



A RESOURCE FOR WORLDWIDE ELECTRONICS CUSTOMERS OF AIR PRODUCTS AND CHEMICALS, INC.

electronics update

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KSG, San Fu win supplier, safety awards

Hynix Semiconductor, Inc., Icheon, Korea, presented its Best Supplier Award to Korea Specialty Gases Ltd. (KSG), part of the company's Korea Industrial Gases (KIG) subsidiary.

United Microelectronics Corporation (UMC) and ProMOS Technologies also honored San Fu Chemical, our Taiwanese joint venture, with all-important safety awards.

KSG was among only 14 suppliers who received the award at a ceremony on January 31 led by Hynix General Manager and Executive Vice President J.S. Choi. A total of 150 suppliers were reviewed. KSG is the No. 1 electronic specialty gases (ESG) supplier to Hynix and was the only ESG supplier among the finalists. In addition, KSG was ranked No. 1 ESG supplier to Hynix during the fourth quarter.

Hynix, which also has major facilities in Hong Kong, Shanghai, Singapore, Tokyo, the United States, the United Kingdom, and Germany, is the world's largest DRAM producer. The company's products also include SRAM, NAND flash and NAND-based MCP offerings.

UMC, the world's second largest semiconductor foundry, gave San Fu its "Excellent Safety Management" Award in recognition of San Fu's outstanding environmental, health and safety (EH&S) performance on UMC's Fab 12A Phase II expansion.

ProMOS Technologies' EH&S Committee honored San Fu for its work on the building of Fab III in the Central Taiwan Science Park at Tai Chung. ProMos is a leading advanced semiconductor memory solution provider in Taiwan, serving many of the "Fortune 500" semiconductor makers. ▲

CONTACT: Jae-Woon You: yujw1@airproducts.com

three new projects strengthen Air Products' expanding asia electronics infrastructure

Three significant new projects announced recently strengthen Air Products' commitment to the dynamic electronics industry in Asia. They include:

- An air separation unit (ASU) and liquefier at Samsung Electronics' newest and also the world's most advanced Thin Film Transistor-Liquid Crystal Display (TFT-LCD) Generation 7 (Gen-7) facility in Tangjung, Korea. To support this project, the company will also begin construction on a second ASU facility at the Tangjung site.
- Construction of an ultrahigh-purity (UHP) ammonia distillation plant in Ulsan, Korea to serve the market in Asia. The state-of-the-art plant and transfill station will be operated by Korea Industrial Gases, or (KIG), an Air Products subsidiary.
- The signing of a joint contract with Air Liquide with Beijing BOE Optoelectronics Technology Co. Ltd. (BOE OT) to supply bulk gases to its newest manufacturing facility in the Beijing Economic Technological Development Area (BDA). BOE is a leading TFT-LCD manufacturer both within and outside China.

The Samsung Electronics' Tangjung factory is the first facility of its kind, and the largest TFT-LCD manufacturing facility in the world. It requires large amounts of bulk gases and electronics gases, and will consume from five to eight times the amount of nitrogen that a typical semicon-



Air Products will build two more air separation units (ASUs) like this one at Tangjung, Korea to serve Samsung's expanding needs.

ductor fab consumes. The same factor applies to NF₃ requirements.

Air Products, being awarded the long term contracts earlier, is supplying the factory with nitrogen, oxygen, argon, NF₃, ammonia (NH₃), and silane (SiH₄) through its Bulk Specialty Gases System (BSGS). Future requirements for hydrogen and helium are also being accommodated.

"Samsung Electronics is our long-term customer and partner. We are honored to once again play a role in one of their progressive efforts. The successful commissioning of the Tangjung ASU and liquefier at its cutting-edge Gen-7 facility is a critical milestone and a key achievement for our global team," said Corning F. Painter, Air Products' regional vice president and general manager, Asia Electronics. "We look forward to our

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Pennsylvania grants will help finance Hometown expansion of global warming



Secretary Dennis Yablonsky of the Pennsylvania Department of Economic and Community Development and Rep. David G. Argall (R-Berks/Schuylkill), chairman of the House Appropriations Committee, recently awarded Air Products with a package of state grants that will be used to expand its Hometown, Pa. electronics specialty gases facility. Both officials visited Air Products' Hometown facility to present the grants.

