



SILEX II

Batch Wet Processing
System for Solar Cells

SILEX II

Modular, Automated Wet Processing System for Batch Cleaning and Etching for Solar Cells

SINGULUS TECHNOLOGIES provides complete automated dry-in/dry-out solutions for wet-chemical treatments of Si-wafers in standard and high-efficiency cell lines.

The modular SILEX II batch system offers a wide range of process options. With respect to highest flexibility in configuration, the SILEX II machine is characterized by a clear modular design and a compact footprint.

The SILEX II machine concept fulfills current and future requirements of capacity, flexibility and reliability for mass production.

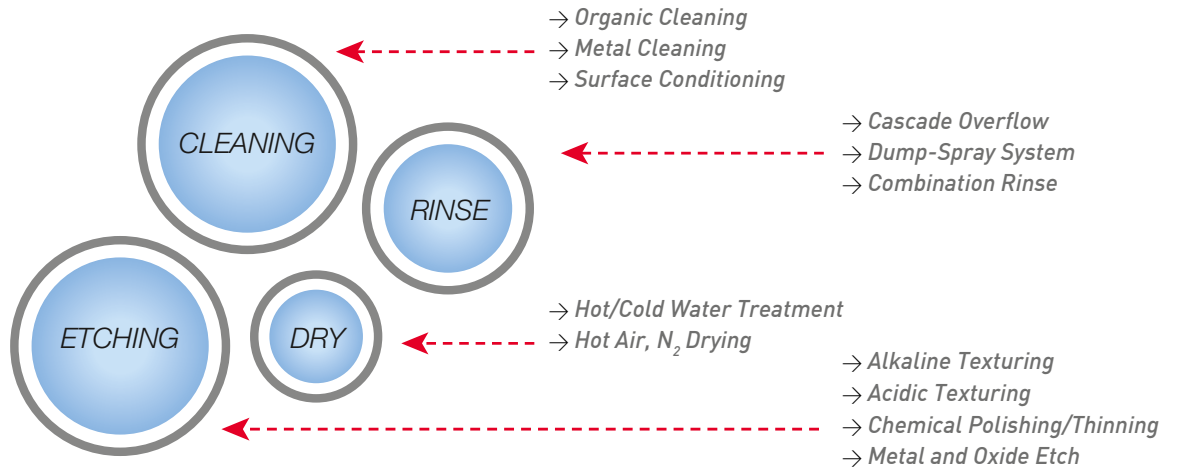
The SILEX II 8000 system achieves an output of up to 8000 wph. The SILEX II 4000 system with a reduced batch size will cover a tool capacity of up to 4000 wph for smaller volume production. Both SILEX II systems are running with very low scrap rates down to 0.01 % and a high process yield.



SILEX II

Batch Wet
Processing Equipment

Common and Advanced Process Applications



SILEX II Batch Wet Processing Equipment

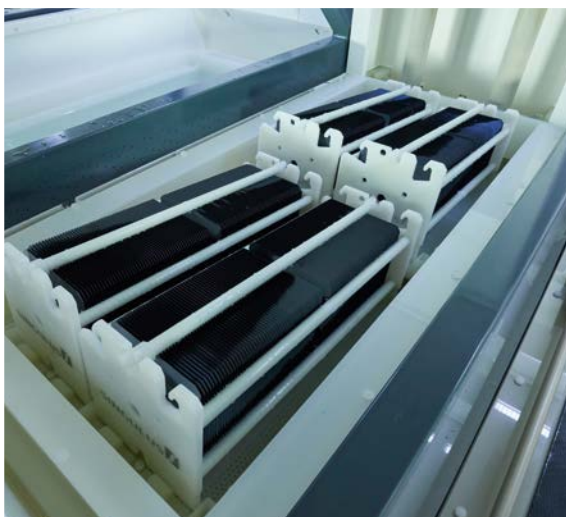
The **SILEX II ALTEX** machine is designed to apply IPA-free texturing processes, offering substantial cost advantages compared to traditional etching systems. This texturing process can be adjusted to the individual requirements of standard and advanced cell technologies.

The **SILEX II CLEANTEX** combines common etching and cleaning steps of monocrystalline Si with advanced cleaning and conditioning processes. Efficient cleaning steps are an indispensable requirement to improve cell efficiencies and reduce operation costs. Ozone-based cleaning operations, applied on SILEX II wet bench, combine efficient organic and metal removal with an appropriate surface conditioning. Due to low chemical costs and consumption, simple process control and high metal removal efficiency, ozonized cleaning baths are the perfect substitute for traditional, expensive multi-step RCA cleanings, known from the solar and semiconductor industry.

The **SILEX II CLEAN** is provided to run dedicated cleaning sequences for pre- or post-deposition processes. Depending on cell process flow and requirement the configuration can be designed individually, involving RCA or Ozone based cleanings as well as slight etching steps.

