

# Solutions for fuel purification

## Highlights

- Choose from a broad range of liquid fuels, natural gas, petrochemical and refining purification solutions that step up to the high demands of industry and ensure compliance with market, environmental and government standards.
- Assure the highest quality, safety and performance while reducing processing costs.
- Apply Engelhard's patented adsorbent technology to reduce nitrogen (N<sub>2</sub>) and/or carbon dioxide (CO<sub>2</sub>) levels from 30 percent or more to the four percent (N<sub>2</sub>) or two percent (CO<sub>2</sub>) generally required by U.S. pipelines – at less cost, and with minimum operator attention.
- Employ the leading adsorbents for removing contaminants, including moisture and heavy hydrocarbons, from natural and industrial gases.
- Effectively remove contaminants from hydrocarbon distillates, organic solvents, waste oils, white finishing oils and waxes.
- Realize more economy from petroleum refining and enhance process productivity with cost-effective catalytic additives.
- Leverage Engelhard's recognized leadership in materials science and surface chemistry.

To meet pipeline specifications, natural gas requires the removal of heavy hydrocarbons and contaminants, including moisture, nitrogen and carbon dioxide. Eliminating or reducing these components is essential to ensuring the safety, performance and efficiency of the world's gas pipelines, as well as the quality and value of gas end products and by-products. However, compliance has been typically expensive and economical only for producers and processors with high production rates.

Engelhard fuel purification solutions reflect our company's long-standing distinction in helping natural gas and petroleum refiners, as well as a variety of specialty firms, meet and surpass tough environmental and government standards with solutions tailored to the specific needs of their industry.

## For natural gas and liquid fuel purification

**Engelhard Molecular Gate® adsorbents** offer a cost-effective option for natural gas purification. Comprised of two separate applications – **Nitrogen (N<sub>2</sub>) Rejection** and **Carbon Dioxide (CO<sub>2</sub>) Removal** – this patented technology delivers a number of benefits to gas producers:

- Purifies natural gas and coal bed methane gas by removing nitrogen and/or carbon dioxide from contaminated gas, making it suitable for use and transport in U.S. gas pipelines.
- Allows separation of gases that are close in molecular size by trapping the contaminant, a molecule smaller than methane – improving productivity and increasing yields.
- Encompasses a unique, patented and field-proven technology that helps reduce processing costs.
- Comes as a complete solution package – modular equipment plus adsorbent.

**ENGELHARD**

Change the nature of things.

The first commercial use of Engelhard Molecular Gate adsorption technology for removal of carbon dioxide and water from natural gas is enabling California-based Tidelands Oil Production Company to produce pipeline-quality natural gas. With Molecular Gate, Tidelands upgrades a water-saturated associated gas stream with 38 percent carbon dioxide (CO<sub>2</sub>) – achieving a water-free product with a CO<sub>2</sub> level of less than two percent.

- Reduces nitrogen and carbon dioxide levels from up to 30 percent or more – to less than the four percent nitrogen or two percent carbon dioxide generally required by U.S. pipelines.
- Economical at flow rates of one to 50 million standard cubic feet per day.

**Sorbead™ adsorbents** set the standard for isolating, separating and removing unwanted components – including water and heavy hydrocarbons – from natural gas. Sorbead adsorbents stay active longer and offer a broad spectrum of advantages:

- Proven track record with over 200 units worldwide using Sorbead in natural gas applications.
- Apply in situations that necessitate a very high degree of hydrocarbon separation, such as the protection of membranes during natural gas treatment.

- Remove hydrocarbons and/or water in situations where pressure drop must be low, loads can change rapidly, start-up must be quick and ease-of-operation is required. Applications can include underground storage, which stores gas in underground caverns during off-peak seasons and releases it for use during the winter.
- Treat gas according to a company's specific needs – at the wellhead, at central processing stations, at any point in the distribution system, or at the final destination.
- Offer a comprehensive range of adsorbent products:
  - **Sorbead R** is ideal for adsorption of large amounts of water vapor.
  - **Sorbead H** is the solution of choice for heavy hydrocarbon adsorption.
  - **Sorbead Plus** offers optimal water adsorption from sour gases.
  - **Sorbead WS** is a water-stable, high-moisture adsorption solution suitable for all applications.

