

CHEMICALS USED IN CHIP FABRICATION

This appendix lists chemicals commonly used in chip fabrication processes – it is not intended to be a comprehensive list of chemicals used by the semiconductor industry. A given semiconductor facility could use many other chemicals. For additional information on toxic gases, see the following sites:

<http://www.city.palo-alto.ca.us/fire/business/tgogasmatrix.pdf>

<http://www.unidocs.org/un-015.html>

Acetic Acid (CH_3COOH) Mildly corrosive liquid used in etching.

Acetone (CH_3COCH_3) Flammable liquid used for cleaning.

Aluminum (Al) A solid metal used to form the electrical interconnections between chip components. It is usually applied in a deposition process called metallization.

Ammonia (NH_3) Explosive, toxic gas used in vapor deposition and etching.

Ammonium Hydroxide (NH_4OH) Oxidant liquid used for developing.

Antimony (Sb) A toxic, highly reactive solid used in doping. Commonly used in the form antimony trioxide.

Antimony Trioxide (SbO_3) A toxic solid used as a dopant.

Arsenic Pentafluoride (AsF_5) Toxic, corrosive gas used in ion implanting.

Argon (Ar) Inert gas used to maintain purity in almost every chip fabrication process.

Arsenic (As) A solid, toxic carcinogen used in ion implanting as **Arsenic Pentafluoride**. It can also be combined with Gallium to make **Gallium Arsenide** semiconducting material.

Arsine (AsH_3) Flammable, toxic gas used in vapor deposition, epitaxy and doping.

Boron (B) A dopant that can be used in either solid or gaseous form. Commonly used Boron compounds include **Boron Nitride**, **Boron Trichloride**, **Boron Trifluoride**, **Boron Trioxide** and **Diborane**.

Boron Nitride (BN) A solid powder used in doping.

Boron Trichloride (BCl_3) Toxic, corrosive gas used in etching and doping.

Boron Trifluoride (BF_3) Toxic gas used in etching and doping.

Boron Trioxide (BO_3) A solid powder used in doping.

Butyl Acetate ($\text{CH}_3\text{COOCH}_2\text{CH}_2\text{CH}_2\text{CH}_2$) Flammable liquid used as a photoresist.

Carbon Dioxide (CO_2) Inert gas used in vapor deposition.

Carbon Monoxide (CO) Flammable, toxic gas used in epitaxy and metallization.

Carbon Tetrachloride (CCl_4) (Also called tetrachloromethane) Noncombustible liquid used in etching.

Chlorine (Cl) Toxic, corrosive gas used in etching.

Chlorine Trifluoride (ClF_3) An extremely reactive, flammable and corrosive gas used for cleaning various semiconductor tool components.

Chlorobenzene ($\text{C}_6\text{H}_5\text{Cl}$) Flammable liquid used as a photoresist.

Chromic Phosphoric Acid (CrPO_4) Noncombustible liquid used in stripping.

Copper (Cu) A solid metal used to form the electrical interconnections between chip components. It is usually applied in a deposition process called metallization.

Diborane (B_2H_6) Pyrophoric, toxic gas used in vapor deposition and epitaxy.

Dichlorosilane (SiH_2Cl_2) Flammable, corrosive gas used in vapor deposition and epitaxy.

Dimethylbenzene – See **Xylene**.

Dimethylzinc [$(\text{CH}_3)_2\text{Zn}$] Flammable, toxic gas used in vapor deposition.

Disilane (SiH_6) Flammable gas used in vapor deposition.

Ethanol – See **Ethyl Alcohol**.

Ethyl Alcohol ($\text{C}_2\text{H}_5\text{OH}$) (Also called ethanol) Flammable liquid used as a photoresist.

Ethylbenzene ($\text{C}_6\text{H}_5\text{C}_2\text{H}_5$) Flammable liquid used as a photoresist.

Ethyl Lactate ($\text{CH}_3\text{CH}_2\text{OCOOC}_2\text{H}_5$) Flammable liquid used as a photoresist.

Ethylene Glycol Monomethyl Ether ($\text{CH}_3\text{OCH}_2\text{CH}_2\text{OH}$) Combustible liquid used as a photoresist.

Formaldehyde (HCHO) Combustible liquid used in plating.

Gallium (Ga) A solid metal used in doping, often in the form **Trimethyl Gallium**. It can also be combined with Arsenic to make **Gallium Arsenide** semiconducting material.

Gallium Arsenide (GaAs) A semiconducting material sometimes used instead of **Silicon**.

Germane (GeH_4) Flammable, toxic gas used in vapor deposition and epitaxy.

Germanium (Ge) A solid semiconducting material. Also combined with hydrogen to make **Germane**.

Helium (He) Inert gas used for purging tools and flushing chemical distribution piping.

Hexamethyldisilazane [$(\text{CH}_3)_3\text{SiNHSi}(\text{CH}_3)_3$] Flammable liquid used to improve adhesion of photoresist to the wafer.

Hydrochloric Acid (HCl) Corrosive liquid used in etching.

Hydrofluoric Acid (HF) Corrosive liquid used in etching.

Hydrogen (H_2) Flammable gas used in most chip fabrication processes. Combined with **Silicon**, **Germanium** and other solids to make process gases like **Silane** and **Germane**.

Hydrogen Chloride (HCl) Toxic, corrosive gas used in oxidation and etching.

