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PRODUCT STEWARDSHIP SUMMARY

CAS No. Mixtures  
EINECS No. Mixtures

# FCC Catalysts and Additives

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## Introduction

Albemarle Corporation provides fluid catalytic cracking (FCC) catalysts to the oil refining industry. Albemarle has provided the industry with technology leading catalysts for over 30 years and has nine FCC Catalysts that are actively marketed today. They are AFX™, ACTION™, AMBER™, CORAL™, UPGRADER™, UPGRADER R+™, GO-ULTRA™, AMBER MD™, and UPGRADER MD™. These catalysts are used to convert petroleum crude oil to gasoline, diesel fuel and valuable petrochemicals. The FCC process supplies 40-50% of the world's demand for gasoline. The FCC process produces higher yields of clean gasoline than thermal cracking processes and higher octane than hydrogen rich cracking process such as Hydrocracking. Using a well-chosen FCC Catalyst allows a refinery to maximize the yield of high value

fuels from the high boiling range cut of heavier and cheaper crude oils. In addition to these FCC catalysts, Albemarle has six FCC performance additives marketed with the following product names: BCMT-500™, BCMT-DC™, BCMT-MD™, PROvantage™, DuraZOOM™, and SMOOTHFLOW™. Performance additives address various FCC unit issues such as propylene maximization, increasing octane, bottoms cracking and accessibility



improvements, and fluidization (or circulation) problems. The Albemarle products KDSOx™, DuraSOx™, SOxMASTER™, KOC-15™,

ELIMINOx™, R-975™, and SCAVENGER™ are environmental additives. These additives are used to remove sulfur from gasoline, and environmentally hazardous materials such as carbon monoxide (CO), sulfur oxides (SOx) and nitrous oxides (NOx) from refinery emissions.

### Description and Properties

The FCC Catalysts are stable off-white, light yellow or yellow powders. They have a negligible solubility in water. They are composed of zeolite, silica, alumina, clay and binder. Almost always the zeolites contained in the FCC catalyst are rare earth, predominantly lanthanum compound. Additionally, some additives may contain magnesium oxide, platinum, or other application specific chemicals.



### Uses

Fluid catalytic cracking (FCC) is the most important technology in modern continuous process refining. The FCC Catalysts crack high boiling range petroleum hydrocarbons into gasoline, diesel fuel, propylene and butylenes. Refiners are always under pressure to process heavier residual feedstock while

maintaining high levels of conversion to valuable products. Also, the global demand for high-quality diesel is expected to grow.

The catalytic cracking process produces high yields of gasoline with good octane rating. FCC units are also playing an increasing important role in meeting the growing worldwide demand for propylene.

FCC catalysts and additives such as AFX, DuraZOOM, and PROvantage help refiners produce this valuable product. Propylene is in high demand in the growing petrochemical industry as it is a building block in a wide variety of synthetic plastics

including polypropylene and other useful polymers. The requirements for gasoline quality continue to change, and the refiners must comply with the mandated octane ratings. FCC Catalysts and additives are

used to maximize quality target fuel production, such as gasoline or diesel, while minimizing undesirable cuts of hydrocarbons. They can increase the octane in gasoline production. They allow refineries to process heavier crude sources with higher levels of contaminants into clean fuels. This improves the refineries' profitability.

Contaminants such as nickel, vanadium, iron and other metals can deactivate the catalyst or alter the process reactions and thus reduce the conversion rate of



the longer length carbon chain in the feedstock to the more valuable short chain fuels. Albemarle's premier FCC catalyst designed to crack these heavier feeds, UPGRADER, helps reduce the negative effect of these contaminants. Albemarle's performance additives, BCMT-500 and BCMT-MD provide fast remedies for the unfavorable effect of iron contamination.

During the refining process, coke, a carbon-rich byproduct, deposits on the catalyst. To restore the catalyst activity, the coke must be burned off in a FCC regenerator. Combustion promoter additives allow better control of the regenerator temperature and reduce or eliminate afterburn. Afterburn creates high temperatures that may cause serious metallurgical damage to parts of the unit, causing unexpected shutdowns and significant losses due to downtime. Use of FCC additives such as KOC-15 and ELIMINOx can improve stability of operation by reducing or eliminating afterburn, as well as lower the rate of emission of harmful compounds from the regenerator such as CO and NOx.

FCC additives also help refineries meet increasingly stringent global environmental regulations on sulfur content in plant atmospheric emissions and product streams, such as gasoline. They are proven to significantly reduce



SOx emissions from FCC units. SOx is the main precursor in the formation of acid rain which is a serious global environmental concern. Refineries can also mitigate the formation of NOx emissions by using FCC additives such as ELIMINOx. Reducing NOx decreases air pollution and ground level ozone. Emissions from automobiles contribute to ozone production and air pollution or smog. By controlling sulfur in gasoline while maintaining octane and gasoline volume from the FCC, additives such as SCAVENGER and R-975 allow refiners to maximize the quantity of clean gasoline they can sell into their respective markets.

