Sylanto
Cationic Photoinitiators
for UV Curing

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SPECIALTIES
**Sylanto Cationic Photoinitiators for UV Curing**

Photoinitiators are chemical compounds which disintegrate upon exposure to UV light, acting as so-called active agents, contributing to the conditioning and speed of the polymerization process. Photoinitiators are included in the base of mixtures added, for instance, to paints, varnishes and polymeradhesives.

**Photochemical characterization**

Cationic polymerization initiators currently used in the industry are subject to a significant technological problem consisting in inefficient absorption of UV radiation. Due to the fact that the primary sources of high power UV light used to induce photochemical reactions are medium pressure mercury (MPM) lamps, and the majority of UV energy emitted by them is at approx. 365 nm, energy efficiency hovers around 10%. The result is that hitherto used cationic photoinitiators based on diaryliodonium salts have poor absorption characteristics, which do not match the characteristics of UV light source emissions. All commercial diaryliodonium photoinitiators exhibit similar UV absorption characteristics in the wavelength range of $\lambda_{\text{max}} = 220-280$ nm, while there are no efficient light sources used for industrial applications in this range.

Sylanto UV-Photoinitiators are devoid of this defect and offer around 90% efficiency allowing them to be used in much smaller concentrations, leading to an increase in the performance rate of production lines. At the wavelength of 365 nm, corresponding to the medium strongest spectral line of MPM lamps, Sylanto UV-Photoinitiators exhibit absorption rates as high as 75% of the maximum absorption occurring at $\lambda_{\text{max}} = 350$ nm.

One modern solution in UV technology is the use of UV-LED diodes, which prevent processes from emitting ozone and heat release, a very important distinguishing feature of those systems in comparison to traditional MPM lamps. While standard cationic photoinitiators are incompatible with ultraviolet diode light sources, Sylanto UV-Photoinitiators retain their full functionality when UV-LED diodes are used.

**Reactivity**

The performance of Sylanto UV-Photoinitiators in comparison to the commercial iodonium photoinitiator (diphenyliodonium hexafluorophosphate, HIP) was evaluated in photopolymerization tests of 3,4-epoxy-cyclohexylmethyl 3,4-epicyclohexyloxycarboxylate under identical reaction conditions using fluorescence probe technology (FPT). The FPT method is based on molecular fluorescent probes, which change their fluorescence characteristics upon changes occurring in the cationic polymerizable composition.

Under the irradiation conditions corresponding to the strongest emission lines of medium pressure mercury lamps ($\lambda_{\text{max}} = 365$ nm), Sylanto UV-Photoinitiators exhibit very high activity, while a composition containing commercial HIP did not polymerize at all within the irradiation time applied, due to the lack of significant light absorption above 325 nm.
Standard photoinitiators generally have a low solubility in the commonly used monomers and mixtures of monomers. These difficulties become even more apparent when it is necessary to use higher concentrations of photoinitiators, often of up to 5 % by weight.

The answer to the above restrictions are Sylanto UV-Photoinitiators characterized by full reactivity in concentration ranges as low as 0.5 – 1 % by weight.

Another advantage of Sylanto UV-Photoinitiators is their good solubility in a number of commonly used monomers at concentrations of up to 5 wt. % or more without the need for additional solvents. Our products are distributed in the form of granular solids or as solutions in propylene carbonate.

### Area of Sylanto UV-Photoinitiators application:

**Printing industry:** UV inks are used in screen printing, flexography, offset, letterpress and digital printing. Photoinitiators constitute 1-10% of the inks by weight, allowing to initiate polymerization in order to achieve instant graphical content. Sylanto UV-Photoinitiators allow to improve printing technology by increasing its efficiency, while reducing production costs.

**Furniture industry:** Use of modern photocurable coatings can significantly reduce the emission of VOC (volatile organic compounds) by eliminating coating methods which use solvent paints. Radiation curable coatings for wood are characterized by excellent chemical and physical resistance. They also exhibit very good susceptibility to grinding, short curing time and very good overall mechanical properties.

