



UV CURING Technology

1. What is UV Curing Technology?

UV Curing Technology is a technology of instant curing or drying in seconds in which ultraviolet is applied to resins such as coatings, adhesives, marking ink and photo-resists, etc., to cause photopolymerization. With polymerization reaction methods by heat-drying or mixing two liquids, it usually takes between a few seconds to several hours to dry a resin.

About 40 years ago, this technology was first used practically for drying the printing on plywood for building materials. Since then, it has been used in specific fields.

Recently, the performance of UV curable resin has improved significantly. Moreover, various types of UV curable resins are now available and their use as well as market is growing rapidly, since it is advantageous in terms of saving energy/space, reducing waste, and achieves high productivity and low-temperature treatment.

In addition, UV is also suitable for optical molding since it has a high energy density and it can focus on minimum spot diameters, which helps to easily obtain high-precision molded products.

Basically, being a non-solvent agent, UV curable resin does not contain any organic solvent that causes adverse effects (e.g., air pollution) on the environment. Moreover, since the energy required for curing is less and carbon dioxide emission is lower, this technology reduces the environmental burden.

2. Features of UV Curing

1. Curing reaction occurs in seconds

In the curing reaction, monomer (Liquid) changes to polymer (Solid) within a few seconds.

2. Outstanding environmental responsiveness

Since the entire material is basically cured by solvent-free photopolymerization, it is very effective to fulfill the requirements of environment-related regulations and orders such as PRTR (Pollutant Release and Transfer Register) Law or ISO 14000.

3. Perfect for process automation

UV curable material does not cure unless exposed to light, and unlike heat-curable material, it does not get cured gradually during preservation. Hence, its pot-life is short enough for it to be used in the automation process.

4. Low-temperature treatment is possible

Since the processing time is short, it is possible to control the rise in the temperature of the target object. This is one of the reasons why it is used in most heat-sensitive electronics.

5. Suitable for every type of application since a variety of materials are available

These materials have high surface hardness and gloss. Moreover, they are available in many colors, and hence can be used for various purposes.

3. Principle of UV Curing Technology

The process of changing a monomer (liquid) into a polymer (solid) with the help of UV is called UV Curing and the synthetic organic material to be cured is called UV Curable Resin.

UV Curable Resin is a compound that consists of:

(a) monomer, (b) oligomer, (c) photopolymerization initiator and (d) various additives (stabilizers, fillers, pigments, etc.).

(a) Monomer is an organic material that is polymerized and converted into bigger molecules of polymer to form plastic. (b) Oligomer is a material which has already reacted to monomers. In the same ways as a monomer, an oligomer is polymerized and transformed into big molecules to form plastic. Monomer or oligomer do not easily generate a polymerization reaction, hence they are combined with a photopolymerization initiator to start the reaction. (c) The photopolymerization initiator is excited by the absorption of light and when reactions, such as the following, take place:

(1) Cleavage, (2) Hydrogen abstraction, and (3) Electron transfer.

By this reaction, the substances such as radical molecules, hydrogen ions, etc., that initiate the reaction are generated. The generated radical molecules, hydrogen ions, etc., attack oligomer or monomer molecules, and a three-dimensional polymerization or crosslinking reaction takes place. Due to this reaction, if the molecules having a size greater than the specified size are formed, the molecules exposed to UV change from liquid to solid. (d) Various additives (stabilizer, filler, pigment, etc.) are added to the UV curable resin composition as required, to give it stability, strength, etc.

Liquid-state UV curable resin, which is freely flowable, is usually cured by the following steps:

(1) Photopolymerization initiators absorb UV.

(2) These photopolymerization initiators that have absorbed UV are excited.

(3) Activated photopolymerization initiators react with resin components such as oligomer, monomer, etc., through decomposition.

(4) Further, these products react with resin components and a chain reaction proceeds. Then, the three-dimensional crosslinking reaction proceeds, the molecular weight increases and the resin is cured.

4. What is UV?

UV is an electromagnetic wave of 100 to 380nm wavelength, longer than that of X-rays but shorter than that of visible rays.

UV is classified into three categories shown below according to its wavelength:

UV-A (315-380nm)

UV-B (280-315nm)

UV-C (100-280nm)

When UV is used to cure the resin, the following units are used to measure the amount of UV radiation:

- Irradiation intensity (mW/cm²)

Irradiation intensity per unit area

- UV exposure (mJ/cm²)

Irradiation energy per unit area and total quantity of photons to reach the surface. Product of irradiation intensity and time.

- Relationship between UV exposure and irradiation intensity

$E = I \times T$

E=UV exposure (mJ/cm²)

I =Intensity (mW/cm²)

T=Irradiation time (s)

Since UV exposure required for curing depends on the material, the required irradiation time can be obtained by using the above formula if you know the UV irradiation intensity.

5. Product Introduction

Handy-type UV Curing Equipment

Handy-type Curing Equipment is the smallest and lowest price UV Curing Equipment among our product lineup.

Built-in UV Curing Equipment

Built-in UV Curing Equipment is provided with the minimum required mechanism for using the UV lamp, and it can be connected to equipment that has a conveyor.

This equipment is composed of a lamp, an irradiator, a power source and a cooling device. Optional parts can be attached to the irradiator. Various types of power sources from a simple inverter to multi-type inverters are available.

Desktop UV Curing Equipment

This is UV Curing Equipment designed for desktop use. Since it is compact, it requires less space for installation and is very economical. It is most suitable for trials and experiments.

This equipment has a built-in shutter mechanism. Any desired irradiation time can be set for the most effective irradiation.

Conveyor-type UV Curing Equipment

Conveyor-type UV Curing Equipment is provided with various conveyors.

We design and manufacture a wide range of equipment from compact UV Curing Equipment having compact conveyors to large-size equipment having various transfer methods, and always offer equipment suitable to customer requirements.