

Solid Scrubber for the Semiconductor Industry

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Environmental Problem

The rapid growth of the American microelectronics industry has spawned new environmental challenges associated with the processes used to prepare semiconductor chips, key components of many sophisticated electronic devices. Harmful chemicals including silane, phosphine, and arsine are used during semiconductor fabrication in a process called chemical vapor deposition (CVD).

Although most large companies have built facilities for handling these materials, smaller manufacturers have vented the gases into the atmosphere or used similarly unacceptable techniques. With increasing production, however, venting is no longer an option. The Emergency Planning and Community Right-to-Know Act designates silane, phosphine, and arsine as extremely hazardous chemicals used by the semiconductor industry; these chemicals also are regulated as toxic chemicals under the Clean Air Act.

SBIR Technology Solution

With support from EPA's SBIR Program, ATMI, Inc., developed an innovative solid scrubbing material

designed especially to reduce toxic air emissions from the semiconductor industry. With 30 times the capacity of activated carbon, the new material became the core of the Novapure Dry Scrubber System that was introduced into the market in 1991. The Novapure System has broad application in the electronics industry and in research and development institutions where small amounts of hazardous materials are routinely employed in CVD processes.

ATMI process scrubbers are smaller than traditional air pollution control equipment. Instead of a single large installation outside a fabrication plant, ATMI's abatement products are small enough to be located at each individual pollution source.

ATMI's scrubber system transforms these toxic gases into nonvolatile, benign solids through chemical adsorption. By neutralizing, solidifying, and concentrating hazardous effluent up to 20,000 times, this technology helps to eliminate toxic air emissions and minimize solid toxic wastes from small semiconductor manufacturers.

Commercialization Information

Since the award of this SBIR contract, ATMI has developed a family of novel vent gas scrubbers that are cost effective in reducing toxic air emissions from small quantity CVD processes as well as toxic air emissions released by semiconductor manufacturers. ATMI was granted four U.S. patents on its dry scrubber technology, and in just 3 years, the company's annual sales grew to nearly \$6 million.

To expand its environmental control equipment market, in 1994 and 1995 ATMI acquired the rights to alternative technologies, including wet scrubbing and combustion scrubbing. These acquisitions increased ATMI's annual revenues to nearly \$30



ATMI's Novapure Dry Scrubber System, designed to reduce toxic air emissions from the semiconductor industry, was introduced to the market in 1991.

million at that time. ATMI has since sold its Novapure Dry Scrubber technology to a division of Applied Materials, Inc.

ATMI is the largest supplier of point-of-use emission control equipment for the semiconductor industry in the world. This SBIR project led to the development of several new safety-related products for the semiconductor industry. One product, called the Safe Delivery Source[®], or SDS[®], that uses adsorbent materials similar to those of the dry scrubber system, eliminates the use of high-pressure toxic gases in the semiconductor industry. ATMI's SDS[®] Sub-Atmospheric Gas Delivery Systems represent the company's largest source of revenue.

Company History

In recognition of its outstanding achievements in technology innovation, ATMI received the Tibbetts Award in 1996. This award is presented by the U.S. Small Business Administration to companies associated with the SBIR Program that are models of excellence in the area of high technology. In 1997, the Danbury, Connecticut-based company was recognized as an Outstanding Small Business Enterprise by EPA. ATMI also was identified as one of America's 100 Fastest Growing Companies by *Individual Investor Magazine* in 2000, and ranked 63rd on Fortune's list of 100 Fastest Growing Companies. In 2002, ATMI was included in Business 2.0's list of Fastest Growing Companies, and made the Connecticut Technology Fast 50 List for the sixth time. Since 1987, when ATMI was awarded the EPA SBIR



Phase I contract, the company has grown from four employees working in a small garage in New Milford, Connecticut, to nearly 1,100 employees in numerous locations around the world. Revenues in

2001 were \$213 million. Originally called Advanced Technology Materials, Inc., the company changed its name to ATMI, Inc., in 1997.

SBIR Impact

- The rapid growth of the microelectronics industry has spawned new environmental challenges associated with the processes used to prepare semiconductor chips.
- This SBIR project led to the development of ATMI's Safe Delivery Source[®] (SDS[®]), which eliminates the use of high-pressure toxic gases in the semiconductor industry.
- ATMI's scrubber system transforms toxic gases into nonvolatile, benign solids through chemical adsorption.
- ATMI sold its successful Novapure Dry Scrubber technology to Applied Materials, Inc.