on the catalyst. Use only approved cleaning materials when washing any portion of the catalysts. A list of approved materials is available from your local distributor.
Handling and storage	Always allow the catalyst to cool to room temperature before removing. Remove the catalyst using heat gloves by means of the side handles. The catalyst element is sensitive to shock and should not be dropped. If not in use, store in a safe place.

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