Anhydrous Hydrogen Bromide

Anhydrous hydrogen bromide is primarily used in two types of applications:

1) To etch poly-silicon wafers for the manufacture of computer chips that are part of electronic devices
2) As a "building block" chemical, meaning it is often reacted with other chemicals in highly-controlled industrial settings to make other chemicals.

Anhydrous hydrogen bromide is made using bromine (for more information see the Product Safety Assessment for bromine). Hydrogen bromide is a colorless gas that can be compressed to liquid form when pressurized. It fumes strongly in moist air, forming hydrobromic acid, which is corrosive to common metals. Anhydrous hydrogen bromide is toxic, irritating to the respiratory system when inhaled, and corrosive to the eyes, skin, and mucous membranes. Anhydrous hydrogen bromide is transported in sturdy cylinders to industrial customers or laboratories.

Identification

Anhydrous hydrogen bromide is identified by several names, all of them referring to the same chemical product. These names include:

- H-Br
- CAS Number [10035-10-6]
- Anhydrous hydrogen bromide
- Anhydrous HBr
- Hydrogen bromide (HBr)
- Hydrogen dibromide (H2Br2)
- Hydrogen monobromide
- Hydrobromic acid (in aqueous solutions)

Description

Production:

Anhydrous hydrogen bromide is made in dedicated manufacturing units. During production, hydrogen and bromine are combined and burned in specially designed furnaces. The anhydrous hydrogen gas generated is purified and packaged for shipment.

Uses:

Hydrogen bromide is commonly used in combination with other chemicals by the semi-conductor industry for plasma etching of polysilicon computer chips used in electronic devices. Anhydrous hydrogen bromide is also regularly used to manufacture agricultural, chemical, and pharmaceutical intermediates.

Properties:	Boiling Point:	-66.8 °C
	Melting Point:	-86 °C
	Water Solubility:	Freely soluble in water

Potential Human Health Effects

Health Effects:

Because anhydrous hydrogen bromide is a gas at ambient temperatures, inhalation is the most significant route of exposure. The effects noted following inhalation of anhydrous hydrogen bromide are coughing, wheezing and severe irritation of the nose, throat and respiratory tract. The chemical reaction that occurs when hydrogen bromide gas interacts with moist mucous membranes in the nose, throat and respiratory passages may cause serious injury or even death. No odor threshold has been established for anhydrous hydrogen bromide, but its characteristic odor has been consistently detected at levels that are lower than those which cause serious harm.

Anhydrous hydrogen bromide in its gaseous form is corrosive to eyes and skin. Contact of liquid anhydrous hydrogen bromide with eyes, skin or other tissues can cause frostbite and chemical burns, as the liquid vaporizes and reacts with moisture in those tissues.

Industrial Use:

Anhydrous hydrogen bromide is used to manufacture widely diverse products and is sold only for use in highly controlled manufacturing facilities by people trained in the hazards of chemical use. Anhydrous hydrogen bromide used in a manufacturing setting must be handled using best practice techniques developed to minimize any potential risk of exposure to liquids and vapors. Industry typically seeks to use engineered systems to minimize the potential for exposure to hazardous chemicals. Employees using anhydrous hydrogen bromide are highly trained and required to wear specialized protective clothing when working with hydrogen bromide as additional protection. Unplanned releases or spills of anhydrous hydrogen bromide can present an immediate danger to life and health. In any spill or release incident, all non-essential personnel are immediately evacuated upwind of the spilled material. All personnel involved with correcting the situation are trained and properly equipped with the required personal protective equipment.

Laboratory Use:

Because it is a building block chemical and its chemistry characteristics are well-understood, hydrogen bromide is regularly used in research laboratories in small quantities to develop new molecules. Similar to industry, scientists use engineered systems, chemical training and specialized protective clothing when working with hydrogen bromide.

Consumer Use:

It is very unlikely that consumers would be exposed to hydrogen bromide, because it is not sold directly to them.

Environmental Release:

Anhydrous hydrogen bromide is handled using highly-engineered systems designed to minimize any release to the environment. When hydrogen bromide is transferred from one vessel to another, there is the potential for a small amount of the material to be released to the environment. However, due to the visible vapor when it fumes in moist air and the sound it makes upon release, leaks during transfer are readily observed and can be quickly corrected.

Regulations typically mandate that hydrogen bromide quantities released to the environment in excess of specified threshold levels must be reported to the appropriate government agencies.

