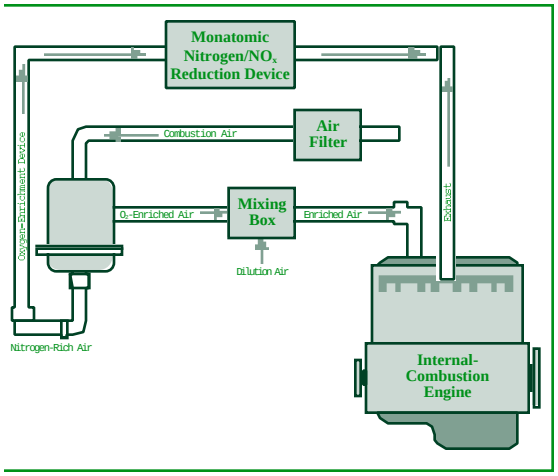
In-Cylinder Combustion

Researchers from Argonne and Compact Membrane Systems are developing a low-cost, permeable membrane that would separate ambient air into oxygen-rich and nitrogen-rich streams. The air-filter-sized membrane would provide an oxygen stream for the engine to improve combustion, while the nitrogen stream would be fed into the exhaust as a plasma to reduce NO_x emissions. Using the membrane in diesel engines, alternative-fueled vehicles, and gasoline engines would reduce emissions, increase power, and improve performance.

Argonne researchers are evaluating the use of nitrogen-enriched air as a viable alternative to the well-known exhaust gas recirculation (EGR) method of controlling NO_x formation.



Improving In-Cylinder Combustion

ARGONNE NATIONAL LABORATORY

Argonne National Laboratory is committed to research and development leading to high-quality, cost-effective products that meet the nation's goal of improving energy efficiency, reducing emissions, and manufacturing affordable, advanced-technology vehicles.

The Laboratory has forged partnerships with many firms in the energy and transportation sectors over the past two decades. Our location, right in the nation's heartland and industrial center, makes cooperative research accessible and cost-effective.

Argonne's innovative research in emissions control technologies is helping to provide solutions to the challenges of creating a new generation of vehicles. These programs are supported by the Department of Energy and U.S. industry.

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EMISSIONS CONTROL

Research and Technology

Reducing Emission

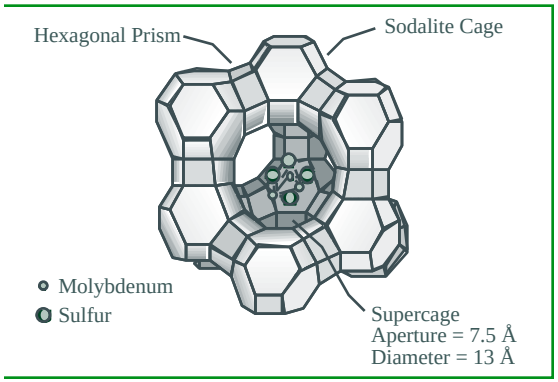
Working in Partnership with Industry

Improving Fuel Economy

Applying Sophisticated Manufacturing Technology

ARGONNE NATIONAL LABORATORY

Catalysts



Controlling Emissions with Catalysts

Argonne scientists have discovered an innovative method for creating diverse, novel materials for catalysts, which can be tailored for specific applications. The new catalysts remove far greater quantities of nitrogen oxides, unburned hydrocarbons, and other pollutants than do current catalysts.

Possible applications are diverse. For example, Argonne is synthesizing new catalysts that can be used in automobile catalytic converters for treating engine exhaust. Argonne scientists are also using the new catalysts to develop more efficient processes for producing motor fuels from natural gas.

And as part of the Low Emissions Partnership of the United States Council on Automotive Research (a consortium of the three major automobile manufacturers), Argonne is one of five national laboratories conducting cooperative research on catalysts for NO_x control in the exhaust gas from lean-burn gasoline engines.

Sensors

Inventing Cost-Effective Emissions Sensors

By combining advanced micromachining, computer-chip manufacturing technology, and state-of-the-art vacuum-system design, Argonne has invented a radically new and cost-effective emissions sensor. Based on a miniature mass spectrometer, the sensor has fast response (less than one millisecond), high dynamic range, and can simultaneously monitor a variety of emissions components and individual hydrocarbon species.

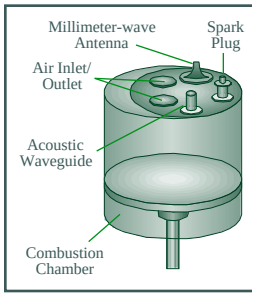
Argonne expects that the sensor will cost less than $100.

Advanced Sensors for Combustion Control

Through the innovative use of cyclic voltammetry, neural-network signal processing, and ceramic-metallic (or cermet) materials, Argonne has developed an innovative electrocatalytic gas microsensor. Sturdy and inexpensive, the microsensor operates at several hundred degrees Celsius and can identify a wide variety of gases and vapors at concentrations approaching 1 ppm.

In principle, the microsensor can measure the concentration of any gas species that reacts with oxygen in its sensing element. The sensor system could provide real-time emissions sensing and feedback for advanced combustion control.

Engine Combustion Diagnostic System



A high-performance engine-monitoring system is key to optimal performance and operation. Argonne's proposed engine-combustion diagnostic system consists of a millimeter-wave antenna for measuring temperature and chemical species and an acoustic waveguide for characterizing combustion noise and oil film. The diagnostic system could be used to obtain the real-time engine combustion data needed for evaluating engine performance.

Surface Acoustic Wave Sensor System

Argonne's real-time, on-line surface acoustic wave (SAW) sensor can be used to control automobile emissions. The instrument features real-time and on-line monitoring, the capability to detect multiple gases, computer control, easy operation, and low cost.