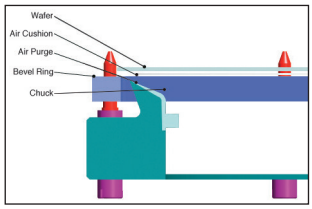
Single Wafer Wet Etch Processing

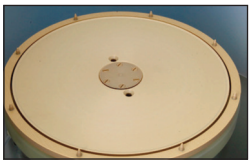
Backside and Bevel Edge Cleaning

Chemical stripping of films on the wafer backside and bevel edge is increasingly important for integrated circuit manufacturing for 90 nm, 65 nm, and 45 nm. Contamination from new materials, such as dielectrics, metals, and protective backside coatings will need to be removed. Veeco's single wafer technology meets these challenges, while attaining the lowest cost of ownership (COO).

Backside Cleaning Technology

Veeco's patent pending gas seal spindle tools protect the active area of the wafer with a non-contacting cushion. The wafer floats on a 100 µm air cushion and is held in place by centrifugal forces with precision retaining rings. An available bevel ring utilizes a capillary action with the etch fluid to etch the bevel area with clean, crisp, sharp lines from an 0.8 mm bevel area. Veeco's approach enables very low flow rate chemistry to be utilized that allows the use of single-pass chemistry.

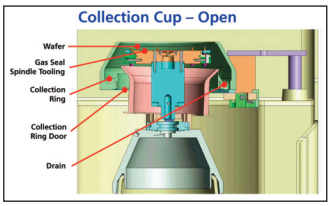


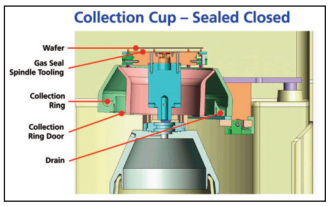


Veeco's patent pending gas seal chuck includes an onboard final point-of-use filter for gas.

Chemical Separation and Recirculation

For applications requiring chemical separation and recirculation, Veeco systems achieve efficiencies > 95% with simple gravity drainage only. There are no moving parts in the plumbing system, as chemistries are transported by pressure and vacuum for clean, low maintenance performance.

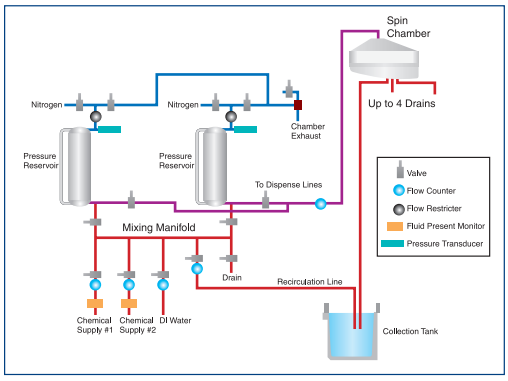




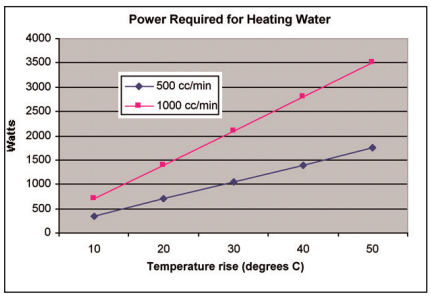
In-situ Collection Ring with Open and Closed Position

Single Wafer Chemistry Technology

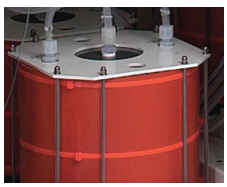
Veeco systems implement closed loop processing with on-the-fly control for chemistry mixture and temperature, whether for one wafer or a batch of 25, by recipe. Chemistry can be mixed by recipe to the ppb level and temperature-controlled on the run, utilizing true single wafer technology. Recipes are controlled by SECS GEM management, and include hot lot capability. Individual data collection provides complete management information.



Chemistry transport is vacuum- and pressure-driven, featuring integrated chemical monitoring with adaptive management.