**Microsorb®** is a high-purity, attapulgite-based mineral with excellent adsorptive properties. Used by the world's major refiners, the Microsorb line delivers important benefits:

- Provides a highly efficient, thermally activated granular solution for purifying, decolorizing and removing water from jet fuel, kerosene and other hydrocarbon streams.
- Comes in various physical forms and granule sizes to meet individual requirements.
- Improves JFTOT (Jet Fuel Thermal Oxidation Test) and WSIM (Water Solubility Index-Modified test) – sometimes referred to as MSEP (Microseparometer) – prior to introduction into pipelines or sale to end-use customers.

- Offers immediate product delivery in emergency situations, helping to prevent shut-downs and enabling producers to meet supply contracts.
- Assures high capacity, minimizing change outs and associated costs.
- Applies well to refining and petrochemical purification.

## For refining and petrochemical purification

For purification of aromatic streams such as BTX, benzene or cumene, Engelhard's **highly active, acid-activated adsorbents** offer the longest lifespan for removing olefins and nitrogen compounds – key to preventing unplanned shutdowns. Engelhard provides a portfolio for aromatics treatment solutions, including **F-24**, the industry standard, which enables companies to:

- Dictate moisture levels according to specific needs.
- Utilize well-proven activation technology to ensure the highest performance.
- Ensure superior water stability to withstand process disturbances.
- Accommodate a range of operational requirements: high pressure drop, high selectivity or maximum cycle length.
- Assure maximum value for products sold as feedstock for petrochemical, specialty chemicals and resins production.

For markets other than aromatics purification, Engelhard furnishes a variety of **acid-activated (and non-activated) clay-based purification solutions** for specialty chemical producers, including plastics, mining and aluminum companies. These products provide advantages in several ways:

- Decolorize and remove byproducts from aluminum rolling oils, used motor oils and copper refining solvents, for example.
- Enable color removal for many streams in petrochemical plants.
- Offer the ability to alter acidity, raw material and particle size when determining the correct product for an application.
- Conform well to special applications, and can be customized to suit very exacting requirements.

Engelhard's family of **alumina-based**

**solutions** includes aluminas with high capacity, tailored pore distribution and physical hardness to provide effective purification and catalysis with long life. Alumina-based technologies for fuel purification include:

- **Selexsorb® adsorbents** are highly effective in removing unwanted contaminants from fuel and petrochemical processing streams. **Selexsorb COS, CDX** and **CD** allow the removal of oxygenates, NH<sub>3</sub>, H<sub>2</sub>S, CS<sub>2</sub>, COS, mercaptans and other sulfur compounds and are widely used in both gas and liquid phase applications.
- **F-200 activated alumina** is effective in a wide variety of drying applications for both liquids and gases and for the removal of contaminants from petrochemical products.
- **Alumina-based Claus catalysts** enhanced activity in Claus reactors. **DD-431** and **S-400 activated aluminas** are high-surface area spheres with tailored pore size distribution to enhance Claus reaction activity through diffusion rates and surface activity.

Both are particularly well-suited for use in sulfur recovery processes operated near or below the sulfur dew point. **DD-931** is a high-surface area activated alumina promoted with titania to enhance activity for COS and CS<sub>2</sub> conversions. **SRC-99ti** is a high performance titania catalyst for improved conversion of sulfur compounds in the Claus process. Unlike standard alumina catalysts, DD-931 and SRC-99ti enable very high conversion of CS<sub>2</sub> and COS maintained over many years.

**Engelhard FCC additives** reflect our company's long leadership in developing ingenious petroleum refining technologies. Engelhard offers two distinct portfolio categories of fluid catalytic cracking (FCC) additives:

- **Performance-enhancing FCC additives** that enable refiners to realize improved product selectivity yields from their operations.
- **Environmental-compliance FCC additives** for various petroleum refining applications, including the reduction of NO<sub>x</sub> emissions and FCC flue gas SO<sub>x</sub> emissions enabling refiners to meet environmental regulations without sacrificing economics or refining operations.

## Engelhard: The name inside the solution

As a Fortune® 500 surface and materials science company and a world leader in developing technologies for environmental, process, appearance and performance applications, Engelhard offers an **integrated resource** companies can rely on to develop and customize products rapidly and cost-effectively. Our **global infrastructure** – supported by more than 6,500 employees in over 100 locations in 29 countries – enables us to serve our business customers with convenient, state-of-the-art manufacturing facilities, comprehensive technical support, superior distribution channels and an experienced and dedicated sales force. Engelhard

**research and development centers** – strategically located within the U.S., Asia and Europe – equip us especially well to address the very unique needs of businesses and industries around the world.

To find out more about Engelhard solutions for fuel purification, please go to [engelhard.com/fuelpurification](http://engelhard.com/fuelpurification).

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