### Health Information

The FCC Catalysts have low toxicity. Minor effects from product dust may occur such as eye, skin and respiratory irritation. KDSOX, DuraSOx and SOxMASTER contain vanadyl sulfate. Repeated inhalation of vanadium

compounds can result in bronchitis and bronchopneumonia. Please consult the product Material Safety Data Sheet for recommended personal protective equipment and further information.

### Exposure Potential

The FCC Catalysts could contain components that may have exposures limits established by individual countries, including so called derived no effect levels (DNELs) for

human health and predicted no effect concentrations for the environment that are being derived under the European REACH regulation. These are listed on the product material safety data sheet. Workplace monitoring and surveillance of environmental releases must be conducted to ensure that workers and the environment are not overexposed to those components for which exposure limits have been established. Good industrial hygiene practices and normal industrial precautionary measures to prevent contact should minimize the health risk when handling these products. In addition to eye protection, workers should use protective gloves and protective clothing when skin contact or clothing contamination is possible. The use of a NIOSH approved respirator is also

recommended when dusty or irritating conditions exist. Please consult the product Material Safety Data Sheet for recommended personal protective equipment and further information.

### Environmental Information

Three of the FCC products, SCAVENGER, R-975 and SOxMASTER are toxic to aquatic organisms and must be labeled as Environmentally Hazardous Substances. These products can be handled properly in transportation, storage and use, preventing release to public waters such as lakes, streams, ponds and oceans.

### Physical Hazards

The FCC Catalysts are all stable materials under normal handling and storage conditions. Extremely high temperatures and dust formation should be avoided.



### Derivation/Manufacturing

Albemarle Corporation manufactures the FCC Catalysts at several locations; Bayport and Pasadena, TX as well as Amsterdam, Netherlands.

## Regulatory Information

Three of the FCC products, SCAVENGER, R-975 and SOxMASTER are regulated for transport purposes as Environmentally Hazardous Substances. SCAVENGER and R-975 are also Marine Pollutants. The rest of the FCC Catalysts are not



regulated for transportation purposes. The FCC Catalysts are in compliance with TSCA and some are also in compliance with other international countries' chemical inventories.

Three of the FCC Additives, KOC-15, SOxMASTER and SCAVENGER are classified under the Canadian Workplace Hazardous Material Information System (WHMIS) as Class D materials in Division 2B. All of the other products are not controlled under WHMIS.

The Emergency Planning and Community Right-to-Know Act (also known as SARA Title III or EPCRA) classifies the FCC Catalysts as being acute health hazards. The products KDSOX, DuraSOx and SOxMASTER are also listed as chronic hazards in addition to the acute health hazards.

Under the European "REACH" Regulation, Albemarle Catalysts BV, acting as EU manufacturer and/or

importer, has pre-registered all and registered the main components of the FCC catalysts. Albemarle is deeply involved in Industry activities to ensure timely registrations with deadlines depending on volume threshold put on the EU market and/or substance characteristics.

## Product Stewardship

Albemarle Corporation is committed to manage FCC Catalysts so that they can be safely used by our customers. Our relationships

with our customers encourage communication about safety and environmental stewardship, and we work with them to minimize the risks of personnel exposure and spills. Albemarle is organized and staffed with experts in toxicology, regulatory compliance, industrial hygiene, and emergency response to investigate and provide advice regarding appropriate corrective actions if such incidents occur.

## Conclusion

FCC Catalysts and Additives are the cornerstone of the modern petroleum refinery, providing high quantities of valuable fuels and petrochemical feedstocks, from a varying quality of feedstock. The FCC catalyst is the key element in converting these heavy feedstocks, containing contaminant metals, into clean gasoline, diesel fuel

oils and light olefins, such as propylene. Specific additives can also be employed to solve production problems in the FCC unit such as fluidization issues, afterburn and metal poisoning. Gasoline specifications are tight due to stringent global environmental regulations. FCC Catalysts and Additives help refineries maintain compliance with these regulations with sulfur reduction and higher octanes in gasoline. FCC Catalysts and Additives are also instrumental in reducing emissions of the environmentally hazardous substances NOx and SOx from FCC Units.

## Note

This document provides general information about FCC Catalysts and does not supplant or replace required regulatory and/or legal communication documents, nor is it intended to provide an in-depth discussion of health and safety information. Always consult the product's material safety data sheet, product label and technical data sheet before using the chemical.

## References

Fluid catalytic cracking. (n.d.). In Wikipedia. Retrieved July 30, 2010, from [http://en.wikipedia.org/wiki/Fluid\\_catalytic\\_cracking](http://en.wikipedia.org/wiki/Fluid_catalytic_cracking)

Nee, J., Harding, R., Yaluris, G., Cheng, W., Zhao, X., Dougan, T. and Riley, J. 2004. Fluid Catalytic Cracking (FCC), Catalysts and Additives. Kirk-Othmer Encyclopedia of Chemical Technology.