Air Products is currently growing its nitrogen trifluoride (NF₃) production facility at Hometown, the world's largest electronics specialty gases complex. This latest investment will increase the facility's NF₃ capacity by 50 percent by the spring of 2005. The expansion is part of a multi-year investment strategy that will continue to position Air Products as one of the world's largest and most reliable providers of NF₃ and other electronics specialty gases, all of which are used in making semiconductors, flat panel displays, and other electronic devices.

The package consists of two grants totaling \$1.8 million earmarked for Air Products' Hometown plant. Hometown employs over 150 workers who are directly associated with the manufacture of NF₃. In total, over 5,500 of Air Products' 18,500 worldwide employees work within Pennsylvania. The package includes:

- An Opportunity Grant in the amount of \$600,000 issued through the Department of Community and Economic Development, and
- \$1.2 million awarded through the Redevelopment Assistance Capital Program.

"The Hometown expansion is an investment in our future," explained Art Katsaros, group vice president, Development and Technology. "Governor Edward G. Rendell, Secretary Yablonsky and Chairman Argall have been very supportive of our efforts there. They understand our Hometown success story—one that has local roots, but whose benefits are measured on a worldwide scale."

NF₃ is used as a chamber cleaning gas during the manufacture of a variety of electronics. When compared with competing products, NF₃ customers benefit from a significant reduction



Participants in the Pennsylvania grant awards ceremony at Hometown (from left to right) included State Senator Jim Rhodes, State Rep. David Argall, Schuylkill County Industrial Development Authority Chairman Michael Mahalchick, Air Products' Group Vice President Art Katsaros, and Pennsylvania Department of Economic and Community Development Secretary Dennis Yablonsky.

of global warming emissions, throughput increases of up to 30 percent, longer chamber life, and faster clean rates. NF₃ is also stable and non-flammable—making it a safer gas to transport, store, and deliver to the customers' process tools than alternative gases. ▲

CONTACT: Tom Yenko: yencho@airproducts.com

air products & chemicals

report from europe:



CONTACT: Carole Weston: westoncd@airproducts.com

Air Products Electronics Europe reports that our Electronic Chemicals facilities based in Milan, Italy have been awarded ISO 9000:2000 certification for the "manufacture and commercialization of laboratory reagents, fine chemicals and process chemicals, strippers, cleaners, and etchants for micro-electronics and associated industries." Milan has two separate facilities employing approximately 100 people. This conversion from

QS 9000:1994 standard to the ISO 9000:2000 was performed to ensure that the facilities will be able to meet the ongoing market requirements and expectations of our key customers.

During autumn, a team of four Air Products scientists from the company's Allentown and Easton, Pa., and Carlsbad, Calif., locations joined the Electronics Europe applications team to stage a series of one-day seminars at customer sites in Belgium, France, Italy, and Germany. The company began holding these in 2000 and they have expanded considerably.

The U.S. participants included Andy Johnson, who presented the company's roadmap for gas purity and also talked about chamber cleaning; Gene Karwacki, who covered advanced dielectric etching, low-k dielectric deposition, and cleaning of dielectric deposition chambers;

Rob Clark, who discussed high-k and metal deposition; and Jennifer Rieker, who unveiled advances in wafer cleaning.

Customer response was very positive. Electronics Europe is now planning the 2005 sessions.

Electronics Europe will again participate in Semicon Europa being held in Munich on April 12, 13, and 14 (Hall B1, Stand 462). This is the group's major annual exhibition and presents the opportunity to meet with existing and prospective customers. This year's focus is on innovation, both in the product portfolio and in Air Products' approach to customer partnerships. New delivery equipment will be featured at the show.

