Innovation with the New Plasma Source HSTC-M™: Introduction of ICP Etching System for SiC/GaN Power Devices up to 8 Inches

Samco Inc.

Introduction

Since the introduction of ICP etching systems in 1996, Samco has consistently delivered innovative process technology and reliable systems to the compound semiconductor market. Our proprietary Tornado ICP® coil, much like Hideo Nomo[1], the first Japanese Major League Baseball player, has pioneered new processes for compound semiconductors. To date, Samco's sales record for ICP etching systems exceeds 600 units. This time, we are pleased to present a newly developed ICP etching mechanism featuring the HSTC-M™ (Hyper Symmetrical Tornado Coil - Modified). This mechanism offers a highly uniform and stable process tailored for the compound semiconductor market, including the expanding production of SiC power devices and GaN power/RF devices. Leveraging our extensive experience and expertise, this advanced solution is designed for wafer sizes up to 8 inches.

Hardware Features

1. New Plasma Source HSTC-M™ (Hyper Symmetrical Tornado Coil Modified):
   The HSTC-M™ is an innovative upgrade of the traditional Tornado ICP®, significantly enhancing etching uniformity across the surface. It also enables the stable and efficient application of 2 kW RF power.
2. High Gas Flow Exhaust Structure:
   The direct connection of the TMP to the reaction chamber enables a high-flow process of up to 1,000 sccm in the usual pressure range. This excellent exhaust performance minimizes the re-adhesion of by-products during the process.
3. Lower Electrode Gap Control:
   The adjustable height of the lower electrode allows for recipe-dependent adjustment of the gap between the substrate and plasma, enabling precise tuning of the etching process.

In addition to the plasma source, exhaust structure, and lower electrode gap control, improvements to the electrostatic chuck (ESC) enhance cooling efficiency and thermal uniformity, allowing for uniform and stable etching up to the edge of 8-inch wafers.

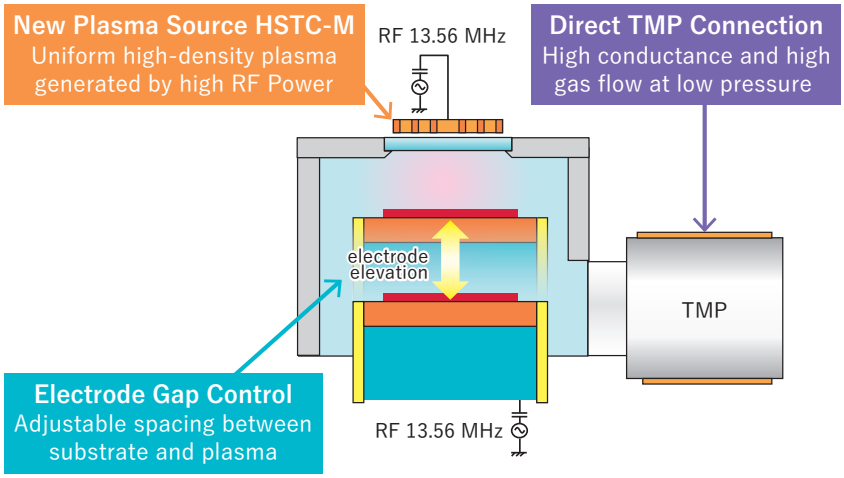

Figure 1.
Reaction chamber diagram

System Lineup

Our new etching mechanism is integrated into a range of systems to accommodate both research and production needs. These include the load-lock system RIE-800iP, the vacuum cassette system RIE-800iPC, and the cluster tool system Cluster H™, which can connect up to three chambers. The RIE-800iP has been redesigned for easier maintenance around the reaction chamber. Additionally, the Cluster H™ system allows the connection of up to three process modules equipped with the new etching mechanism, offering high productivity.

Photo 1. RIE-800iP ICP Etching System (Load-Lock Type)

Conclusion

Samco has successfully introduced numerous ICP etching systems to the research and development sector. In recent years, the sales of production equipment, such as the Cluster Tool System to electronic device factories, have witnessed a substantial increase. The newly introduced etching mechanism with HSTC-M™ excels in in-plane controllability and process stability for substrates up to 8 inches, significantly contributing to enhanced yield in research, development, and production sites that demand high reproducibility. Like the impact made by Shohei Ohtani[2] as a two-way player in Major League Baseball, we persist as a two-way player in the semiconductor industry, catering to both research and production; developing devices and process technology specialized for SiC power devices and GaN power/RF devices.

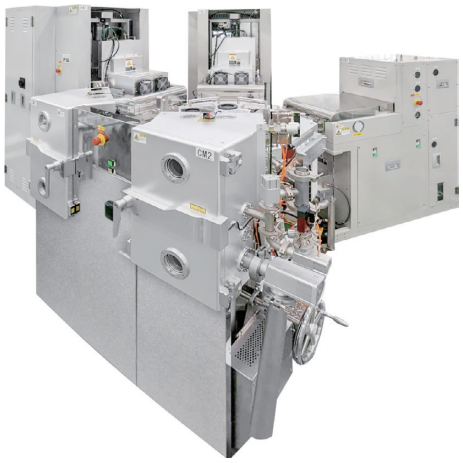

Photo 2. Cluster H™ Cluster Tool System

1 Hideo Nomo, born on August 31, 1968, is a former professional baseball player from Osaka, Japan. He joined Nippon Professional Baseball's (NPB) Kintetsu Buffaloes in 1990 as the top amateur pitcher. In 1995, he moved to Major League Baseball (MLB) with the Los Angeles Dodgers, gaining attention for his unique tornado pitching style and earning him the Rookie of the Year award in his debut season. After playing for multiple MLB teams, he retired in 2008 and has since been actively involved as a coach and baseball commentator.

2 Shohei Ohtani, born on July 5, 1994, is a professional baseball player from Iwate, Japan. He emerged as a professional baseball talent when he joined the Hokkaido Nippon-Ham Fighters in 2013. Known for playing both as a pitcher and a batter throughout the season, a style known as "two-way play," he transferred to MLB's Los Angeles Angels in 2018. He was selected as the Season MVP in 2021 and 2023, gaining international attention and making a significant impact on the baseball world.

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For more information please email: info@samco.co.jp URL: https://www.samco.co.jp/en/

Japan (Kyoto)
Phone: +81-75-621-7841

South Korea (Suwon)
Phone: +82-70-8252-7841

Taiwan
Hsinchu Office
Phone: +886-3-516-5100
Tainan Service Office
Phone: +886-927-607-351

PR China
Beijing Office
Phone: +86-10-8219-4215
Shanghai Office
Phone: +86-21-6249-4662

Singapore
Phone: +65-6465-4220

Malaysia
Phone: +603-7629-7560

US, Canada & Latin America
West Coast Office, California
Phone: +1-408-734-0459
East Coast Office, New Jersey
Phone: +1-631-464-0664

samco-ucp ltd. Liechtenstein
Phone: +423-377-5959
Email: info@samco-ucp.com