PC programmable temperature controllers provide on-the-fly control of the fluid dispensed. These units are specifically sized for the required flow rate and temperature rise. They are true "single wafer technology temperature controllers," avoiding the cost and performance degradation of batch chemistry heaters.

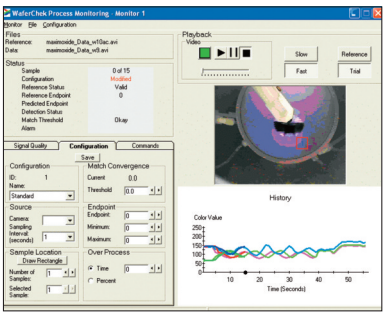


Veeco

Precision Surface Processing

In-situ Adaptive Process Control

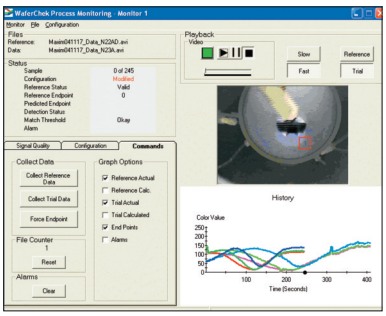
Veeco's WaferChek™ system provides further means to control the single wafer processing with process status feedback for film strip cleaning control. Wet etching rates can be controlled by traditional techniques of managing chemistry temperature, flow rate, and concentration. Control of the etch process can be determined automatically by the optical properties of the surface. The result is uniform film conditions, wafer to wafer, despite process variables. This is advantageous for both single pass and recirculated chemistry applications. Several examples that follow show the effectiveness of this technique.



8000 Å SiO2 Backside Strip

The color change went through approximately 1 of the 5 color cycles. About 20% of the SiO2 was removed (1500 Å) in the 10 seconds of etch time.

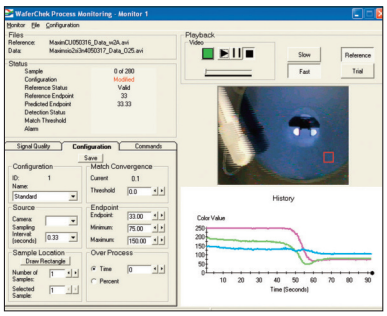
Process parameters: HF 49%, < 100 ml/minute flow rate; etch rate 15,000 Å/minute @ 20 °C



1,500 Å Si3N4 Backside Strip

Nitride film wafers were completely stripped in 200 seconds by processing with controlled chemistry temperature and flow rate.

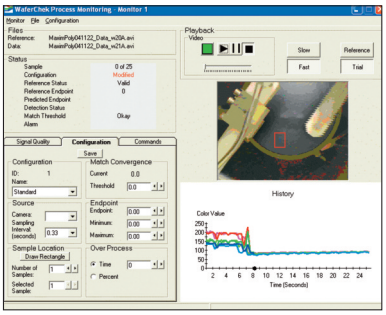
Process parameters: HF 49%, < 400 ml/minute flow rate; etch rate 600 Å/minute @ 50 °C



Copper Removal

We see from the chart that the first 40 seconds are utilized to strip the copper layer and then the insulating layer appears in the seconds that follow.

Process parameters: H2SO4:H2O2:DI, 10:10:4,000, 100 ml/minute flow rate; etch rate 2,000 Å/minute @ 25 °C



1,500 Å Poly Silicon

Process parameters: HNA (HF:HNO3:CH3COOH:H2O, 3:123:6:63), < 350 ml/minute flow rate; etch rate of 8,000 Å/minute @ 20 °C

