Cleaning

Contamination at the molecular level can affect product performance and quality. Consequently, with microfabrication of semiconductors at the micron and nano level, cleaning can comprise up to a third of the overall production process.
Removing invisible contaminants with invisible light:
This is a cleaning process that is possible thanks to Ushio's optical technology.

Semiconductor manufacture: A "battle with contamination"

Did you ever wonder why semiconductors and liquid crystal are made in cleanrooms? The answer is that the microscopic particles shed not only by people and manufacturing materials, but by seemingly innocuous items such as notepads and pencils, interfere at the molecular level with the manufacture of liquid crystal and semiconductors, resulting in defective products.

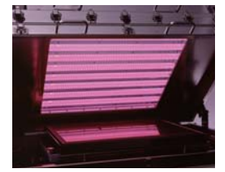
For that reason, the process used for cleaning devices to remove particles and organic matter that accrete during semiconductor or liquid crystal manufacturing is one of great importance. However, wet cleaning with water or solvents cannot remove all organic matter at the molecular level, and cleaning by atmospheric-plasma jet entails risk of electrically damaging products. This is where Ushio's method of using ultraviolet for "cleaning by light" enters the equation.

PHOTOLEX UV cleaning system
Developed in 1983 as the world's first optical cleaning system. At the time, it used a low-pressure UV lamp.

Cleaning by light?!

With light, energy capable of inducing chemical change increases in proportion to the shortness of the wavelength of light. This energy has the ability to disrupt the bonds between molecules. It follows that VUV (vacuum ultraviolet), which has a wavelength even shorter than UV (ultraviolet) should be able to neutralize and remove organic contaminants by breaking them down into harmless CO_2 and H_2O. This is the idea behind optical cleaning. This method makes it possible to clean substrates without the possible effects of using water or solvents. Furthermore, since ultraviolet light carries no heat, it can be used without fear of harming heat-sensitive films or glass.

In 1993, Ushio created an excimer lamp (a dielectric barrier discharge excimer lamp) that became the world's first commercial VUV lamp. Efficiently producing energy with a wavelength of 172 nm, it was the first lamp capable of producing high speed photochemical reactions, Today, it not only supports the quality and performance of many leading semiconductor and liquid crystal production lines, but finds use in medicine and environmental applications.



Excimer VUV cleaning system
Introduced in 1994, the year following development of the excimer lamp. Made it possible to clean 10 times faster than with low-pressure UV lamps at a low temperature and consuming 1/3 the power. Now made in lengths of up to 3 meters.

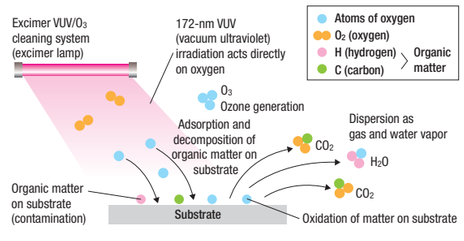
* Excimer lamps are also used in the following applications.
Curing and Bonding (see page 26)
Healing with Light (see page 74)
Protecting with Light (see page 78)

"Cleaning with light" The Mechanism

VUV radiation is applied with an excimer lamp. As the result:

① Ozone and active oxygen are generated.
② The direct action of VUV radiation breaks the molecular bonds of organic matter on the substrate.

These effects take place simultaneously, breaking organic matter (contaminants) down into water vapor and carbon dioxide, which is released to the atmosphere. This leaves the surface of the substrate completely free of contaminants.



* Concept illustration of optical cleaning