Hydrogen Peroxide (H_2O_2) Oxidant liquid used in stripping.

Hydrogen Selenide (H_2Se) Flammable, toxic gas used in ion implanting.

Hydrogen Sulfide (H_2S) Toxic gas used in vapor deposition.

Indium (In) Solid used in doping. Commonly used in the form **Trimethyl Indium**.

Isopropanol – See **Isopropyl Alcohol**.

Isopropyl Alcohol [$(\text{CH}_3)_2\text{CH}_2\text{O}$] (Also called isopropanol) Flammable liquid used for cleaning.

Magnesium (Mg) Combustible metal used as a target in ion implanting.

Methanol – See **Methyl Alcohol**.

Methyl Alcohol (CH_3OH) (Also called methanol) Flammable liquid used for removing marker inks and in plating.

Methyl Benzene – See **Toluene**.

Methyl Chloroform – See **Trichloroethane**.

Methyl Ethyl Ketone ($\text{CH}_3\text{COCH}_2\text{CH}_3$) Flammable liquid used in developing.

Methyl Isobutyl Ketone [$(\text{CH}_3)_2\text{CHCH}_2\text{COCH}_3$] Flammable liquid used for cleaning.

n-Methyl Pyrrolidone ($\text{CH}_3\text{NCH}_2\text{CH}_2\text{CH}_2\text{CO}$) (Also called m-Pyrol, a trademark name) Combustible liquid used for cleaning.

M-Pyrol – See **n-Methyl Pyrrolidone**.

Nitrogen (N_2) Inert gas used in oxidation, epitaxy and doping.

Nitrogen Trifluoride (NF_3) Toxic gas used in etching.

Nitrous Oxide (N_2O) Explosive gas used in vapor deposition.

Oxygen (O_2) Oxidant gas used in oxidation, diffusion, vapor deposition and etching.

Phosgene (COCl_2) Flammable, toxic gas used in epitaxy, doping and vapor deposition.

Phenol ($\text{C}_6\text{H}_5\text{OH}$) Combustible liquid used in stripping.

Phosphine (PH_3) Pyrophoric, toxic gas used in epitaxy, doping and vapor deposition.

Phosphoric Acid (H_3PO_4) Corrosive liquid used in etching.

Phosphorous Pentafluoride (PF_5) Toxic, corrosive gas used in ion implanting.

Potassium Hydroxide (KOH) Oxidant liquid used in developing.

Propanol – See **Propyl Alcohol**.

Propyl Alcohol ($\text{CH}_3\text{CH}_2\text{CH}_2\text{OH}$) (Also called propanol) Flammable liquid used for cleaning.

Propylene Glycol ($\text{CH}_3\text{CHOHCH}_2\text{OH}$) Combustible liquid used as a photoresist.

Propylene Glycol Monomethyl Ether Acetate ($\text{CH}_3\text{CHOHCH}_2\text{OH}$) Combustible liquid used as a photoresist.

Silicon (Si) The most common semiconductor chip base material. Grown as elemental crystals for slicing into wafers. Also combined with other elements to make process gases such as **Dichlorosilane**, **Hexamethyldisilazane**, **Silicon Tetrachloride** and **Silicon Tetrafluoride**.

Silicon Tetrachloride (SiCl_4) Pyrophoric gas used in vapor deposition, epitaxy and etching.

Silicon Tetrafluoride (SiF_4) Toxic, corrosive gas used in ion implanting and etching.

Sodium Hydroxide (NaOH) Oxidant liquid used in developing.

Sulfur Hexafluoride (SF_6) Inert gas used in etching.

Sulfuric Acid (H_2SO_4) Corrosive liquid used in etching.

Tellurium (Te) Solid metal used in doping, often in gaseous form as **Tellurium Hexafluoride**.

Tellurium Hexafluoride (TeF_6) Toxic gas used in doping.

Tetraethylorthosilicate [$(\text{C}_2\text{H}_5)_4\text{SiO}_4$] Combustible liquid used in vapor deposition.

Tetrachloromethane – See **Carbon Tetrachloride**.

Tetramethylammonium Hydroxide [$(\text{CH}_3)_4\text{NOH}$] Strongly basic liquid used in developing.

Titanium (Ti) Combustible metal used as a target in ion implanting.

Toluene ($\text{C}_6\text{H}_5\text{CH}_3$) (Also called methyl benzene) Flammable liquid used as a photoresist.

Trichlorobenzene ($\text{C}_6\text{H}_3\text{Cl}_3$) Combustible liquid used as a photoresist.

Trichloroethylene (CHClCCl_2) Combustible liquid used for cleaning wafers.

Trichloroethane (CH_3CCl_3) (Also called methyl chloroform) Combustible liquid used for cleaning wafers.

Trimethyl Aluminum [(CH₃)₃Al] Toxic, pyrophoric liquid sometimes used to carry **Aluminum** for metallization processes.

Trimethyl Gallium [(CH₃)₃Ga] Toxic, pyrophoric liquid used to carry **Gallium** for doping processes.

Trimethyl Indium [(CH₃)₃In] Toxic, pyrophoric liquid used to carry **Indium** for doping processes.

Tungsten Hexafluoride (WF₆) Corrosive gas used in vapor deposition.

Xenon (Xe) Inert gas used in etching.

Xylene [C₆H₄(CH₃)₂] (Also called dimethylbenzene) Flammable liquid used as a photoresist.