

# TANAKA's Product Lineup Supports Production of White LEDs

One hundred twenty-six years since the company's foundation, TANAKA Precious Metal Group, a specialist of precious metals, has been contributing useful products to the society. One area is the environment and energy field.

As the development of new energy sources gives prime consideration on environment friendliness, growing interests in energy conservation fields has been noted throughout the society today. In these markets, light-emitting diodes (LEDs) are anticipated to have significant growth. As LEDs can reduce power consumption compared with conventional incandescent lamps, high-intensity white LEDs attract attention as lighting sources, which help achieve energy savings.

Another application that cannot be overlooked is the large-screen LCD TVs backlight. Conventionally, cold-cathode tubes have been used in TV backlights. However, moves to replace them with LEDs have been rapidly underway as they can reduce power consumption.

## Metal for LED Materials, Manufacturing

Various precious metal materials are

used for materials constituting white LEDs and their manufacturing. For example, the sapphire wafer is used for the base substrate of LED devices. In the process for generating single crystalline sapphires, precious metal iridium crucible with a high melting point is used.

Furthermore, the metal organic chemical vapor deposition (MOCVD) process that is used to produce LED devices requires high-purity hydrogen gas as carrier gas. Palladium (Pd) is used as a hydrogen permeable film to purify the hydrogen. Thus, to the configured LED devices, gold (Au) or platinum (Pt) electrodes are formed by the vapor deposition or sputtering method, and silver (Ag)-based material is used as a reflection film to improve the light extraction efficiency.

## Other Application Areas

Precious metals are also used in processes other than the manufacturing of LED devices.

Ag paste is used for electrodes and wirings and for plugging thermal vias of ceramics packages in order to facilitate the flow of electricity and release heat and to efficiently convert electricity to light. Ag is also used as surface treatment of

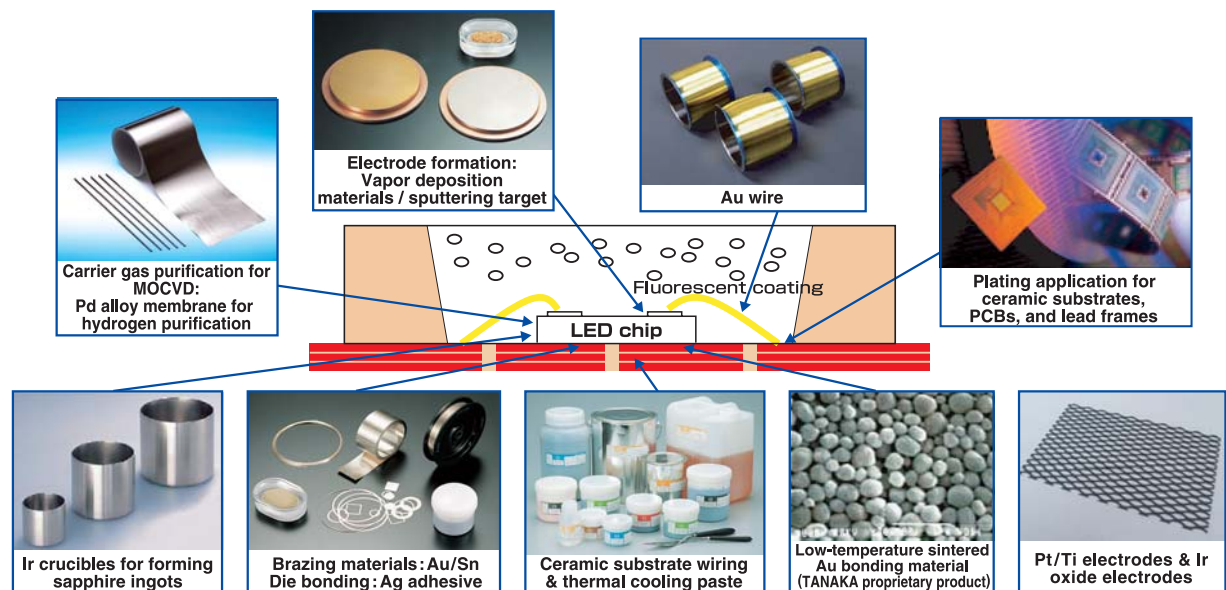


Noriaki Hara, Ph.D., Deputy General Manager of Marketing Department, R&D/Marketing Division of Tanaka Holding Co., Ltd. introduces Tanaka's products.

printed wiring boards and lead frames, and furthermore functions as a reflection film to obtain high luminosity. The configured packages are electrically connected with LED devices by Au bonding wires.

