March 12, 2020

Notice Regarding Sales of Peroxidizer®, a High-Concentration Hydrogen Peroxide Gas Supply System for ALD Processes

Taiyo Nippon Sanso Corporation ("TNSC") and its group company RASIRC Inc. ("RASIRC") hereby announce that they will sell the Peroxidizer®, a high-concentration hydrogen peroxide gas supply system used in high-speed, high-quality oxidizing atomic layer deposition (ALD) processes.

1. Background

Atomic layer deposition (ALD), which enables superior film thickness control and step coverage, has been widely used in recent years with the miniaturization and structural complexity of semiconductors. For example, aluminum oxide for high-k dielectrics or titanium oxide for double patterning is formed with the ALD method, conventionally with water vapor or ozone gas as oxidizing agents. However, the growth per cycle of these processes is generally slow and lowering the process temperature could compromise film quality. Utilizing a more reactive oxidizing agent, hydrogen peroxide, is seen as a solution, but it is generally distributed as a 30% liquid solution and is difficult to use at a fixed concentration when vaporized.

2. Overview of the Peroxidizer® and its Effects on Film Formation Characteristics

TNSC's U.S. subsidiary Matheson Tri-Gas, Inc. acquired a majority stake in RASIRC in 2012. RASIRC, which developed an original ultra-high-purity purification technology based on membrane separation, manufactures and sells the Peroxidizer®, high-concentration hydrogen peroxide gas supply system. The Peroxidizer® uses hydrogen peroxide liquid solution (30wt%) used in chemical etching as a raw material to deliver high-concentration, high-purity hydrogen peroxide gas with concentrations as high as 50,000 ppm via vaporization and purification through the membrane separation technology. Supplying hydrogen peroxide gas at 50,000 ppm has a maximum carrier gas flow of 5 L/min and water vapor concentration of 20%.

Recently, TNSC's ALD experiment using a Peroxidizer® demonstrated faster growth of high-quality aluminum oxide and titanium oxide films compared to conventional oxidizing agents (water vapor or ozone gas). At a substrate temperature of 175℃, titanium oxide film formed at a growth rate of about 0.1 nm/cycle (twice as fast as using ozone gas) with an etching rate of 0.1 nm/min in hydrofluoric acid solution (20 times slower than using ozone gas)*.

3. Future Plans

Going forward, TNSC will expand sales of the Peroxidizer® for ALD of oxide thin films. The results of the aluminum oxide ALD will be reported at the 20th International Conference on Atomic Layer Deposition (ALD 2020) held in Belgium from Sunday, June 28–Wednesday, July 1, 2020.

Exterior view of the Peroxidizer®

(Note)

* “A Comparative Study on the Oxidants for the Atomic Layer Deposition of Titanium Oxide Thin Films” was announced during the Poster Session of the 41st International Symposium on Dry Process (http://www.dry-process.org/2019/index.html) held in Hiroshima in November 2019.