**Paints and varnishes industry:** UV technology allows for the reduction of environmentally harmful solvents, and also enables the production of coatings with improved mechanical properties.

**Adhesives and sealants industry:** Bonding materials incompatible with each other by definition, such as metal, glass, wood, paper and plastics is one of the major problems of manufacturers of various kinds of adhesives and sealants. At present, the available methods are characterized by low bonding efficiency. This can be solved by adhesives which polymerize under UV irradiation in the presence of highly efficient Sylanto UV-Photoinitiators.

**Automotive industry:** In automotive industry protective coatings are becoming a necessity, both due to the exposure of vehicle paint to harmful environmental conditions and to its contact with chemical agents. From technology and utility points of view, the latest trends are UV cured paint coats. In automotive industry, photocuring can also be used for joining all kinds of vehicle parts. Application examples of UV-curing include enclosure elements for head lamps, rear lamps, side decor, parts of mechanical and electronic systems, coats of internal plastic elements or external protective coats of aluminium rims.

**Food packaging industry:** Photopolymerisation processes are especially suitable for industrial graphics in food packaging, where UV-cured paints are commonly used. Modern paints intended for contact with food are mainly based on cycloaliphatic epoxy resins and have a number of advantages which include the fact that after polymerisation paint coat is odourless, organoleptically neutral and prevents the penetration of plastic composition elements to food.

**Electronics industry:** UV-curing technologies play an important role in electronic elements production processes and influence the quality and properties of products. UV-cured coats are used to make printed circuit boards in order to secure them against moisture, dust, chemicals and extreme temperatures. Photopolymerisation reactions are also used in the chips for mobile phones and other mobile devices.
Sylanto-7M Cationic UV-Photoinitiators

**Sylanto-7MP** is a diaryliodonium hexafluorophosphate.

**Sylanto-7MS** is a diaryliodonium hexafluoroantimonate.

### General information

- **Sylanto-7M UV-Photoinitiators** are recommended for photopolymerization processes of epoxy monomers (especially cycloaliphatic epoxy monomers, glycidyl monomers, epoxy silicone resin) and vinyl ethers.

- **Sylanto-7M UV-Photoinitiators** have very good solubility in epoxy and vinyl monomers as well as in most organic solvents.

- **Sylanto-7M UV-Photoinitiators** exhibit very good absorption of light in the UV range between 200 nm and 400 nm, with maximum absorption located at $\lambda_{max} = 350$ nm, which guarantee high compatibility with emission characteristic of Medium Pressure Mercury Lamps.

- Recommended light sources for **Sylanto-7M UV-Photoinitiators** are: MPM (Medium Pressure Mercury) lamps, doped mercury arc lamps, UV-LEDs (especially recommended are UV-LEDs with emission characteristics of $\lambda_{max} = 365$ nm), as well as halogen and xenon lamps.

- Individual substrates used for the production of **Sylanto-7M UV-Photoinitiators** are non-toxic and free of VOC (Volatile Organic Compounds).

### Benefits of Sylanto-7M Cationic UV-Photoinitiators

- Provide rapid cure at depth.

- Can be used in presence of pigment systems, including TiO$_2$.

- Typical concentration range: 0.5-2 wt.% per epoxide or vinyl containing material.

- No other co-initiators nor photosensitizers required.

### Sylanto-7M UV-Photoinitiators usage recommendations

- The optimum concentration of **Sylanto-7M UV-Photoinitiators** should be established by the user.

- To ensure maximum solubility of **Sylanto-7M UV-Photoinitiators**, it is recommended to wait a few minutes prior to the use of the final formulation.

- "Dimmed" light conditions or another form of light shielding for mixing and formulating when using **Sylanto-7M UV-Photoinitiators** is recommended to prevent unwanted prepolymerization.

- **Sylanto-7M UV-Photoinitiators** and final formulations are light sensitive and should be kept in dark places or in light proof bottles when not in use.