Electronics customers throughout Europe have responded favorably to the new high-purity trimethylalu-

minium (TMAI) offering. Akzo Nobel Polymer Chemicals and Air Products recently signed a long-term distribution contract to supply TMAI to customers in Europe, Asia, and North America. This arrangement enhances our electronic specialty materials (ESM) portfolio by adding another high-k dielectric precursor to our Schumacher branded product line. ▲



The Air Products' scientists visited customers in Belgium, France, Italy, and Germany.

two

Ermentrout addresses Lehman Bros. session

The expanding commitment of Air Products' Electronics Division to the global electronics industry was the focus of a presentation given by Vice President and General Manager Jerry Ermentrout at a recent Lehman Brothers Materials Select Conference in New York.

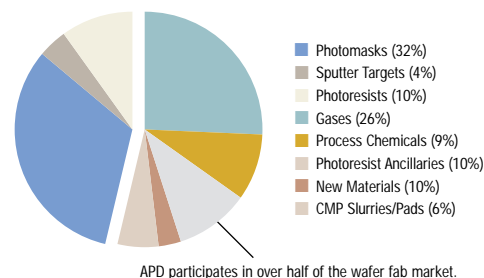
The company's electronics business comprises approximately \$1.3 billion in bulk gas, specialty material and equipment, including affiliates. Today, Air Products is a \$7.4 billion gases and specialty chemicals company serving diversified markets and geographies.

Ermentrout noted that 45 percent of the division's sales are in Asia and that number

is increasing. Specialty materials now make up more than half of sales and the division continues to experience double-digit average growth.

"Our global electronics vision remains constant—to be the premier material solution and service provider to the electronics industry globally," Ermentrout said. He pointed to three key areas of emphasis:

- Complete, integrated solutions for customers (on-site services and long-term relationships)
- Broad materials and applications capability (combination of unique gas and chemical skills)



APD participates in over half of the wafer fab market.

The global wafer fab materials market was US\$7 billion in 2002.

- New product development (Customer, OEM/process tool programs, and in-house R&D).

Advanced materials continue to drive the division's growth, he said.

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three new projects strengthen Air Products' electronics infrastructure (continued from page 1)

continuing long-term partnership with Samsung Electronics and will continue to meet their growing needs with our solid infrastructure and engineering capabilities."

The second ASU facility that Air Products will construct at Samsung Electronics' Tangjung site will supplement the current ASU and is tentatively slated for completion in late 2005. Additionally, Air Products has allocated space at the Tangjung site for a planned third ASU plant to be built at a later time for future factories.



Air Products' Nanke ESG facility in southern Taiwan near Tainan serves the South Science Park and the rest of Taiwan and China.

the new Ulsan facility

The new Ulsan UHP ammonia plant will complement the company's manufacture of UHP ammonia at its Morrisville and Hometown, Pennsylvania locations. This new third location—Air Products' first in Asia—is being built to meet growing customer demand, and will reinforce

Air Products' position as the leading UHP ammonia supplier to the global electronics industry. The company is also the largest supplier of UHP ammonia to the U.S. electronics market.

UHP ammonia is an electronic specialty gas integral to the TFT-LCD, integrated circuits, and light emitting diode (LED) markets. Each of these markets is evolving, driven by substantial growth in production facilities throughout Asia.

"This investment is just the next chapter in a growing worldwide electronics infrastructure—one that best serves our customers, no matter where they are in the world," explained KIG President Soo Yon Lee. "By investing in the world's newest ultrahigh-purity ammonia facility now, we're better positioned to meet the growing flat panel market and LED demands that we see happening in Asia."

Air Products will manufacture two lines of Ammonia at Ulsan: VLSI Ammonia (99.999% purity), which is already being used by the integrated circuit and TFT-LCD industries, and its White Ammonia™ (99.99999% purity) product, a key material in LEDs. Air Products' White Ammonia product offering is the electronics industry's most ultra-pure line of ammonia available on the market today. Its purity is critical in the production of LEDs, which are displacing conventional lighting alternatives based on their ability to operate at reduced power, at lower temperatures, and with extended lifetimes.

