

# Chemicals-1 ~Gas Products~

High-purity Gases/Solvents for Electronics

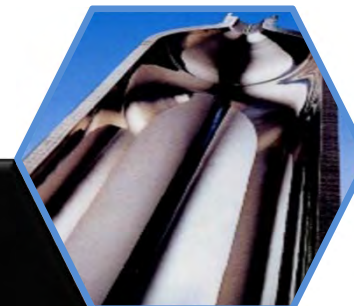
SOLFINE™



Fluorine Chemicals

Gases for Electronics

Purification



Electrolysis

Electrolysis

Surface Treatment

Chlorine Hydrogen

High Corrosion Resistant Plating

Clean-S™

Industrial Gases

Specialty Gas Chemicals

Inorganic Materials Design



ECOANN™

Plastic Recycling

High-Temperature Heat Treatment



Mixing/Dispersion

Abatement System for Specialty gases

Supercritical Carbon Dioxide

SHOWA DENKO  
GAS PRODUCTS CO., LTD.

# High-purity gases/chemicals for electronics

## ~ for semiconductors ~



昭和電工株式会社

### Example products

High-purity gases / chemicals are used in the electronic industry for semiconductor manufacturing processes and FPD production processes.



### Our technologies

Using purification technologies of “distillation, extraction, and filtration,” high-purity gases for semiconductors are manufactured.

To ensure the quality of the products, we own technologies including the following:

- Technology to treat and clean the inside of containers
- Sensitive analysis technology (LC, GC, ICP-MS)
- Plant construction and mass production technology



Plant to fill high-purity solvents

Sensitive analysis instrument(ICP-MS)



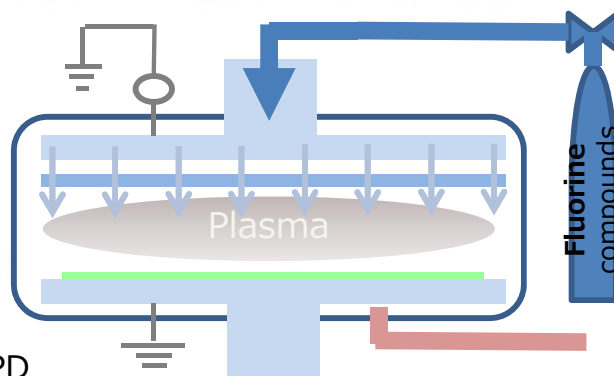
## Example products

Fluorine compounds are decomposed in plasma and react with materials such as silicon to form vapor materials.

Taking advantage of such characteristics, fluorine chemicals are used for dry etching in semiconductor manufacturing process and dry cleaning of the chambers.

Silicon Semiconductor			
C <sub>2</sub> F <sub>6</sub>	C <sub>4</sub> F <sub>6</sub>	F <sub>2</sub>	HBr
CH <sub>3</sub> F	C <sub>3</sub> F <sub>8</sub>	HF	CH <sub>2</sub> F <sub>2</sub>
HCl	NF <sub>3</sub>	C <sub>4</sub> F <sub>8</sub>	CHF <sub>3</sub>
NH <sub>3</sub>	BCl <sub>3</sub>	CF <sub>4</sub>	Cl <sub>2</sub>
N <sub>2</sub> O	SF <sub>6</sub>	SiF <sub>4</sub>	H <sub>2</sub> Se

**Display, Optoelectronics**



Semiconductor/FPD manufacturing instrument

## Our technologies

Fluorine is an atom that can easily combine with any element. Utilizing such characteristics of fluorine, our fluorine technologies are applied to various products.

We own technologies including the following:

- Fluorine synthesis technology ( $2\text{HF} \rightarrow \text{F}_2 + \text{H}_2$ )
- Fluorine compound synthesis technology (gas phase)
- Fluorine compound synthesis technology (liquid phase)
- Sensitive analysis technologies (LC, GC, ICP-MS)
- Plant construction and mass production technology

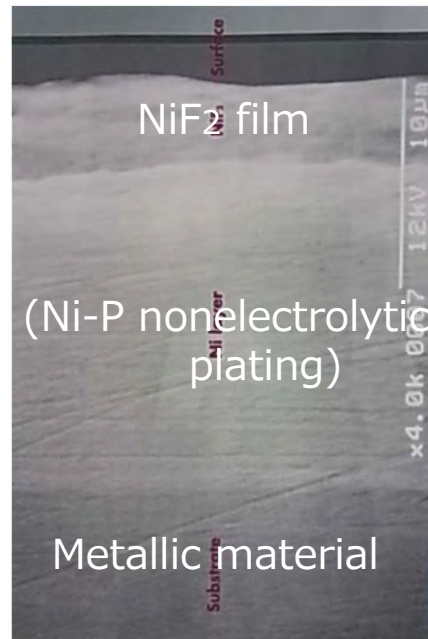
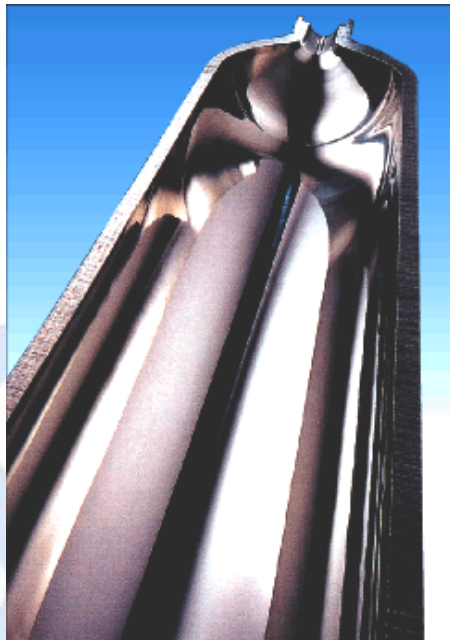


