

Silane Safety Seminar

SESHA Conference 2008

March 25, 2008 - Doubletree Hotel and Executive Meeting Center - Portland, OR

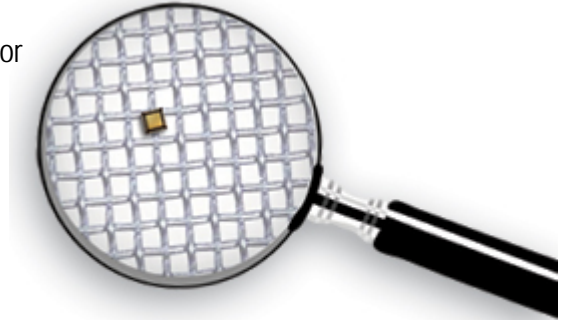
Focused on what matters most
SAFETY



Silane Safety Seminar

Focused on What Matters Most – Safety

Silane (silicon tetrahydride) is an electronic specialty gas that has widespread use in the semiconductor fabrication industry. It has been used in commercial quantities since the mid 1960's, when the first Integrated Circuit (IC) manufacturers began operations. In those early days, there was little information available on the safe handling of Silane or its behavior when released. Numerous incidents, involving fire and explosions, occurred during use, handling, transportation and manufacturing. Over the last 40 years, considerable studies have been conducted to better understand the properties of Silane.



**Focused on what
matters most.**

Safety standards have been developed based on these studies. These studies include CGA G-13 - 2006 Storage and Handling of Silane and Silane Mixtures, FM Global 7-7 – 2004 Semiconductor Fabrication Facilities and NFPA 318 – 2006 Standard for the Protection of Semiconductor Fabrication Facilities.

In the mid-1980's through the mid-1990's, a series of Silane technical and safety seminars were conducted in the United States and Europe. These seminars created the awareness of potential problems, and helped to drastically reduce the number of incidents and/or their potential severity.

Within the last ten years, LCD and PV manufacturers have expanded significantly. In 2008, these manufacturers will use more Silane than IC companies. Recently, significant incidents occurred with the use of Silane, highlighting the need to reinforce safe handling procedures.

Air Products launched and championed the Silane safety efforts in late 2005. Since a majority of the semiconductor industry is based in Asia, the first seminars were conducted in Taiwan (May 2006), Korea (Jan 2007) and Singapore (Dec 2007). These were a huge success, with over 1000 attendees.

Recognizing a similar need in the United States, Air Products is sponsoring this one day seminar, which brings together many acknowledged experts on Silane to reinforce standards and regulations.

Agenda – March 25th

8:00 – 8:30 Registration

Morning

8:30 – 8:45 **Welcome & Seminar Opening Remarks** - Bruce Hargus

8:45 – 9:30 **An Overview of Silane Safety & Incidents** – Eugene Ngai

9:30 – 10:15 **Silane Manufacturing and Filling** – Megan Kujawa, REC

10:15 - 10:30 Coffee Break

10:30 –11:15 **CGA Bulk Silane Release Testing & G-13** – Roger Smith, CGA

11:15 – 11:45 **FM Global Silane Testing & Standards (FM 7-7)** – Vinnie DeGorgio, FM Global

11:45 – 12:45 Lunch

Afternoon

12:45 – 13:30 **Design of Silane delivery and distribution equipment** - Cindy Hughes

13:30 – 14:15 **Silane Fire Protection & Risk Engineering** – Al Brown, Rushbrook Consultants

14:15 – 14:30 Coffee Break

14:30 – 15:15 **Silane Venting/Treatment Lessons Learned & Best Practices** – Jim VanOmmeren

15:15 – 16:00 **Silane Emergency Response** – Eugene Ngai

Abstracts

An Overview of Silane Incidents and Release Behavior

Eugene Y. Ngai, Director of ER & Disposal Technology, Air Products

Silane has been involved in a number of severe incidents over the last 40 years of use. This presentation will review key incidents and how Silane behaved in the incident. While Silane is pyrophoric gas with a wide flammable range, releases into the air may not always ignite immediately or sometimes not at all. Understanding this behavior can help improve safety in the design and operation of systems, as well as improve the response procedure in the event of an incident.