LED technology is rapidly being adopted in the global automotive industry and also in traffic signaling, signage, and LCD backlighting applications. TFT-LCDs are a key component in the manufacture of flat panel screens in computer monitors, cell phones, personal organizers, televisions, and other electronic devices.

The Ulsan plant is scheduled to be on-stream in the last quarter of calendar year 2005 (CY05).

BOE OT contract

Finally, Air Products and Air Liquide are forming a 50/50 joint venture to build and operate a new ASU in BDA. Slated to come on-stream in the second half of 2005, this facility will have the capacity to produce 12,000 cubic meters per hour of ultra-pure nitrogen for pipeline supply to BOE OT and approximately 430 tons per day of liquid oxygen, nitrogen, and argon for the merchant market. Furthermore, the joint venture will have the capacity and the right to supply bulk gases via pipeline to other customers in BDA.

The joint venture will invest about US\$30 million to build the ASU.

Air Products was one of the first foreign industrial gas companies to enter China with a joint venture in 1987 and today, has established a solid infrastructure in Northern, Southern, and Eastern China. The company recently announced an expansion to its existing ASU facility in Guangzhou, making it the largest single production facility of liquefied products in China and one of the largest that Air Products operates worldwide.

Air Products has a significant and growing presence in Asia with locations in nine Asian countries and over 4,400 employees. Its \$1.1 billion in Asian sales including affiliates represents nearly 15 percent of the company's total revenues. ▲

CONTACT: Corning Painter: paintecf@airproducts.com

"Electrochemical Generator for Sub-atmospheric Supply of Arsine to the Ion Implant Market,"

R. J. Mohr, J. R. Leenhouts, J. R. Phillips, W. M. Ayers, D. Tavianini, C. L. Hartz, and R. M. Machado, Proceedings of the 2004 Ion Implant Technology Conference, Taiwan, October 26, 2004.

"Atomic Layer Deposition Analysis of HfSiO4 by Mass Spectroscopy and XPS,"

M. S. Kim, S. A. Rogers, Y. S. Kim, J. H. Lee, and H. K. Kang, Korean Phys. Soc., 1317, 45(5), Nov. 2004.

"Reduction of PFC Emissions to the Environment Through Advances in CVD and Etch Processes,"

A. D. Johnson, R. G. Ridgeway, and P. J. Maroulis, IEEE Transcripts On Semiconductor Manufacturing, 491, 17(4), Nov. 2004 ▲

CONTACT: Jeanette Lang: langjp@airproducts.com

chamber clean R&D efforts lowering costs

Air Products is committed to helping our global electronic customers lower their cost of ownership and reduce environmental emissions during CVD chamber cleaning.

During the last few years, Air Products has undertaken a number of internal R&D initiatives as well as conducting chamber clean optimization projects at over 20 IDM and OEM customer sites in North America, Asia and Europe. We provide the most comprehensive process monitoring and optimization services to the electronics industry, according to the program's leading architects, Dr. Peter J. Maroulis, senior research associate, Dr. Andrew D. Johnson, lead research chemist, and Dr. Robert G. Ridgeway, research associate.

Maroulis said that Air Products has helped customers realize significant savings for both installed CVD chambers and newer chamber clean processes. "These savings result from using less NF₃ for chamber cleans, optimizing C₂F₆ recipes, switching from C₂F₆ to NF₃, substituting C₂F₆ for CF₄, evaluating other chemistries, or finding other methods to optimize processes."

Equally important, said Johnson, is supporting our customers efforts to reduce emissions of chamber cleaning gases having high global warming potentials. "We're very focused on process optimization strategies that both lower the cost of ownership and result in processes that are more environmentally friendly."

