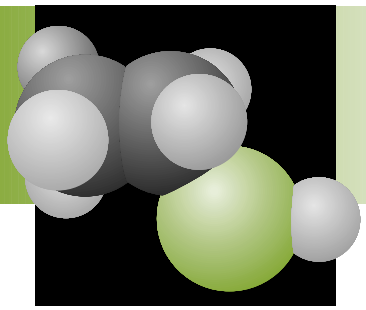
CHEMICALS

Project Fact Sheet



Solvent Vapor Recovery

Benefits

HFE-7100 resource recovery will cut environmentally harmful solvent emissions while saving energy and money.

For a typical plant using 2,880 gallons of HFE-7100 solvent per year, annual savings due to solvent recovery will amount to:

- 1.8 billion Btu of energy
- $432,000 in cost
- Elimination of 8 tons of fluorine released to the atmosphere

By 2010, commercialization of this technology nationwide could:

- Save $2 billion in costs per year
- Save about 1 trillion Btu per year in energy
- Cut greenhouse gas emissions by 70,600 tons per year

Applications

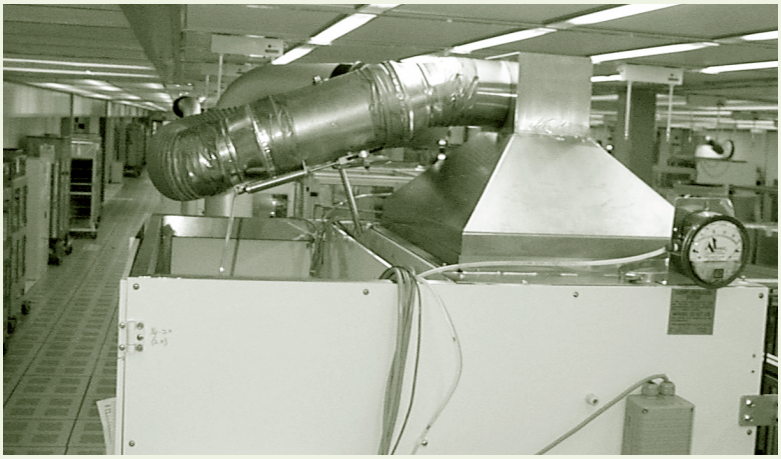
HFE-7100 solvent recovery technology is being tailored to reduce operating expenses and improve environmental quality for computer disk manufacturers and other users of specialty solvents. The technology is also suitable for solvent recovery in other industries, including semiconductor manufacturing and the aerospace industry.

New procedure lowers operating costs and greenhouse gas emissions for manufacturers using specialty solvents

In conjunction with the NICE^3 program, Alzeta Corporation is demonstrating a system that successfully addresses problems caused by specialty solvent vapors. The HFE-7100 recovery system captures potentially harmful hydrofluoroether vapors before they enter the atmosphere and turns them into a liquid that can be reused in the manufacturing process. This greatly reduces greenhouse gas emissions and the amount of costly solvent needed for production. Although Alzeta is developing this system for computer disk manufacturing, it can also be applied to other industrial applications where specialty solvents are used.

Alzeta has innovatively combined three proven technologies. It uses a zeolite absorbent to concentrate vapors, maintains proper vapor temperatures to avoid solvent decomposition, and condenses (liquefies) the vapors for reintroduction into the manufacturing process. Given current solvent use, this innovation could save California high tech manufacturers $10 million per year. By the year 2010, when Alzeta projects that it could have 450 units in place, this technology could save $2 billion nationwide, be responsible for national energy savings of just over 1 trillion Btu per year, and cut greenhouse gas emissions by 70,600 tons per year.

Solvent Vapor Recovery



Alzeta's recovery system dramatically reduces the amount of expensive specialty solvents required to manufacture computer disks and other materials by capturing for reuse significant amounts of solvents that would otherwise become greenhouse gas emissions.

OFFICE OF INDUSTRIAL TECHNOLOGIES
ENERGY EFFICIENCY AND RENEWABLE ENERGY • U.S. DEPARTMENT OF ENERGY

Project Description

Goal: The project goal is to deploy the Alzeta HFE-7100 solvent recovery system at a commercial site for a 6-month test to confirm the significant cost and energy savings and environmental benefits HFE recovery offers.

