

Application Note

WetSpec In-line Process Analyzer

Cleaning: Water in Organic Solvents & SC1 Composition

Continuous real-time monitoring of wet processes achieves two major goals in the semiconductor industry: improved yield and reduced costs. On-line measurement of chemical concentrations enables tighter process control, helps avoid out-of-spec process conditions, and improves yield. Chemical monitoring also extends the lifetime of chemical baths, thus reducing both fresh chemical costs, and the costs of chemical disposal. These goals are accomplished without burdening the fab laboratory with endless analysis.

Abstract

This application note describes two WetSpec installations that monitor two very different chemistries: water in an organic solvent, and the composition of SC1. The calibration model for the water content of ACT 970 was developed on-site at a customer's fab, and provided accurate real-time data on the photoresist stripping process. This enabled correct process control and significant savings in chemical and chemical disposal costs. Calibration models for both hydrogen peroxide and ammonium hydroxide in a SC1 solution were developed in CI-Semi's laboratory, and successfully applied in the customer's tool, providing feedback on periodic process changes.

Case Study Outline

I. Organic solvents are commonly used in the industry for photoresist stripping. Many of these solvents contain a certain percentage of water that is critical to the proper use of the solvent. The stripper is not effective when the water content is too low, and too high of a water content can cause corrosion of metal layers on the wafer. Water tends to evaporate from these solvents in the heated process baths, so 'spiking' the bath with extra water is often required in order

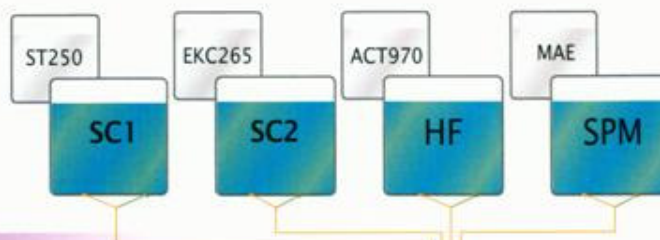
to extend the solvent lifetime, and reduce the costs of solvent replacement and disposal. Using the WetSpec for on-line monitoring of the solvent water content can enable the extension of bath lifetime while maintaining proper bath operation.

II. Standard Clean 1, or SC1, is one of the most commonly used cleaning solutions in the industry. Its effectiveness is dependent on maintaining constant concentration of its components, ammonium hydroxide and hydrogen peroxide. Ammonia evaporates from the heated solution, and hydrogen peroxide is unstable in these conditions, turning into water and oxygen, which appears as bubbles in the solution. The presence of bubbles is a challenge to any monitoring system. On-line monitoring of SC1 can enable the proper addition of chemicals to the cleaning solution in order to maintain cleaning effectiveness.



WetSpec200

Schematic System Configuration



Typical Applications *

Application	Component	Range wt%
SC1	NH ₄ OH	0-1.5
	H ₂ O ₂	0-3
SC2	HCl	0-4
	H ₂ O ₂	0-8
DSP	H ₂ SO ₄	8-13
	H ₂ O ₂	2-5
HF/HCl	HF	0-20
	HCl	0-1.2
HF	HF	0-20
Hydrofluoric Peroxide	HF	22-27
	H ₂ O ₂	13-17
Buffered Oxide Etch	HF	1-5
	NH ₄ F	16-24
Nitric/Acetic Acid	HNO ₃	1-4
	CH ₃ COOH	8-12
ACT 970	H ₂ O	14-19
EKC265	H ₂ O	16-28
ST-265	H ₂ O	5-20
ST-250	H ₂ O	34-38
Peroxide in CMP Slurry	H ₂ O ₂	0-5
Ammonium Hydroxide	NH ₄ OH	0-5
Citric Acid	Citric Acid	0-1.5



* Other chemistries/ranges supported per request

Key Specifications

Measurement method	Fiber-optic remote NIR spectroscopy
Calibration method	Chemometrics
Multi-channel ability	Up to eight measurement channels
Time per measurement	Up to 30 sec (Application depended)
Sample conditioning	None required
Temperature compensation	Automatic and continuous
Wetted materials	Process compatible cell body (Teflon®/PEEK/SS), sapphire windows, approved seal materials
Communication	RS232 / Analog / Ethernet
Fiber length	Up to 200m
Size	Single 2U 19" rack unit



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Specifications are subject to change without prior notice.

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