Typical Features

- High throughput performance up to 8000 wph
- High uptime up to 95 %
- Low breakage rate down to 0.01 %
- Wafer thickness down to 120 µm (<120 µm on request)
- Individual, flexible process sequencing
- Onboard scheduler software for throughput tuning
- Onboard performance analyzer software
- Ozone-enhanced cleaning and etching processes
- Short and stable IPA-free texturing process
- Appropriate and effective rinsing and drying



SILEX II

Technical Data

Application	Etching and Cleaning of Solar/IC Wafers	
Throughput	Up to 8000/4000 wph	
Dimension (L/W/D)	SILEX II CLEAN ³	8800 x 2150/2600 ² x 2600 mm
	SILEX II ALTEX ¹	13600 x 2150/2600 ² x 2600 mm
	SILEX II CLEANTECH ¹	18400 x 2150/2600 ² x 2600 mm
Processes	Pre-Clean	Alkaline, acidic
	SDE/Texture	Alkaline (CellTex®)
	Cleaning	Alkaline, acidic
	Rinse	DIW overflow rinse
	Drying	Hot Air, Hot N ₂
Wafer	Size	M1-M4
	Thickness	<120 µm post process
Facilities	Liquid media	DI water, chemicals
	Gases	Compressed air, N ₂ , O ₂
	Exhaust	
	Electrical power	400 VAC
Options	DI water heater Chiller Extended load/unload buffer Chemical supply systems Waste water pump stations SINGULUS process carrier (100 wafers) Ozone system	

¹ Standard configuration for CellTex® Process (BKM SINGULUS)

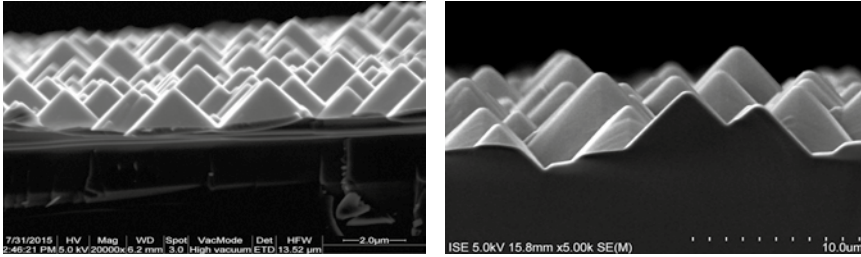
² 200/400 wafer batch

³ Standard configuration 2-steps clean

SILEX II

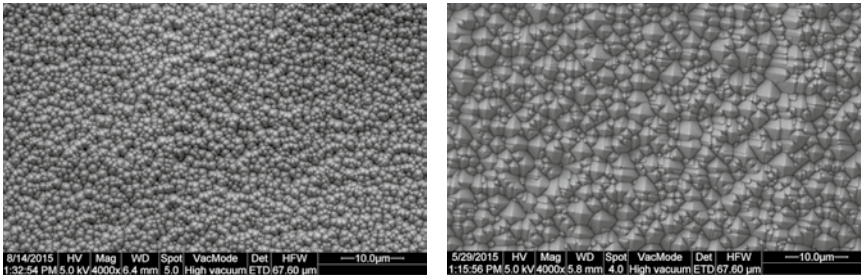
Advanced Wet Processing

Pyramid Rounding with Ozone



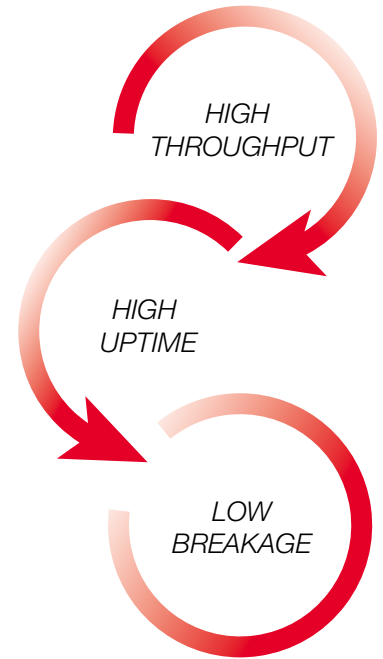
Slight Etch-back
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BKM SINGULUS – CellTex®



CellTex® ULTRA 1-3 µm

CellTex® ULTRA M 2-5 µm



Alkaline Texturing

The core of the current and future batch process applications is the alkaline texturing process of mono-crystalline silicon, generating pyramidal-etched surfaces with optimal light trapping, passivation and contacting properties.

State-of-the-Art Texturing Additive

- Commercially available product, worldwide supported
- Multiple pyramid size tuning options
- Short and robust etching process with large process window and close uniformity range
- Stable composition with long bath lifetime
- Non-hazardous, non-flammable, non-dangerous
- Readily biodegradable

Ozone Cleaning

Ozone is one of the most powerful oxidizing agents. Effective Ozone-gas injection, low chemical concentrations and ambient process temperatures guarantee stable and highly effective process sequences for oxidation, cleaning and etching.

- Reduced CoO cost saving effect vs. RCA cleaning (high chemical cost)
- Higher minority carrier lifetime (combined Si etch-back and advanced cleaning)
- Smaller machine footprint (reduced number of process tanks)
- Improved surface passivation
- Environmentally friendly process using



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THIN FILM
DEPOSITION

SURFACE
ENGINEERING

THERMAL
PROCESSING

WET
CHEMICAL

SINGULUS TECHNOLOGIES – Innovations for New Technologies

SINGULUS TECHNOLOGIES develops and assembles innovative machines and systems for efficient and resource-saving production processes, which are used worldwide in the solar, semiconductor, medical technology, consumer goods and optical disc sectors.

The company's core competencies include various processes of coating technology, surface treatment and wet-chemical and thermal production processes.