12/1/2005 Lot ID: Unknown, User: s, Recipe: test.prs, Nonstop Cassette 1

Wafer	Start	Finish	Duration	SpinMod1	SpinMod2	SpinMod3	SpinMod4	SpinMod5	SpinMod6	
1	16:00:11	16:02:09	1:58	0:56	-:-	-:-	-:-	0:38	-:-	(16:00:43 F2 Mod1 HF/DI 20 ml/min) (16:00:43 Mod1 Arm 1 Temp 26 C) (16:01:12 EPD 1 Time 25 seconds)
2	16:00:23	16:02:27	2:04	-:-	0:58	-:-	-:-	-:-	0:41	(16:00:52 F5 Mod2 HF/DI 20 ml/min) (16:00:52 Mod2 Arm 1 Temp 24 C) (16:00:58 EPD 2 Time 26 seconds)
3	16:00:32	16:03:06	2:34	0:55	-:-	-:-	-:-	0:38	-:-	(16:01:41 F2 Mod1 HF/DI 20 ml/min) (16:01:41 Mod1 Arm 1 Temp 26 C) (16:02:10 EPD 1 Time 25 seconds)
4	16:01:24	16:03:22	1:58	-:-	0:54	-:-	-:-	-:-	0:41	(16:01:53 F5 Mod2 HF/DI 20 ml/min) (16:01:53 Mod2 Arm 1 Temp 24 C) (16:01:58 EPD 2 Time 26 seconds)
5	16:01:36	16:04:08	2:32	0:55	-:-	-:-	-:-	0:37	-:-	(16:02:43 F2 Mod1 HF/DI 20 ml/min) (16:02:43 Mod1 Arm 1 Temp 26 C) (16:03:12 EPD 1 Time 25 seconds)
6	16:02:27	16:04:24	1:57	-:-	0:53	-:-	-:-	-:-	0:41	(16:02:56 F5 Mod2 HF/DI 20 ml/min) (16:02:56 Mod2 Arm 1 Temp 24 C) (16:03:01 EPD 2 Time 26 seconds)
7	16:02:35	16:05:11	2:36	0:55	-:-	-:-	-:-	0:38	-:-	(16:03:45 F2 Mod1 HF/DI 20 ml/min) (16:03:45 Mod1 Arm 1 Temp 26 C) (16:04:14 EPD 1 Time 25 seconds)
8	16:03:29	16:05:26	1:57	-:-	0:54	-:-	-:-	-:-	0:42	(16:03:57 F5 Mod2 HF/DI 20 ml/min) (16:03:57 Mod2 Arm 1 Temp 24 C) (16:04:03 EPD 2 Time 26 seconds)
9	16:03:37	16:06:12	2:35	0:55	-:-	-:-	-:-	0:37	-:-	(16:04:47 F2 Mod1 HF/DI 20 ml/min) (16:04:47 Mod1 Arm 1 Temp 26 C) (16:05:16 EPD 1 Time 25 seconds)
10	16:04:31	16:06:32	2:01	-:-	0:54	-:-	-:-	-:-	0:41	(16:04:59 F5 Mod2 HF/DI 20 ml/min) (16:04:59 Mod2 Arm 1 Temp 24 C) (16:05:05 EPD 2 Time 26 seconds)
11	16:04:39	16:07:19	2:40	0:55	-:-	-:-	-:-	0:38	-:-	(16:05:50 F2 Mod1 HF/DI 20 ml/min) (16:05:50 Mod1 Arm 1 Temp 26 C) (16:06:19 EPD 1 Time 25 seconds)
12	16:05:33	16:07:35	2:02	-:-	0:58	-:-	-:-	-:-	0:42	(16:06:02 F5 Mod2 HF/DI 20 ml/min) (16:06:02 Mod2 Arm 1 Temp 24 C) (16:06:07 EPD 2 Time 26 seconds)
13	16:05:42	16:08:21	2:39	0:55	-:-	-:-	-:-	0:37	-:-	(16:06:56 F2 Mod1 HF/DI 20 ml/min) (16:06:56 Mod1 Arm 1 Temp 26 C) (16:07:24 EPD 1 Time 25 seconds)
14	16:06:40	16:08:37	1:57	-:-	0:54	-:-	-:-	-:-	0:41	(16:07:08 F5 Mod2 HF/DI 20 ml/min) (16:07:08 Mod2 Arm 1 Temp 24 C) (16:07:13 EPD 2 Time 26 seconds)
