



Supporting "solidify with light"

The technology that uses light to solidify resin is used in various fields, such as smartphones and other displays, 3D printer materials, semiconductors, etc., especially in the display area, because it is easy to design and process finely. This section introduces the photo-acid generator of San-Apro Ltd., which is essential for this photo curing.

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What is the technology to solidify with light?

LCD televisions and smartphones are essential for our lives. The clear plate used on this screen is the flat panel display (FPD). Multiple functional films are attached to glass using adhesive to make up FPD. There are two types of methods for curing the adhesive: thermal curing using heat, and photo curing using UV light.

In particular, photo curing can control the curing speed and the material is not damaged by heat. Thus, it is the best method for the field of electronic materials, etc. that dislike the influence of heat. It is also excellent in environmental properties, because organic solvents may diffuse into the air at drying (curing) in thermal curing, whereas photo curing does not release anything into the air. Therefore, the demand for light-cured resins has been increasing widely in the field of FPD in recent years.

Utilization of "photo-cationic polymerization" is expanded in the field of FPD

There are two methods for photo curing: photo-radical polymerization and photo-cationic polymerization. Basically, photo-radical

polymerization is used for curing acrylic resin, and photo-cationic polymerization is used for curing epoxy resin.

Photo-radical polymerization has a fast curing rate and relatively low cost, but it has a disadvantage of shrinking about 10% after curing. In comparison, photo-cationic polymerization features a low shrinkage rate of 1-2% after curing. This shrinkage range become more prominent with larger products and gives influence to products such as distortion; therefore, photo-cationic polymerization is chosen for manufacturing products which require higher dimensional accuracy.

Epoxy resin used for photo-cationic polymerization is characterized not only by the ability to adjust hardness, but by the persistence (toughness), which is less likely to crack when bent, and also by excellent electrical insulation. These features got a good evaluation and photo-cationic polymerization has been introduced several years ago as an adhesive to the film of polarizing plates used for FPD.

Acid produced by light promotes curing

Acid is essential for photo-cationic polymerization. It is photo-acid generators of San-Apro to generate the acids by using light.

■ Characteristics of photo-cationic polymerization

Main ingredient	Photo-cationic polymerization	Photo-radical polymerization
Type of resin	Epoxy resin	Acrylic resin
Curing rate	Slow (registration is possible after UV irradiation)	Fast (registration is impossible after UV irradiation)
Shrinkage rate after curing	Small	Large
Oxygen inhibition	None	Yes
Adhesive strength (adhesion)	Large	Small
Toughness	Good	Slightly inferior

To facilitate photo-cationic polymerization, first mix the photo-acid generator with epoxy resin. At this point, the mixture remains liquid (monomers and oligomers). Photo-acid generator decomposes and produces acids when exposed to UV light. The produced acid acts on some epoxy and the epoxy begins polymerization. It gradually changes to solid (polymers). Since the time of epoxy resin solidification and its hardness depend on the amount and strength of acid generated, the technology that controls them determines the performance of photo-acid generators. San-Apro manufactures photo-acid generators essential for this photo-cationic polymerization and has a number of technologies to control acids. As display is widely spread and its size is enlarged, San-Apro is expanding the market.

Use in future technologies and medical fields

San-Apro products can adjust the amount and strength of acid and produce acid at a wide

wavelength. By changing ingredients, we have the advantage of accommodating for various applications, such as hardening at pin points and hardening of areas where light is difficult to reach. At present, the CPI-100 - 400 series with different wavelengths, amounts and strength of acid generated, and solubility are launched as product line-up. We offer the best photo-acid generators to meet the needs of FPD manufacturing customers.

As the display evolves, the market for photo-cationic polymerization is expanding further, and it has recently been used for thin, curved displays, etc., using the organic EL that has been a subject of great interest. Currently, research on the handling of the following materials of organic EL as well as medical fields such as drugs, regenerative medicine, and biotechnology is ongoing. We expect to expand applications for further use in the future.

■ Main photo-acid generator of San-Apro

Product name	Corresponding wavelength (nm)				Features
	UV full wavelength	365 (i line)	405 (h line)	436 (g line)	
CPI-100P	◎	○			General-purpose photo-acid generator (photo cationic polymerization initiator) for thin films. Highly pure, showing excellent single-liquid storage stability with epoxy resins. Mainly used for coating and adhesive applications.
CPI-101A	◎	○			General-purpose antimony type photo-acid generator for thick film. Mainly used for photoformation and resist applications. Highly pure, showing excellent single-liquid storage stability with epoxy resin. Corresponds with hazardous substances.
CPI-200K	◎	○			A non-antimony type and highly active photo-acid generator. Possible to use for various applications, such as coatings, photoformation, resist, and adhesive agent, etc. Shows excellent storage stability with epoxy resin and solubility with various organic compounds.
CPI-210S	◎	○			
CPI-310B	◎	◎			Highly sensitive i-line type. It generates a low corrosive borate anion.
CPI-410S	◎	◎	◎	○	Highly sensitive i-g line type. Shows excellent storage stability with epoxy resin and solubility with various organic compounds.
IK-1	◎				Shows excellent solubility to various organic compounds. Suitable for longer wavelength (i-g line) using sensitizer.

Contact San-Apro Ltd. for handling. Also, be sure to read the "Safety Data Sheet" (SDS) in advance. It is the responsibility of the user to determine the suitability and safety of the intended use.