Liquid anhydrous hydrogen bromide vaporizes rapidly and will be absorbed quickly by moisture in the surrounding environment. Vaporization causes rapid cooling of any material that remains in contact with liquid hydrogen bromide. In contact with soil, anhydrous hydrogen bromide will form simple bromide salts with minerals that may be present. Because of the rapid diffusion of gaseous hydrogen bromide in air and its activity in soil, it is not considered to be bio-accumulative.

Physical Hazards

Hydrogen bromide is classified as a non-flammable gas and is shipped under the label "Hydrogen Bromide Anhydrous UN 1048" in cylinders as a liquefied gas. Hydrogen bromide can rapidly expand from a liquid to a gas, which will quickly cool equipment with which it comes into contact and can subsequently become cold enough to cause frostbite. Anhydrous hydrogen bromide will fume and become very corrosive in the presence of atmospheric moisture. In addition, hydrogen bromide readily dissolves in water to form hydrobromic acid.

Potential Environmental Impact

Environmental Fate Information:

Anhydrous hydrogen bromide in its gaseous form has greater density than air and tends to accumulate in low-lying areas when released into the environment. When hydrogen bromide contacts water (or moisture in the air or soil), it forms hydrobromic acid, which causes increased acidity. Liquid anhydrous hydrogen bromide vaporizes rapidly and will be absorbed quickly by moisture in the surrounding environment. Vaporization causes rapid cooling of equipment and materials that remain in contact with hydrogen bromide. In contact with soil, anhydrous hydrogen bromide will form simple bromide salts with minerals that may be present. Because of the rapid diffusion of gaseous hydrogen bromide in air and its activity in soil, hydrogen bromide is not considered to be bio-accumulative.

Toxicity:

Hydrobromic acid forms when anhydrous hydrogen bromide comes in contact with moisture. When this reaction occurs in the environment, acid deposition (or lowering of pH) is the

result. This reduction in pH of water or soil may have toxic effects on living organisms. The primary effect on aquatic organisms (e.g., fish, invertebrates, microorganisms, etc.) is an impaired ability to balance ions. The pH reduction may also cause aluminum and other metals to change forms and be mobilized at toxic levels. The particular toxic effects that are observed are determined by the amount of anhydrous hydrogen bromide released and sensitivity of the organisms to the substance and the acidity level.

Product Stewardship

Manufacturing locations:

Facility process safety management procedures, SDS, technical guidance documents and training are available to communicate safe handling, risk mitigation measures and emergency response information and requirements to employees.

Environment:

When hydrogen bromide is used as a chemical intermediate, it is destroyed during use. Systems that use hydrogen bromide control the potential for emissions using carbon adsorption systems, chemical scrubbers, recycle systems or other capture systems. If hydrogen bromide is released into the environment, the area should be evacuated, and hazardous materials professionals must be called to manage the situation and monitor the resulting hydrobromic acid residues that are expected to form.

Consumers:

Consumers are not usually exposed to hydrogen bromide, because LANXESS Solutions US Inc. does not directly sell to them. Hydrogen bromide is among the many hazardous materials that are commonly shipped to manufacturing locations. Consequently, there exists the potential for the general public to be exposed to hydrogen bromide during a transport accident. Because of the properties and hazards of hydrogen bromide, special sturdy containers are used to transport bromine worldwide. Additional precautions are taken throughout transport to ensure the vessel movements are well controlled and the risk to the public is minimized.

LANXESS Solutions US Inc. conducts an ongoing analysis of its products to evaluate potential risk areas throughout the product's life cycle. Chemical risks are identified at the very early stage of new products. They are evaluated by stage-gated reviews using environmental, health and safety (EHS) criteria. The analysis of existing products will evaluate raw materials, manufacturing, transportation, customer end-use and disposal.

Additionally, before changes in existing product formulations are made, a detailed evaluation is made of the proposed change. A critical component of all of these processes is the Safety Data Sheet, which lists detailed product hazard information.

Potential product risks that are identified are reviewed according to current controls. In the context of a continually improving risk-reduction program, periodic reviews of current controls occur in order to identify opportunities for improvements or enhancements. This includes adaption of existing procedures to changes in regulations (e.g., covering workplace and transportation).

Conclusion

Hydrogen bromide is a unique substance with a wide variety of uses in manufacturing. Though it is a hazardous material, it is only handled by highly trained people in manufacturing environments utilizing specialty equipment, safety controls, and personal protective equipment. There are only a few locations around the world where it is made and used.

Contact Information

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Notices

Use and Application Information