Sanyo Chemical Industries, Ltd.

# PFAS-Free Gallium-Based Photoacid Generators from San-Apro Delivering High Performance Without Compromising Sustainability

Kyoto, Japan – [June 24, 2025] – San-Apro Ltd., a subsidiary of Sanyo Chemical Industries, Ltd., is repositioning its gallium-based photoacid generators (Ga-PAGs) as environmentally friendly materials and expanded its lineup. Going forward, San-Apro is increasing promotional efforts across related industries. Amid the rising demand for PFAS-free solutions in the electronics and photopolymer industries, San-Apro's Ga-PAGs are receiving renewed attention.

These materials deliver high performance and environmental compatibility, offering manufacturers a viable alternative to PFAS-containing materials without compromising technical capabilities. By promoting these advanced materials, Sanyo Chemical group supports customers in meeting their sustainability goals and advancing environmentally responsible manufacturing practices.

## Evolving Market Needs for PAGs

Photo-curing technology is a key enabler across many sectors, including displays, electronics, and semiconductors. At the heart of this technology are photoacid generators (PAGs), which generate acid upon exposure to light. PAGs play a critical role in initiating cationic polymerization in UV-curable resins and enabling high-resolution patterning in photolithography—both essential to product quality and production efficiency.

In recent years, growing environmental awareness and tighter global regulations have accelerated the push to eliminate PFAS (per- and polyfluoroalkyl substances) from materials. Meanwhile, high sensitivity, reliability, and patterning precision are still essential performance criteria for PAGs, creating a challenge in balancing PFAS-free formulations with high performance.

Most PAGs are ionic compounds structured as onium salts, consisting of cationic and anionic components. Traditionally, anions such as those based on antimony (Sb), boron (B), or phosphorus (P) have been used—some of which include PFAS. As a result, the industry is seeking new PAGs that are both high-performing and free of PFAS and Sb.

## Key Features of San-Apro's Ga- PAGs

By uniquely combining a gallium-centered anion structure with San-Apro's proprietary cation structure, San-Apro's Ga-PAGs achieve both industry-leading performance and environmental compatibility. These PAGs deliver performance equal to or exceeding that of conventional high-performance Sb-PAGs, while also being Sb-free and PFAS-free.

San-Apro's Ga-PAGs feature a unique combination of a gallium-centered anion structure—well-known in the field—and San-Apro's proprietary cation structure, resulting in outstanding performance and environmental compatibility.

(1) Proprietary Molecular Design

Utilizing the molecular design and synthesis expertise that San-Apro has accumulated over the years, we precisely controls key properties—such as acid generation behavior under light exposure, thermal and chemical stability—at the molecular level, achieving a balance between high performance and environmental compatibility.

(2) Excellent UV Curing Performance
The materials exhibit high sensitivity (acid generation upon light exposure) and strong reactivity of the generated acid, delivering UV curing performance compatible or exceeding Sb- PAGs. This contributes to reducing curing time and improving manufacturing efficiency.

(3) High Transparency and Thermal Yellowing Resistance
The cured resins remain highly optically transparent and resist yellowing even at elevated temperatures. This makes Ga-PAGs suitable for applications such as displays and electronic devices where visual quality and optical performance are critical.

(4) Sb-Free and PFAS-Free
These materials are designed without the use of Sb, and are not classified as deleterious substances under the Japanese Poisonous and Deleterious Substances Control Act , resulting in easier handling and storage. Furthermore, their absence of PFAS makes them a promising solution in response to increasingly stringent global environmental regulations and growing safety expectations.

(5) No Generation of Hydrogen Fluoride (below detection limit in accelerated testing: PCT* )
These PAGs do not release HF during curing or patterning processes, thereby minimizing corrosion risks to substrates and metal circuitry. This feature ensures both safety and stability in the manufacture of electronic components, where high insulation and reliability are required.
*HF was quantified using ion chromatography after the PCT: Pressure Cooker Test (PAG/water = 1/25, 160°C x 3 days), based on our in-house test results.