HFE-7100 is one of the new specialty chemicals manufactured by 3M to replace previously used solvents with higher environmental impact, particularly as global warming gases. The new solvent lowers the global warming potential of solvent vapors in the atmosphere primarily by reducing the atmospheric half-life of the molecule. It achieves this result through the unusual instability of the solvent molecule. Instability leads the molecule to break down in the atmosphere under the influence of the ultraviolet band in sunlight.

The technology used for recovering the HFE-7100 predecessor solvents involved adsorption on activated carbon beds and removal of the solvents from the beds with steam heat. When this technique was tried on HFE-7100, it was discovered that the steam caused the solvent to break down, producing hydrofluoric acid, which ruined the equipment used to recover the solvent. This weakness prevents current manufacturing systems from capturing HFE-7100 solvent vapors for reuse as liquid solvent. The inability to reuse the solvent translates into major financial costs for manufacturers. An average sized computer disk processing plant loses more than 2 billion Btu per year through vapor loss, the equivalent of more than $500,000 per year, when the energy required to manufacture the solvent is taken into consideration.

Alzeta has devised an HFE-7100 solvent recovery system using existing technology to eliminate the loss of 75% of the vapors by returning them to a liquid form for reuse. The system utilizes an effective zeolite adsorbent to strip solvent vapors from the exhaust air stream. A multistage concentration scheme, using zeolite beds and temperature-swing desorption, increases the vapor pressure and concentration to the point where it can be recondensed to a liquid state for reuse.

Alzeta Corporation is demonstrating this new technology with assistance from the California Energy Commission and the NICE^3 Program in the Department of Energy's Office of Industrial Technologies.

Progress and Milestones

- Verify adsorption and desorption of HFE-7100 in a lab-scale zeolite bed.
- Condense high-vapor concentration HFE, showing recovery of low-concentration vapor to useful, liquid form.
- Present a modified solvent loss reduction plan to IBM that includes a combination of low-cost, static-flow evaporation reduction and a zeolite recovery system.
- Acquire detailed HFE concentration loss data, such as time-resolved concentration-loss results, from IBM's disk-lube facility.
- Design and fabricate a vapor-reduction system for use at IBM. The system includes pneumatic valves that integrate with IBM's current controls, a modified air inlet plenum, a zeolite adsorption bed, and a maximum flow limiter.
- Deploy system to end-user.
- Prepare final report, including a commercialization readiness plan.

Industry of the Future—Chemicals

The chemicals industry is one of several energy- and waste-intensive industries that participate in OIT's Industries of the Future initiative. In December 1996, the chemicals industry published a report, ***Technology Vision 2020: The U.S. Chemical Industry****, that helps establish technical priorities for improving the industry's competitiveness and develops recommendations to strengthen cooperation among industry, government, and academia. It also provides direction for continuous improvement through step-change technology in new chemical science and engineering technology, supply chain management, information systems, and manufacturing and operations.*

OIT Chemicals Industry Team Leader: Paul Scheihing (202) 586-7234.

NICE^3—National Industrial Competitiveness through Energy, Environment, and Economics: An innovative, cost-sharing program to promote energy efficiency, clean production, and economic competitiveness in industry. This grant program provides funding to state and industry partners for the first commercial demonstration of energy efficient and clean production manufacturing and industrial technologies. Total project cost for a single award must be cost-shared at a minimum of 50% by a combination of state and industrial partner dollars. The DOE share for each award shall not exceed $500,000 to the industrial partner and up to $25,000 to the sponsoring state agency for a maximum of $525,000.

Project Partners

Alzeta Corporation
Santa Clara, CA

California Energy Commission
Sacramento, CA

NICE^3 Program
U.S. Department of Energy
Washington, DC

For project information, contact:

John Sullivan, Engineering VP
Alzeta Corporation
2343 Calle Del Mundo
Santa Clara, CA 95954
Phone: (408) 727-8282
Fax: (408)727-9740

For program information, contact:

Lisa Barnett
Program Manager, NICE^3 Program
U.S. Department of Energy
1000 Independence Ave., SW
Washington, DC 20585
Phone: (202) 586-2212
Fax: (202) 586-7114
lisa.barnett@ee.doe.gov

Visit our home page at
www.oit.doe.gov

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

DOE/GO-102000-0894
Order# NICE^{3}CH-9
January 2000