Albemarle PowerPoint Presentation – 2007 Albemarle Overview FCC Catalyst Technology Training Presentation

Albemarle PowerPoint Presentation – 2008 Maximum LCO with Albemarle superior FCC Catalysts

Albemarle Brochure – ACTION Catalysts that raise the octane value of FCC gasoline with minimal loss of volume, November 2006

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Albemarle Brochure – Boosting middle distillate production in FCC, November 2008

Albemarle Technical Data Sheet – OPAL Resid catalyst for low bottoms and low coke

Albemarle Technical Data Sheet – Want to increase the propylene production from your fluid catalytic cracking unit?, FCC-19-09

Albemarle Technical Data Sheet – UPGRADER Improve you FCC Unit residual feedstock processing

Albemarle Technical Data Sheet – SMOOTHFLOW The solution to FCC catalyst fluidization problems

Albemarle Technical Data Sheet – Total Olefins Management, Minimizing gasoline olefins

Albemarle Technical Data Sheet – BCMT-500 FCC additive for the treatment of iron poisoning

Albemarle Technical Data Sheet – KOC The flexible and effective way to lower afterburn in your FCC unit

Albemarle Corporation Americas MSDS  
Date: 12-Apr-2010, Product Name:  
FCC Catalyst: Access; Action; Advance;  
Amber, Aztec; Centurian; Cobra;  
Conquest; Coral; Eclipse, Emerald,  
Expander; Horizon, (Octa)Vision; Opal;  
Provantage, Ruby, Sapphire; Smoothflow;  
Upgrader; GO-ULTRA

Albemarle Corporation Americas MSDS  
Date: 12-Feb-2010, Product Name:  
SK-SCS; ADC; AFX-1F; AFX-8F

Albemarle Corporation Americas MSDS  
Date: 11-Aug-2010, Product Name: BCMT;  
BCMT 100; BCMT 100J; BCMT 500;  
BCMT MD

Albemarle Corporation Americas MSDS  
Date: 11-Aug-2010, Product Name:  
KOC-15; KOC-18

Albemarle Corporation Americas MSDS  
Date: 09-Jun-2010, Product Name:  
ISOBOOST; K-1000; K-2000; B.O.O.S.T.;  
Z.O.O.M.; Super B.O.O.S.T.; DuraZoom;  
ISOZOOM; ZOOM GPC

Albemarle Corporation Americas MSDS  
Date: 20-Jul-2010, Product Name:  
KDSOX; SOXDOWN, KDSOX-ZH; DURASox

Albemarle Corporation Americas MSDS  
Date: 04-Nov-2007, Product Name:  
SOxMASTER

Albemarle Corporation Americas MSDS  
Date: 12-Aug-2010, Product Name:  
R 975

Albemarle Corporation Americas MSDS  
Date: 11-Aug-2010, Product Name:  
ELIMINOx; ENT-84plus; EN-3; EN-4

Albemarle Catalysts Company bv MSDS  
Date: 19-Feb-2010, Product Name:  
FCC Catalyst: Access; Action; Advance;  
Amber, Aztec; Centurian; Cobra;  
Conquest; Coral; Eclipse, Emerald,  
Expander; Horizon, (Octa)Vision; Opal;  
Provantage, Ruby, Sapphire; Smoothflow;  
Upgrader; GO-ULTRA

Albemarle Catalysts Company bv MSDS  
Date: 27-Jul-2007, Product Name: Fluid  
Catalytic Cracking Additive – BCMT

Albemarle Catalysts Company bv MSDS  
Date: 01-Mar-2010, Product Name:  
KOC-15; KOC-18

Albemarle Catalysts Company bv MSDS  
Date: 17-Dec-2009, Product Name: ISOBOOST;  
K-1000; K-2000; B.O.O.S.T.; Z.O.O.M.; Super  
B.O.O.S.T.; DuraZoom; ISOZOOM

Albemarle Catalysts Company bv MSDS  
Date: 22-Oct-2009, Product Name: KDSOX;  
SOXDOWN; KDSOX-ZH; DURASox

Albemarle Catalysts Company bv MSDS  
Date: 09-Sep-2008, Product Name: Fluid  
Catalytic Cracking Additive – SOxMASTER

Albemarle Catalysts Company bv MSDS  
Date: 27-Sep-2007, Product Name: ELIMINOx

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## How to Contact Us

You can write us for additional information at:

Albemarle Corporation  
Responsible Care Coordinator  
451 Florida Street  
Baton Rouge, LA 70801-1765

Or e-mail us at: [HSE@albemarle.com](mailto:HSE@albemarle.com)



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