Plant for synthesizing fluorine compounds

## Example products

We undertake the treatment of metal surfaces to prevent corrosion, such as cylinders, pipes, and valves.

Such treatment is used for various applications, such as semiconductor manufacturing equipment components, vacuum pumps (molecular pumps, dry pumps), and plastic injection molding machines.

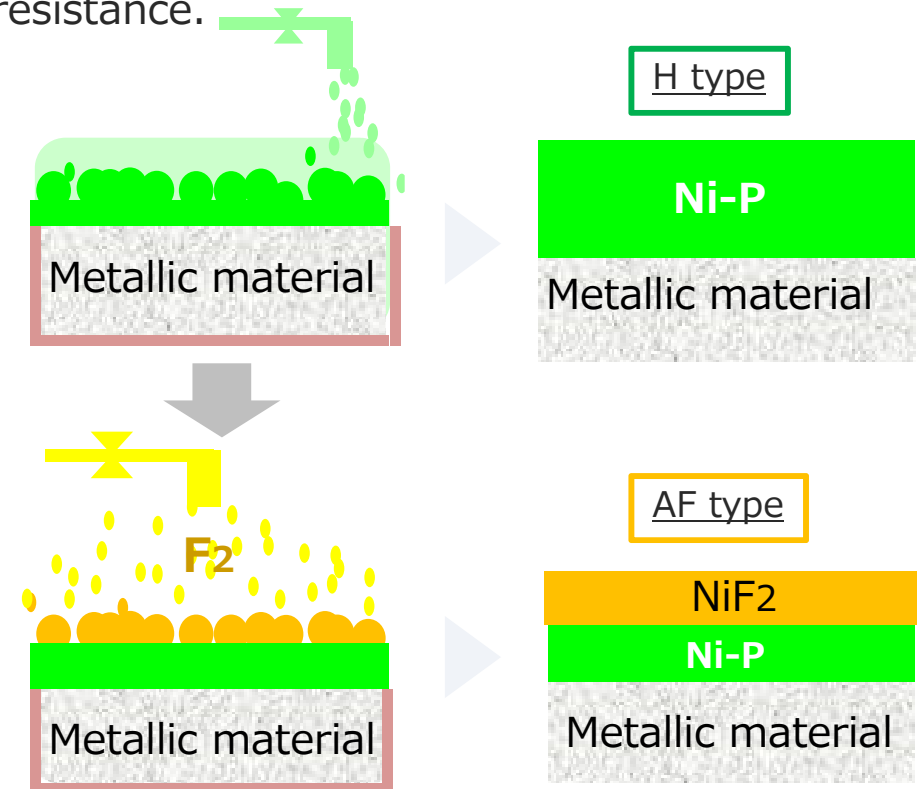


## Our technologies

### ■ Surface treatment technology

We own the technology to improve corrosion resistance performance by forming nickel alloy films on SUS and aluminum using an electroless plating process.

We have also developed our own passive state treatment technology to form NiF<sub>2</sub> films through the reaction of fluorine gas, thus achieving high corrosion and abrasion resistance.



## Product Example

The use of supercritical CO<sub>2</sub> enables processes that conventionally needed organic solvents as well as processes not possible with organic solvents.

## Supercritical CO<sub>2</sub> painting system



Supercritical painting device (Painting pump unit, CO<sub>2</sub> unit)

## SHOWA DENKO GAS PRODUCTS CO., LTD.

### Our technologies

#### ■ Supercritical CO<sub>2</sub> application technology

### Features of supercritical CO<sub>2</sub>

- (1) Dissolves organic substances well.
- (2) Can be dissolved well in resins to reduce their viscosity.
- (3) Can be discharged as a gas when the pressure is reduced to atmospheric pressure.



23°C·6MPa    Raising temperature/pressure → 31°C·7.4MPa

### Applications of supercritical CO<sub>2</sub>

- (1) Cleaning/drying: Precision removal of even infinitesimal amounts of ingredients
- (2) Dyeing/impregnation: Transferring effective ingredients to nano-sized spaces
- (3) Painting: Alternative to a dilution solvent
- (4) Creating a fine powder: Using the bubbling and cooling effects when sprayed
- (5) Macromolecular polymerization: Reaction field with no residual solvent