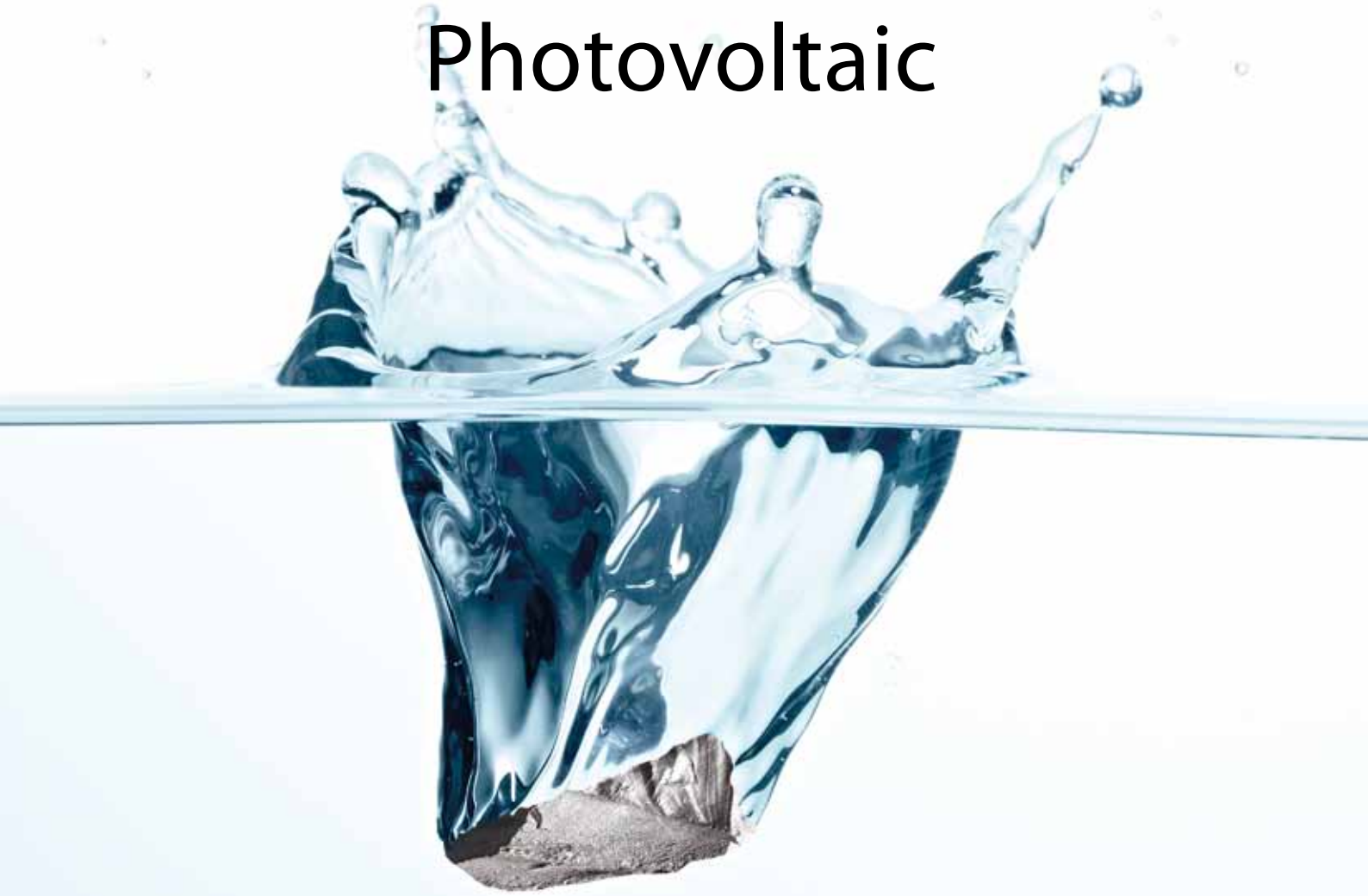
DECKER

Photovoltaic



Version 2 / 02.2011

Wet chemical solutions - created by DECKER

DECKER at a glance

Silicon

A material which has changed the world …

And it was just the same for DECKER. The complex process of production of this ultrapure material is a challenge for equipment and manufacturer. Purity, homogeneous process conditions and reliable machine technology are the elementary construction guidelines for each new plant.

The company DECKER has also changed due to these requirements, the former iron foundry is now an international active company and it is a reliable partner in realizing turnkey factories for the production of poly- and monocrystalline silicon.

References

- **Bosch**
- **MEMC**
- **PERI**
- **Q-Cells**
- **Semitool**
- **SEZ**
- **Siemens**
- **SIZ**
- **Solar World**
- **STSIC**
- **TPSI**
- **Wacker**

Milestones

Outstanding milestones in the long history

1891 Establishment of the GEBRÜDER DECKER KG

1978 Production start of silicon ingot and wafer etching equipments for the semiconductor industry

1980 First etching equipments for solar cells

1989 First etching equipment for microelectronic grade silicon chunks

2004 Recycling equipment for granular silicon down to 50 µm

2010 Wet wafer separator GECKO

About Us

DECKER is experienced in processing of various silicon materials like ingots, chunks, wafers and granule. Our profound knowledge in cleaning, etching, drying, recycling, handling and waste gas treatment is appreciated by customers in the semiconductor and PV industry.
Specific, tailor-made solutions, often developed in close cooperation with our customers, have met acceptance in high degree.