Today, chamber cleaning gases are a significant part of any fab's cost stack. Processing larger substrates (e.g., 300 mm, flat panels displays) will require even larger quantities of chamber clean gases. Air Products has the resources and capabilities to assist customers to optimize their chamber clean processes to reduce gas usage and emissions resulting in a lower cost of ownership. ▲

CONTACT: Peter J. Maroulis: maroulpj@apci.com

Wai Gao Qiao (WGQ) site receives award

Our Wai Gao Qiao (WGQ) site, which is located in the Shanghai WGQ Free Trade Zone in China, was awarded the prestigious "Model of Safe Operations/Production Award" by the Pudong New District Safety Supervision Bureau in December. Officials from the Safety Bureau visited the WGQ Technical Center to present the award and congratulated the team for its outstanding performance.

Criteria for the award included assessments in three categories (safety management practices, hazardous chemicals/toxic materials management, and overall site management), as well as achieving high scores on all quarterly inspections throughout the year.

The WGQ location, which is a Global Operations site, houses Air Products' Shanghai Electronic Operations Technical Center, electronic specialty materials warehouse, and an on-site plant that supplies nitrogen via pipeline to the industrial park. ▲

CONTACT: Roy Yang: yangr@airproducts.com

Ermentrout address Lehman Bros.

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"In the semiconductor market, square inches of silicon grew by about 20 percent in 2004. That's projected to slow to between 0 and 5 percent this year. However, for the display market, square meters of TFT-LCD capacity grew in excess of 30 percent last year. That growth rate is expected to slow somewhat, but remain above 30 percent in 2005. Obviously, that's why the Asian electronics industry is doing so well and why we're doing well in Asia," Ermentrout said. ▲

tell me more

www.airproducts.com/electronics

company information

Air Products is a Fortune 500 company with sales over \$5 billion annually and operations in 30 countries. As a leading supplier of industrial gases, chemicals, equipment, and services, our success has been the result of our operational excellence, our commitment to safety, and our customer relationships based on understanding, integrity, and passion.

news of interest:

mySAP's fifth phase rolls out on may 2

Air Products continues its implementation of mySAP Business Suite as its global information system. The start date for the fifth phase of the roll-out is May 2, 2005.

This phase will include our process chemical, ACT, CMP clean, parts cleaning, tool refurbishment, and Legacy tool service businesses.

We invite you to visit our SAP Internet site at www.airproducts.com/SAP to find up-to-date answers as to "What will change and when?" and "How are we communicating changes?"

Update web version gets high scores

The *Electronics Update* newsletter is e-mailed to approximately 1200 industry contacts.

We thought you'd like to know that the independent data programmer who handles the e-mailings reported a greater than 75 percent view rate for the Winter 2004 web issue. He reports that most consider a 30 to 40 percent view rate as good for a targeted mailing list.

"77 percent is awesome!" he said.

And that makes us feel good because our goal is to produce a newsletter that people want to read. By the way, if you'd like to be on our e-mail list for *Update*, or know of any colleagues who might like to be, please contact Ed McKendry at: mckendej@airproducts.com.

CONTACT: Ed McKendry: mckendej@airproducts.com


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Air Products and Chemicals, Inc.
7201 Hamilton Boulevard,
Allentown, Pennsylvania, U.S.A. 18195-1501
Tel 610-481-4911
www.airproducts.com/electronics

Air Products PLC, Electronics Group
Hersham Place: Molesey Road,
Walton-on-Thames, Surrey, England KT12 4RZ
Tel 44-0-1932-249959
Fax 44-0-1932-258063
E-mail euroelec@airproducts.com

Air Products Asia Inc. (Shirley Hsu)
21 Chung Shan North Road
Taipei 104, Taiwan
Tel 886-2-2521-5891
Fax 886-2-2567-4704

Air Products and Chemicals, Inc.
Attention: Ed McKendry
7201 Hamilton Boulevard
Allentown, Pennsylvania, U.S.A.
18195-1501