(6) High Solubility in Solvents and Resins
Compared to many conventional PAGs, which often face solubility challenges in organic solvents or UV-curable resins, San-Apro's Ga- PAGs demonstrate excellent solubility across a wide range of organic solvents and UV-curable resins. This enhances formulation flexibility for product designers.

San-Apro is also developing a lineup of PFAS-free thermal acid generators (TAGs) that generate acid upon heating. These next-generation materials incorporate gallium-based anion structures and share key features with the Ga-PAGs, such as high transparency, resistance to thermal yellowing, the absence of Sb and PFAS, no generation of hydrogen fluoride, and excellent solubility in solvents and resins. They are expected to be applied in a broad range of advanced materials.

**Product Lineup: Ga-PAGs**

| Product Name | IK-1FG | CPI-310FG | VC-1FG | ES-1FG |
|---|---|---|---|---|
| Cation Type | Iodonium | Sulfonium | | |
| Anion Type | Ga-based | | | |
| Absorption Wavelength | –300nm | –370nm | –390nm | –440nm |
| Features | Dual-use as TAG | Standard | LED-compatible | h-line light source compatible |

| | | | | |
|---|---|---|---|---|
| Development Stage | Prototyping stage | Commercialized | Under basic research | Under basic research |

**Product Lineup: Ga-TAGs**

| Product Name | TA-100FG | AA-01FG | IK-1FG |
|---|---|---|---|
| Cation Type | Sulfonium | Ammonium | Iodonium |
| Anion Type | Ga-based | | |
| Thermal Decomposition Temp.* | 137℃ | 154℃ | 242℃ |
| Features | High reactivity | Better storage stability than sulfonium-based | Dual-use as PAG |
| Development Stage | Prototyping stage | Under basic research | Prototyping stage |

* Lower decomposition temperatures when dissolved in epoxy resin.

San-Apro remains committed to providing a stable supply of high-performance, PFAS-free PAGs and TAGs, contributing to the reduction of environmental impact and the advancement of high-precision manufacturing processes—ultimately supporting a more sustainable society.

**About Sanyo Chemical**

Sanyo Chemical established in 1949 in Kyoto, Japan, is a global manufacturer and seller of performance chemicals. Beginning as a manufacturer of soap and textile agents we have since diversified our product portfolio to meet the needs of the market, Today, we feature over 3,000 diverse types of products and have established an international presence. Our portfolio of chemicals spans a variety of industries and types, from automotive components to daily-use electronics, as well as cosmetics and medical equipment, all with the aim of creating safe and environmentally friendlier offerings, improving lives and societies across the world. We aim to contribute to realize a sustainable society through our corporate activities
https://www.sanyo-chemical.co.jp/eng

**About San-Apro**

San-Apro, a wholly owned subsidiary of Sanyo Chemical, specializes in the development and production of photoacid generators, thermal acid generators, and super strong bases. The company has earned a strong reputation in the field of electronic materials through its proprietary synthesis technologies and rigorous quality control systems.
https://www.san-apro.co.jp/en/

**Terminology**

1. PFAS

Per- and polyfluoroalkyl substances. Known for their water and chemical resistance, PFAS are also highly persistent in the environment. This press release follows the definition set by the European Chemicals Agency (ECHA).

2. Photoacid Generator (PAG)

Compounds that generate acid upon exposure to light. The resulting acid initiates reactions such as cationic polymerization or deprotection in UV-curable resins and photolithography, enabling curing, cross-linking, and fine pattern formation in applications like coatings, adhesives, 3D

printing materials, and photoresists.

3. Thermal Acid Generator (TAG)
Compounds that generate acid upon heating beyond a certain threshold. Commonly used in electronics and optical materials where heat-triggered curing or cross-linking is required.

4. h-line light source
A UV light source with a wavelength of 405 nm, commonly used in photolithography for semiconductor manufacturing.

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