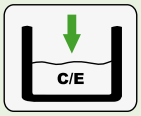
Our customers are well-known companies in the PV and semiconductor sector all over the world.
Our modern business facilities are located in Germany/Bavaria nearby Nuremberg.

DECKER is certified to ISO 9001, accredited according to § 19 I Water Management Act and has met the strict quality requirements of the semiconductor and automotive industry for years.

Worldwide

Our goal is to create uncompromisingly best quality at sustainably low operational costs - worldwide. Day by day, the realization of this ambitious aim is tackled by our capable team with inventive talent, pragmatism and enthusiasm. Due to this fact, today DECKER is an important supplier of turnkey systems for wet chemical processes for cleaning and etching of crystalline silicon in the PV sector. The next business objective is the extension of the global presence to support our customers on site in an optimal way.

Business Segments

	Cleaning / Etching 	Recycling 	Special Application 
chunks	X		
rods	X		
granule	X	X	
scrubber			X
wafer	X	X	X

DECKER at a glance

Silicon Chunks

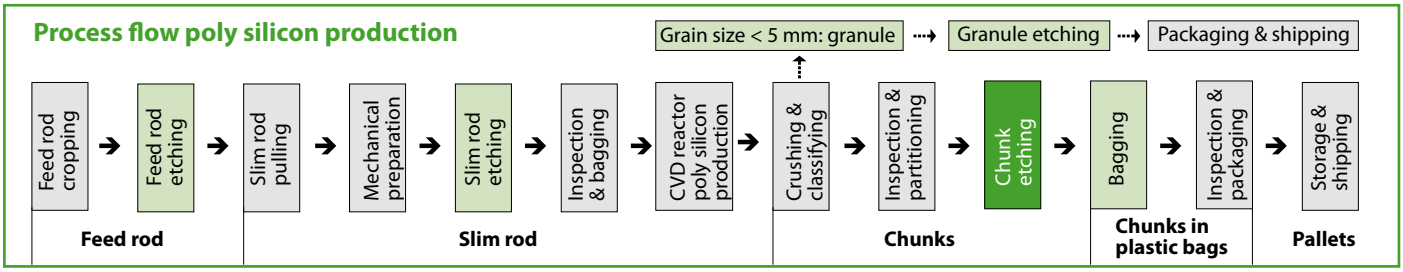
Etching of Silicon Chunks

DECKER's automatic chunk etching systems incorporate the latest wet-cleaning technology for best silicon quality and high throughput. This technology allows the removal of all particles, organic and metal impurities adsorbed on the surface of silicon chunks. Low chemical, water and power consumption help to produce silicon for PV and micro-electronic applications with marginal operational costs. Process sequence and length of equipment can easily be customized by the modular design of the equipment to each customer's requirement in microelectronic or PV applications.

Key Benefits

- Homogeneous etching process for removing all impurities from silicon surface
- Patented barrel dryer for low temperature silicon drying
- Modular process and equipment design for easy adaptation to customer's requirements
- Consistent silicon surface-conditions by inline monitoring of process parameters
- Low water consumption by water reuse in Multi-Function-Rinses
- Ergonomic loading, unloading and packing solutions available

Process flow poly silicon production



Handling of Silicon Chunks

The polysilicon rods are mechanically broken into 5 to 100 mm chunks and undergo stringent surface etching and cleaning in a clean room environment. DECKER's etching machine is equipped with perforated rotating barrels for the transfer of the chunks from tank to tank. The adjustable slow rotation of the barrel induces a careful shift between the chunks, ensuring thereby a uniform treatment. At the same time breakage of chunks and drag-out of process liquid are reduced to a minimum. Up to five packing batches are processed in separate barrel compartments.

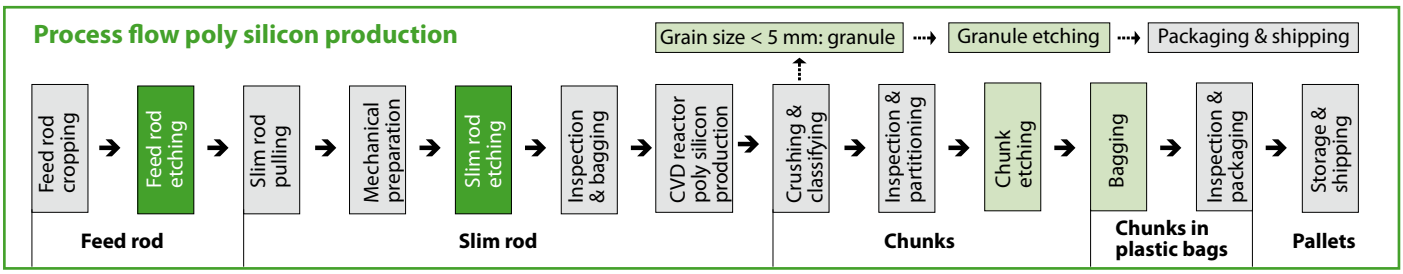
Silicon Rods

Etching of Silicon Rods

DECKER's flexible automatic rods etching equipment can handle all kinds of silicon rods (Slim rods, feed rods and rods for wafer manufacturing).
The combined cleaning and etching process allows to produce silicon rods without particles, organic and metal impurities adsorbed on the ,rod surface. A combined cleaning and etching tank, together with cascade rinse technique save installation space as well as rinse water.