In recent years, the adoption of flip-chip packaging has been actively studied. Flip chip packaging is applied for the purpose of improving heat-dissipation properties and higher luminescence through the formation of bumps (protruded electrodes) on LED devices by plating and the formation of gold electrodes on the package by bumping wires.

TANAKA Precious Metal Group can provide precious metal materials that support LED package technology. □



White LED fabrication & Tanaka product lineup

# Tanaka Product Lineup for LED Manufacturing Processes

## Wafer/Chip Side

### Substrate manufacturing

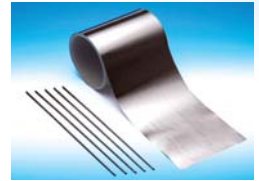
- Sapphire ingot growth (CZ method): Iridium crucible



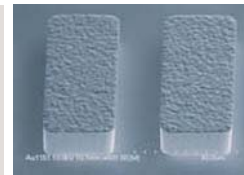
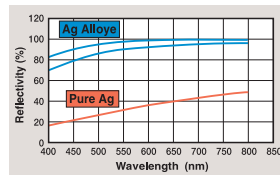
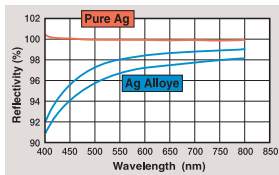
Ir crucible

### LED wafer fabrication (epitaxial growth/electrode formation)

- Carrier gas purification for MOCVD: Palladium (Pd) alloy membrane for hydrogen purification
- Electrode formation: Vapor deposition materials & sputtering targets
- Electrode formation: Formation of Au plating electrode for flip-chip bonding, Au bump plating solution, & full-automatic plating equipment
- Die-attach: Gold-tin alloy plating



Pd alloy membrane for hydrogen purification



Non-cyanide Au plating process and equipment



Vapor deposition materials/sputtering target

## Substrate Side

### Ceramic substrate, Organic substrate & Lead frame

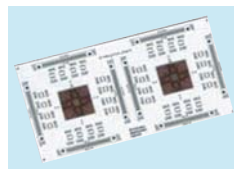
- Electrode formation/circuit formation: Via fill paste (Ag paste)
- High-reflection film formation paste: Ag/Pt paste
- High performance/low cost: Electro/Electroless Ni/Pd/Au plating
- High-reflection film plating: Au/Ag alloy plating & Ag plating
- Printed wiring board: Designed to provide high reflectivity & high thermal cooling
- High durability electrodes: King plates and micro-plates



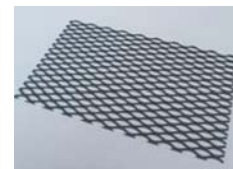
Pastes



Various examples of plating's practical uses



Printed wiring board



Insoluble electrodes

## Assembly

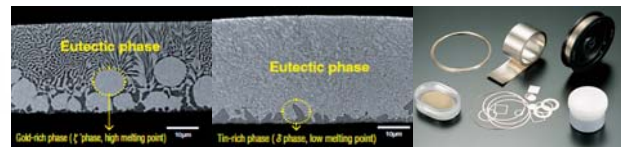
- Die bonding: Ag adhesive, Au/Sn bonding materials & low-temperature sintered Au bonding material (TANAKA proprietary product)
- Flip-chip bonding: Au bumping wire
- Wire bonding: Au wire & Ag alloy wire



Au bumping wire



Au wire



Au/Sn Brazing materials

PV



FCEV



## Fostering the Evolution of New Energy Creation and Energy Saving

Innovatively applying the use of precious metals for future Energy needs

SUPERCONDUCTOR



LED



Tanaka Precious Metals (in Japanese Tanaka KiKinzoku Group) supports society's progress by developing the untapped potential of precious metals. We are active in the environmental and energy sectors in the fields of new energy, such as the energy generation business (fuel cells and solar cells), and of energy saving (superconductive materials and LED materials). Our applied technologies are used in a wide variety of industries to solve the environmental problems facing the global community.

As proof of the reliability of its technologies for the collection, refinement and analysis of precious metals, which provide the foundation for realizing their potential, Tanaka Precious Metals has been accredited as one of the five international Good Delivery Referees, whose role is to assess the quality of gold traded in the London Bullion Market, the most reputable gold market in the world.

Using advanced technologies for the environmental recycling of precious metals, whose supply is limited, Tanaka Precious Metals will continue to work in a variety of fields in order to contribute to the creation of a peaceful and affluent society.

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The Future is Precious.



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