Silane Manufacturing and Filling

Megan Kujawa, Materials Engineer, REC Silicon

REC Silicon is the world's largest manufacturer and supplier of Silane gas. With over 20 years in the Silane business, REC Silicon has developed a strong technical expertise in the field of storing, handling, and shipping large volumes of Silane. This presentation will provide an overview of the many uses of Silane and will give insight into the process of manufacturing Silane on a large-scale basis. The viewpoint of a sizeable user and manufacturer of Silane will be considered in safe-handling discussions. Domestic and overseas transport will also be covered.

CGA Bulk Silane Release Testing & G-13

Roger Smith, Technical Director, Compressed Gas Association

The Compressed Gas Association developed CGA G-13 Storage and Handling of Silane and Silane Mixtures after a series of Silane release tests were conducted in Socorro, New Mexico in 1996. This presentation will briefly describe the initial theoretical work and the testing itself. A 5-minute video of the testing will be shown and an overview of the content of G-13 will be presented. CGA G-13 was first published in 2000 as CGA P-32 but never became an American National Standard (ANS). The second edition of the standard, published as G-13, was approved as an ANS in 2006. The development of G-13 as an ANS will be discussed, as will its adoption regionally and internationally. Work on the third edition, also to be an ANS, will be discussed

FM Global Silane Testing & Standards (FM 7-7)

Vinnie DeGorgio, Principal Engineer, FM Global

FM Global is worldwide property insurance company and leading insurer of semiconductor companies. It is recognized as a leader in the semiconductor industry for its loss prevention standards. In the mid-1990's, FM Global was contracted by Sematech, Inc to review the earlier Silane safety studies and to conduct additional studies (300+ releases) to better understand Silane release behavior in a gas cabinet. As a result of this effort, FM Global updated their semiconductor standard (FM 7-7) to include comprehensive guidance on Silane systems.

Abstracts (continued)

Design of Silane Delivery and Distribution Equipment

Cindy Hughes, Electronics Equipment Senior Engineer, Air Products

This presentation will focus on Silane delivery system design and recommended changes to historical basis due to changes in regulations made with the US NFPA, ICC IFC and the latest publications of ANSI/CGA G-13. Air Products has further strengthened its internal safety guidelines for Silane equipment. While the recommendation continues to be the use of open air systems, gas cabinets and exhausted enclosures can be used given new, updated exhaust requirements and other safeguards. Safety-related items in the design and operation of Silane delivery systems will be covered. Equipment types addressed will include gas cabinets, BSGS and VMBs, with application to the IC, PV and TFT-LCD markets.

Silane Fire Protection & Risk Engineering

Al Brown, Managing Director, Rushbrook Consultants

Although based on the same science and research, each of the main Silane standards and guidelines has a different objective, whether it be life safety, property protection, or preventing business interruption. Al Brown will review the objectives of the standards and will discuss some of the factors that have affected recent Silane projects including RFO sizing, ventilation and separation distances. Al will also look at some of the designs and practices still found in industry which remain a cause for concern.

Silane Venting / Treatment Lessons Learned and Best Practices (45 minutes)

James VanOmmeren, Process Safety Engineering Associate, Air Products

The use of Silane by electronics, photovoltaic and specialty glass customers requires delivery systems with the capability to safely vent or treat residual Silane. The hazards of venting and treating Silane gas will be presented. Each hazard will be illustrated by evaluating an actual venting incident and resulting lessons learned. Preferred venting solutions and best practices will be discussed, along with video presentations showing various types of venting system experiments and performance.

Biographies



Al Brown
Managing Director,
Rushbrook
Consultants.

Al Brown is a leading specialist in fire and risk engineering and assessment, with particular expertise in the semiconductor and TFT-LCD industries, including assessment of manufacturing equipment and processes as well as semiconductor gas and chemical facilities. Before founding Rushbrook Consultants in 1999 he spent 14 years with FM Global where he was the Staff Engineering Semiconductor Industry Specialist and contributor to the development of FM 7-7 including the section on protection of Bulk Silane systems. He is regularly involved the development of risk mitigation strategies, as well as the design of fire protection systems for semiconductor wafer and LCD fabs in Europe and SE Asia. Al is a registered professional engineer in the UK, and member of the Institution of Fire Engineers, Society of Fire Protection Engineers and Institution of Mechanical Engineers. He is a member of the NFPA 318 Technical Committee, Co-chair of SEMI Europe EHS Committee and co-leader of the Fire Protection and Risk Assessment Task Forces.



