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TANAKA HOLDINGS Co., Ltd.

Tanaka Precious Metals

Tanaka Precious Metals establishes ultrathin membrane processing technology for palladium-based hydrogen separation (permeation) membranes, starting provision of samples to Europe, the US and Asia

With a minimum thickness of 5μm and a maximum width of 200mm, hydrogen permeation volume is triple, enabling the hydrogen separation to be more compact and reducing the cost by lowering the use of precious metal

Tanaka Holdings Co., Ltd. (a company of Tanaka Precious Metals, Headquarters: Marunouchi, Chiyoda-ku, Tokyo; President & CEO: Hideya Okamoto) announced today that Tanaka Kikinzoku Kogyo K.K. (a company of Tanaka Precious Metals, Headquarters: Marunouchi Chiyoda-ku, Tokyo; President & CEO: Hideya Okamoto) has established ultrathin membrane processing technology for rolled palladium based foils used for hydrogen separation (permeation) membranes, and will begin provision of samples to Europe, the US and Asia. The technology makes it possible to manufacture ultrathin palladium based membranes as thin as 5μm and as wide as 200mm, which will enable to reduce the size of hydrogen separation membranes used in production devices and refinement devices for hydrogen, which is expected to be a source of clean energy in the future, and reducing costs due to the use of less precious metal. Samples of this technology began to be provided in Japan in March 2010, and due to increasing inquiries from Europe, the US, South Korea and Taiwan, the company decided to begin providing samples to Europe, the US and Asia.

As the only waste produced when consuming energy generated by hydrogen is water, it is gaining much attention as an environmentally friendly clean energy source. For example, by using it as fuel in a fuel cell for generating electricity through a chemical reaction with oxygen in the air, it is possible to create an environmentally friendly power generation system. Reductions in size and cost have been issues in hydrogen production devices and a variety of organizations have been conducting research and development in Japan as well as abroad. “Reformer (*1) + PSA (*2)”, “reformer + preferential oxidation (PROX) catalyst (*3)” and “reformer + Pd (palladium) membrane” are generally considered as hydrogen production methods. The “palladium membrane method” utilizes a palladium-based hydrogen separation (permeation) membrane as a filter, by utilizing the property that palladium or palladium alloy foil without any flaws such as pinholes allows only hydrogen to pass through, to obtain high-purity hydrogen from hydrogen gas containing impurities typically seen in steam reforming gas. Research and development is being conducted on the “palladium membrane method” due to its ability to obtain ultrapure 9N (99.9999999%) hydrogen gas using compact equipment, but it has been indicated that there are shortcomings such as a substantial initial cost and slow permeation rate. With this development, Tanaka Precious Metals has established ultrathin membrane processing technology for rolled palladium foil enabling dramatic improvements in both cost and performance.

This technology makes it possible to process palladium in rolls up to 200mm wide at a thickness of 5μm, which is 1/3 the thickness of 15μm deemed to be the limitation of processing in the past. This makes it possible to increase the volume of hydrogen permeation to three times the level achieved in the past, and also reduces the amount of palladium used due to the membrane being made thinner. Alternative technology to create thin membranes using plating method is also under consideration, but because of the difficulty resolving the issue of residual flaws, the rolling process was adopted to form a dense foil, enabling the production of palladium membranes with few flaws.

For example, the residential fuel cells system that have recently begun to become widespread have an output of around 750W-1KW, and about 10L of hydrogen gas is required every minute to output 1KW (depending on operating conditions). In order to provide this using conventional hydrogen separation membrane technology (Pd15μm), area of 220cm^2 (4.0g of palladium) is required. By using the hydrogen separation membrane (Pd5μm) of this technology, it is possible to provide this output with just 1/3 the area at 73cm^2 (0.4g of palladium), resulting in a significant reduction in device size and dramatic reductions in the amount of precious metal used, enabling the provision of a next-generation hydrogen energy supply solution.

Potential applications of the technology include:

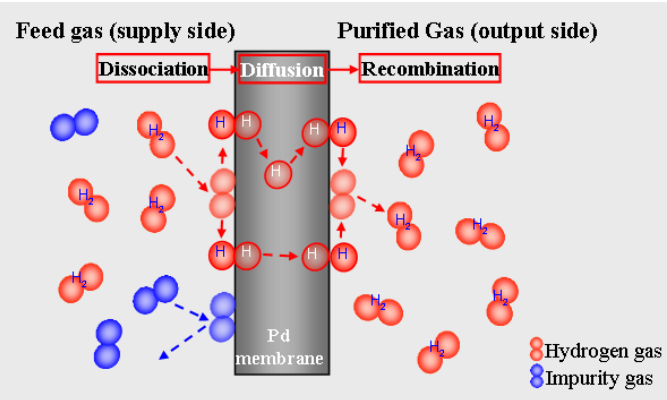
- For refinement of hydrogen for semiconductor process gas
  → Purification of hydrogen gas used in the manufacture of compound semiconductors, LEDs and SiCs
- For refinement of hydrogen for reforming gas
  → Extraction of hydrogen from gas reforming gas, methanol reforming gas and coal reforming gas
- For refinement of hydrogen gas for other industrial purposes
  → Purification of hydrogen gas for atmosphere gas in the manufacture of high-purity glass and hydrogen gas for thermal treatment of metals

etc.

■ Features of palladium-based hydrogen separation (permeation) membranes using ultrathin membrane processing technology

- A minimum thickness of 5μm and a maximum width of 200mm
- Entire process from alloy melting to rolling is consistently controlled
- A wide range of binary and ternary palladium alloys
- A highly clean process that keeps insoluble contaminants to a minimum

Mechanism of hydrogen permeation using palladium



Palladium material used for hydrogen permeation membranes (thin tube/ ultrathin foil)

■Terminology

*1 Reformer:

A reactor that converts fossil fuel into hydrogen-enriched (carbon monoxide and hydrogen) gas.
(In case of methane gas the chemical reaction formula is $CH_4+2H_2O \rightarrow 4H_2+CO_2$)

*2 PSA (Pressure Swing Adsorption) method:

A method in which hydrogen-enriched reforming gas is pressurized using a compressor and high-purity hydrogen gas is separated in an adsorption chamber.

*3 Preferential oxidation (PROX) catalyst:

A catalyst for selectively oxidizing and eliminating trace carbon monoxide contained in reforming gas used in polymer electrolyte fuel cells as carbon dioxide (CO_2).

■Company Overview

Company name:	TANAKA HOLDINGS Co., Ltd. (Holding Company of Tanaka Precious Metals)
Address:	22F, Tokyo Building, 2-7-3 Marunouchi, Chiyoda-ku
Representative:	Hideya Okamoto, President & CEO
Founded:	1885
Incorporated:	1918
Capital:	500 million yen
Employees:	3,115 (Consolidated basis, as of March 2010)
Sales:	710 billion yen (Consolidated basis, as of the financial closing at the end of March 2010)
Major affiliates:	Tanaka Kikinzoku Kogyo K.K. Tanaka Kikinzoku Hanbai K.K., Tanaka Kikinzoku International K.K., Tanaka Denshi Kogyo K.K., Tanaka Kikinzoku Jewelry K.K., Electroplating Engineers of Japan, Limited, TC Catalyst, Inc.
Businesses:	Manufacture, sales, import and export of precious metals (platinum, gold, silver, and others) and various types of industrial precious metals products. Recycling and refining of precious metals.
Website:	http//www.tanaka.co.jp