

Air Products to Present Findings on Optimization of Remote NF₃ Plasma Processes for CVD Chamber Cleans at SEMICON® West

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Chemical vapor deposition (CVD) chambers can be cleaned using less nitrogen trifluoride (NF₃) by operating at higher argon/NF₃ ratios and lower pressures, according to advanced research conducted by an Air Products and Chemicals, Inc. (NYSE:APD) Electronics Division team led by Senior Principal Research Chemist Andrew D. Johnson, Ph.D.

Dr. Johnson will discuss the team's findings and benefits for semiconductor customers—including a lowered cost of ownership—during a presentation entitled, "Further Reductions in the Cost of Cleaning CVD Chambers: Optimization of Remote NF₃ Plasma Processes," at SEMICON West in San Francisco on July 16, 2001*. Optimization refers to identifying those processes that have lower gas usage, yet effectively clean the chamber in the same amount of time.

NF₃ is the process gas of choice for next generation CVD chamber cleaning due to its lowest cost per clean and environmental benefits. NF₃ essentially eliminates perfluorocarbon (PFC) emissions, enabling semiconductor manufacturers to achieve PFC reduction targets set by the World Semiconductor Council. In addition, remote NF₃ plasmas exhibit faster clean times and less chamber damage than traditional in situ PFC plasmas. These combined environmental and process benefits cannot be achieved with traditional fluorocarbon-based processes.

"Working with Samsung Electronics Co., Ltd. to optimize a remote clean process, we have learned that faster cleans are favored by higher NF₃ flow rates, higher argon/NF₃ ratios and lower pressures," said Dr. Johnson. "Processes were identified that reduce NF₃ usage by 23 percent with no impact on the clean time. Alternatively, the chamber can be cleaned 25 percent faster using the same amount of NF₃ as the baseline process," he added.

Air Products is the leading global supplier of NF₃, with production capacity at its Hometown, Pa. electronic specialty gases manufacturing facility and regional transfill capabilities in Amagasaki, Japan; Tainan, Taiwan; Shihwa, Korea; and Keumiee, Belgium. Beyond NF₃, the company also continues to lead the industry in the development, production and supply of other chamber cleaning and etching gases, including hexafluoroethane (C₂F₆), tetrafluoromethane (CF₄), chlorine trifluoride (ClF₃), sulfur hexafluoride (SF₆) and hexafluorobutadiene (C₄F₆).

"Our broad range of experience working closely with the leading tool and device manufacturers enables us to optimize cleans for clean times, cost of ownership and environmental compliance," noted Dr. Johnson. "For example, our understanding of the chemistries and customer processes enables us to optimize both C₂F₆-based in situ cleans for older tools, or improve efficiencies of NF₃-based remote cleans for new tools."

In addition to spending the last seven years working with semiconductor customers to enhance CVD chamber clean processes, Dr. Johnson has also studied and aided in the development of in situ and process effluent monitoring, trace gas analysis, gas purity requirements for semiconductor manufacturing and new technologies for the contamination-free delivery of process gases. He has patented three inventions and authored more than 25 technical publications.

Air Products and Chemicals, Inc. (www.airproducts.com) is the world's only combined gases and chemicals company. Founded more than 60 years ago, the business has annual revenues of \$5.5 billion and operations in 30 countries. Air Products is a market leader in the global electronics and chemical processing industries, and a longstanding innovator in many industrial markets, including coatings, adhesives and polyurethanes. The company distinguishes itself through its 17,500 employees around the world, who build lasting relationships with their customers and communities based on understanding, integrity and passion.

NOTE: This release may contain forward-looking statements. Actual results could vary materially, due to changes in current expectations.

*EDITOR'S NOTES:

Dr. Johnson will present the team's findings during the SEMI Technical Symposium (EHS Session 101) at the San Francisco Marriott Hotel at 9:35 a.m. on July 16th. Dr. Johnson's corporate biography and photo are available via Air Products' online Press Room at www.airproducts.com/pressroom. Click on "Biographies" and then on "Frequently Referenced Employees." Starting July 16th, an Air Products SEMICON® West 2001 virtual press kit will also be available at www.airproducts.com/pressroom.