Vinnie DeGiorgio
Principal Engineer
FM Global Inc.

Vinnie DeGiorgio is the semiconductor Principal Engineer for FM Global and provides company-wide technical leadership. He has over 27 years of property loss control and business impact risk assessment experience associated with the semiconductor and related high technology industries. Vinnie is particularly knowledgeable of the Asian semiconductor industry as a result of numerous site visits to Asia. Vinnie has a BS Degree in Engineering and a MS Degree in Fire Protection Engineering. He maintains memberships in the NFPA, SFPE and SSHA. He is the secretary of the NFPA 318 Technical Committee on Cleanrooms and on the Board of Directors for SSHA.



Cynthia L. Hughes
Sr. Product Engineer
Air Products and Chemicals, Inc

Cindy graduated from Penn State University with a Bachelor's Degree in Mechanical Engineering. She has been employed with Air Products and Chemicals, Inc. for the past 9 years, working as a specialty gas systems designer, manufacturing engineer and product engineer. Currently, she is the Senior Product engineer responsible for the GASGUARD Product line of electronics specialty equipment. In that role, she has been managing the ventilation testing and design changes needed to meet the new US Silane requirements.



Megan Kujawa
Materials Engineer
REC Silicon

Megan Kujawa is a Materials Engineer for REC Silicon (formerly ASIMI), in Butte, MT. In this role, she has been instrumental in the design and fabrication of packages for silicon gasses filling, transportation, and discharge. She holds bachelor's degrees in Metallurgical Engineering and Welding Engineering from Montana Tech of the University of Montana. Megan is a Certified Welding Inspector (CWI) and serves as an adjunct welding and metallurgy professor for the University.

Biographies (continued)



Eugene Y. Ngai
Director of ER and Disposal
Technology,
Air Products and Chemicals, Inc.

Eugene has 35 years of Specialty Gas Experience in Production, Laboratory, R&D, Engineering, Safety positions. Was the Vice President of Technology for Solktronic Chemicals for 10 years prior to the Air Products acquisition in 1999 with responsibility for EHS, Engineering, Information Technology, Research and Development, and Quality. Most recently he was Director of CS Technology in the Electronics Division and is now Director of ER and Disposal Technology in the Product Safety Group. He started the Emergency Response Equipment and Training group in 1990. He is the Course Director for a 3 day Specialty Gas Emergency Response course, which has trained over 4000 customers, government agencies and employees and over 750 Firefighters in Compressed Gas Safety and Emergency Response. He has 4 US patents for Gas Safety Devices and 2 pending for new Purification Technology



Roger A. Smith
Technical Director
Compressed Gas Association

Roger Smith is the Technical Director for the Compressed Gas Association (CGA), which promotes the safe manufacture, transportation, storage, trans-filling, and disposal of industrial and medical gases and their containers, located in Chantilly, Virginia. Mr. Smith has 35 years experience in the industrial and medical gas industry with 25 years in operations. Industry experience includes the management of manufacturing facilities, both single and multiple site operations, and as Senior Vice President of Operations, directed of all activities related to manufacturing, engineering, regulatory affairs, quality assurance and research and development for 8 years at Matheson Gas Products.



James VanOmmeren
Process Safety
Engineering Associate,
Air Products and
Chemicals, Inc.

James VanOmmeren joined Air Products and Chemicals, Inc. in 1981 and has held various technical assignments within the corporation, including Development and Process Engineering. In 1993, he joined Process Safety Engineering supporting high purity hazardous materials and equipment for Electronics use. He is an Engineering Associate and is the Global Process Safety Lead for Air Products' Electronics Specialty Materials Division. Jim is responsible for Process Safety involving Electronics equipment manufacturing, gases and chemicals manufacturing, transportable containers, and operational services provided to customers. He specializes in various qualitative risk review and quantitative risk calculation methodologies, and provides safety training globally to employees, customers, local authorities, and emergency responders. Jim received his BScE from University of Delaware in 1981 and is currently a member of several CGA and CCPS subcommittees. He has authored several papers, given presentations at global symposiums, and holds eight patents dealing with gas and cryogenic processing.

For More Information

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