15	16:06:48	16:09:24	2:36	0:55	-:-	-:-	-:-	0:38	-:-	(16:07:59 F2 Mod1 HF/DI 20 ml/min) (16:07:59 Mod1 Arm 1 Temp 26 C) (16:08:28 EPD 1 Time 25 seconds)
16	16:07:42	16:09:40	1:58	-:-	0:55	-:-	-:-	-:-	0:41	(16:08:10 F5 Mod2 HF/DI 20 ml/min) (16:08:10 Mod2 Arm 1 Temp 24 C) (16:08:16 EPD 2 Time 26 seconds)
17	16:07:50	16:10:26	2:36	0:55	-:-	-:-	-:-	0:37	-:-	(16:09:01 F2 Mod1 HF/DI 20 ml/min) (16:09:01 Mod1 Arm 1 Temp 26 C) (16:09:29 EPD 1 Time 25 seconds)
18	16:08:45	16:10:42	1:57	-:-	0:53	-:-	-:-	-:-	0:42	(16:09:13 F5 Mod2 HF/DI 20 ml/min) (16:09:13 Mod2 Arm 1 Temp 24 C) (16:09:19 EPD 2 Time 26 seconds)
19	16:08:53	16:11:29	2:36	0:55	-:-	-:-	-:-	0:37	-:-	(16:10:04 F2 Mod1 HF/DI 20 ml/min) (16:10:04 Mod1 Arm 1 Temp 26 C) (16:10:33 EPD 1 Time 25 seconds)
20	16:09:47	16:11:45	1:58	-:-	0:55	-:-	-:-	-:-	0:42	(16:10:15 F5 Mod2 HF/DI 20 ml/min) (16:10:15 Mod2 Arm 1 Temp 24 C) (16:10:20 EPD 2 Time 26 seconds)
21	16:09:55	16:12:31	2:36	0:55	-:-	-:-	-:-	0:37	-:-	(16:11:06 F2 Mod1 HF/DI 20 ml/min) (16:11:06 Mod1 Arm 1 Temp 26 C) (16:11:34 EPD 1 Time 25 seconds)
22	16:10:50	16:12:47	1:57	-:-	0:54	-:-	-:-	-:-	0:42	(16:11:18 F5 Mod2 HF/DI 20 ml/min) (16:11:18 Mod2 Arm 1 Temp 24 C) (16:11:24 EPD 2 Time 26 seconds)
23	16:10:58	16:13:40	2:42	0:55	-:-	-:-	-:-	0:44	-:-	(16:12:09 F2 Mod1 HF/DI 20 ml/min) (16:12:09 Mod1 Arm 1 Temp 26 C) (16:12:38 EPD 1 Time 25 seconds)
24	16:11:52	16:13:58	2:06	-:-	0:55	-:-	-:-	-:-	0:48	(16:12:20 F5 Mod2 HF/DI 20 ml/min) (16:12:20 Mod2 Arm 1 Temp 24 C) (16:12:25 EPD 2 Time 26 seconds)
25	16:12:00	16:14:32	2:32	0:55	-:-	-:-	-:-	0:34	-:-	(16:13:11 F2 Mod1 HF/DI 20 ml/min) (16:13:11 Mod1 Arm 1 Temp 26 C) (16:13:39 EPD 1 Time 25 seconds)

Total Time = 00:14:21, Total Wafers = 25, Average Time per Wafer = 00:00:34

Average output = 31.0 sec per wafer or 116 wafers per hour

Veeco 3303/4 Fully Automated, 3-4 Process Modules

Veeco Systems for Effective, Backside Wafer Cleaning Performance

Veeco systems are available in sizes and configurations suitable for your production requirements. All systems are SEMI® S2-0703e Safety and SEMI S8 Ergonomics Compliant, CE Marked, and ETL Listed.

Learn more about Veeco's single wafer process capabilities at www.veeco.com/PSP

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