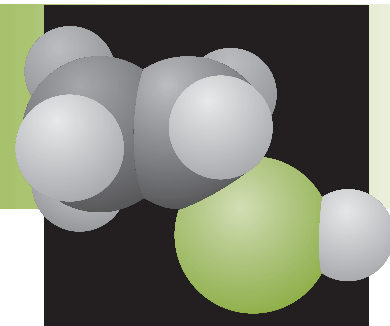


# CHEMICALS

## Project Fact Sheet



## ADVANCED SORBENTS AS A VERSATILE PLATFORM FOR GAS SEPARATION

### BENEFITS

- Energy savings of 4.2 trillion Btu per year from industrial use of low-cost gas
- Reduce the cost of producing industrial gases by 25 to 30 percent
- Lower net energy use by 2.0 trillion Btu per year in the aluminum industry
- Reduce the cost of argon purification
- Expand existing markets or open new markets for industrial-gas applications

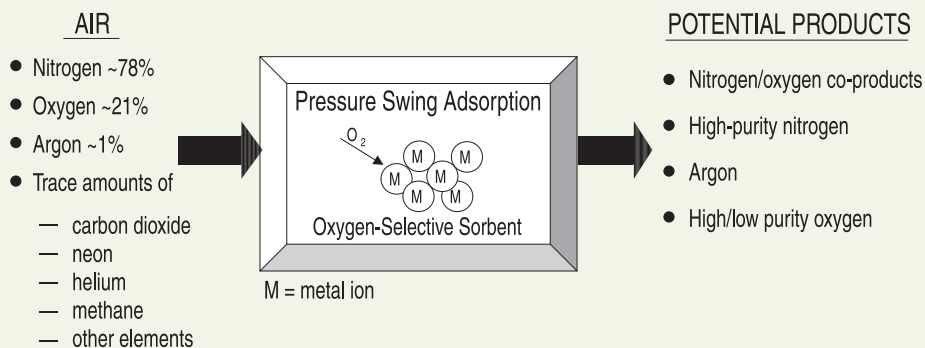
### APPLICATIONS

Low-cost oxygen and nitrogen are important for the aluminium industry which is a major consumer of these gases. The low cost of gases produced with the new technology will stimulate additional market penetration in the chemical, metals, and glass industries. There are also significant market opportunities for the use of low-cost oxygen instead of air in industrial furnaces, with enormous potential for reducing furnace energy consumption.

## COST-EFFECTIVE GAS PRODUCTION WILL SPUR NEW INDUSTRIAL APPLICATIONS

A new technology based on oxygen-selective sorbent materials and pressure swing adsorption (PSA) could cost-effectively produce industrial gases, such as oxygen and nitrogen. This technology requires less energy for gas separation compared to conventional techniques and provides high-purity gases at lower cost. Lower-cost gases are important for many industrial processes. For example, in the aluminum industry, high-purity nitrogen is used to prevent oxidation in annealing and other applications, and low-purity oxygen is used in combustion to reduce fuel consumption. The availability of inexpensive oxygen could also motivate furnace operators to use oxygen in place of air in their systems, thereby improving combustion efficiency and reducing emissions. With this technology, nitrogen, oxygen, and gas mixtures could be produced on-site by small plants in quantities of 20 to 200 tons per day in remote locations. This would allow the use of oxygen at many sites where it is currently not economical.

### PRESSURE SWING ADSORPTION



**Process using oxygen-selective sorbents produces important industrial gases at low cost.**



## Project Description

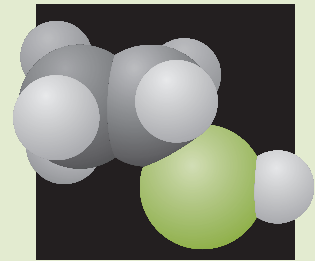
**Goal:** To develop a commercially viable oxygen-selective sorbent that is cost-effective for separating commercial gases using pressure swing adsorption processes.

Researchers will conduct five technical tasks: (1) Develop, characterize, and scale-up the oxygen-selective materials in powder form (sorbent); (2) convert powder sorbents to useful agglomerates of oxygen-selective materials; (3) assess hazards during preparation, use, and disposal of sorbent; (4) develop processes and systems for using the sorbent (e.g., material properties and component design); and (5) assess applications for sorbents.

Praxair will conduct materials development and testing, look at applications, and perform market analyses. Sigma-Aldrich will be responsible for sorbent production and cost analysis. The University of New Mexico will perform solid formation studies, and serve as a consultant on sol-gel agglomeration. Pennsylvania State University will serve as a consultant in powder compaction. Alcoa has expressed interest in the initial commercial demonstration of the technology. Future efforts will focus on applications that match the properties of oxygen-selective sorbents.

## Progress and Milestones

- An oxygen-selective material was shown to be economical for various gas separations of industrial significance.
- Development of stable transition element complexes (TECs or equilibrium-based, oxygen-selective materials) is mandatory to the success of this project and a primary goal.
- Reducing the cost of sorbent and providing economic incentives for its application is an on-going objective.



## PROJECT PARTNERS

Alcoa  
Pittsburgh, PA

Bend Research  
Bend, OR

Pennsylvania State University  
University Park, PA

Praxair  
Danbury, CT

Sigma-Aldrich, Inc.  
St. Louis, MO

University of New Mexico  
Albuquerque, NM

## FOR ADDITIONAL INFORMATION, PLEASE CONTACT:

Charles Russomanno  
Office of Industrial Technologies  
Phone: (202) 586-7543  
Fax: (202) 586-1658  
Charles.Russomanno@ee.doe.gov  
<http://www.oit.doe.gov/IOF/chemicals>

Please send any comments,  
questions, or suggestions to  
[webmaster.oit@ee.doe.gov](mailto:webmaster.oit@ee.doe.gov)

Visit our home page at  
[www.oit.doe.gov](http://www.oit.doe.gov)

Office of Industrial Technologies  
Energy Efficiency  
and Renewable Energy  
U.S. Department of Energy  
Washington, D.C. 20585



February 1999