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**

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

**Common and Advanced Process Applications**

- **ETCHING**
  - Alkaline Texturing
  - Acidic Texturing
  - Chemical Polishing/Thinning
  - Metal and Oxide Etch

- **CLEANING**
  - Organic Cleaning
  - Metal Cleaning
  - Surface Conditioning
  - Cascade Overflow
  - Dump-Spray System
  - Combination Rinse

- **RINSE**
  - Hot/Cold Water Treatment
  - Hot, N₂ Drying
  - Alkaline Texturing
  - Acidic Texturing
  - Chemical Polishing/Thinning
  - Metal and Oxide Etch

- **DRY**
  - Hot Air, N₂ Drying
  - Organic Cleaning
  - Metal Cleaning
  - Surface Conditioning
**SILEX II**  
*Technical Data*

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<th>Application</th>
<th>Etching and Cleaning of Solar/IC Wafers</th>
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<tr>
<td>Throughput</td>
<td>Up to 8000/4000 wph</td>
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<tr>
<td>Dimension (L/W/D)</td>
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<tr>
<td>SILEX II CLEAN</td>
<td>8800 x 2150/2600² x 2600 mm</td>
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<tr>
<td>SILEX II ALTEX</td>
<td>13600 x 2150/2600² x 2600 mm</td>
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<tr>
<td>SILEX II CLEANTEX</td>
<td>18400 x 2150/2600² x 2600 mm</td>
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<td>Pre-Clean</td>
<td>Alkaline, acidic</td>
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<tr>
<td>Wafer Size</td>
<td>M1-M4</td>
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<td>Thickness</td>
<td>&lt;120 μm post process</td>
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<td>Facilities</td>
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<td>400 VAC</td>
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<td>DI water heater</td>
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<td>Chiller</td>
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<td>Extended load/unload buffer</td>
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<td>Waste water pump stations</td>
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<td>SINGULUS process carrier [100 wafers]</td>
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<td>Ozone system</td>
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1 Standard configuration for CellTex® Process (BKM SINGULUS)  
2 200/400 wafer batch  
3 Standard configuration 2-steps clean
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
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 data storage.

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