Silicon Rods

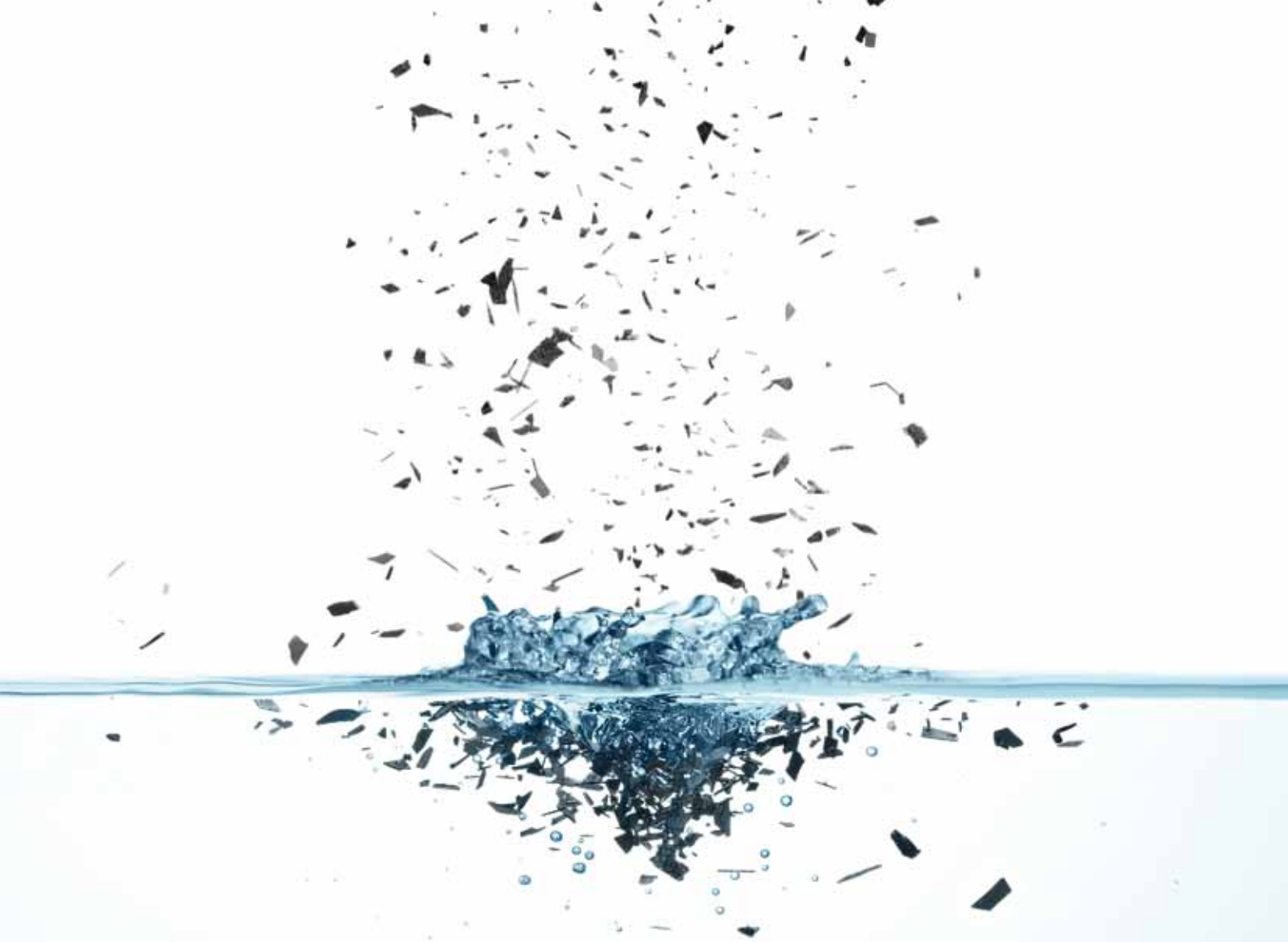
Process flow poly silicon production



Key Benefits

- Flexible – easily adjustable barrels for all kinds of silicon rods
- Safe – completely enclosed system for safety, protection against pollutants and reduction of exhaust volume
- Reliable - rigid, chemical resistant design for long term customer satisfaction
- Consistent – relevant process parameters are monitored continuously
- Economic - low rinse water consumption by water reuse in Multi-Function-Rinses
- Ergonomic - approved loading, unloading and packing solutions available
- Qualitative - homogeneous etching process to remove all impurities from the rod surface

Silicon Rods

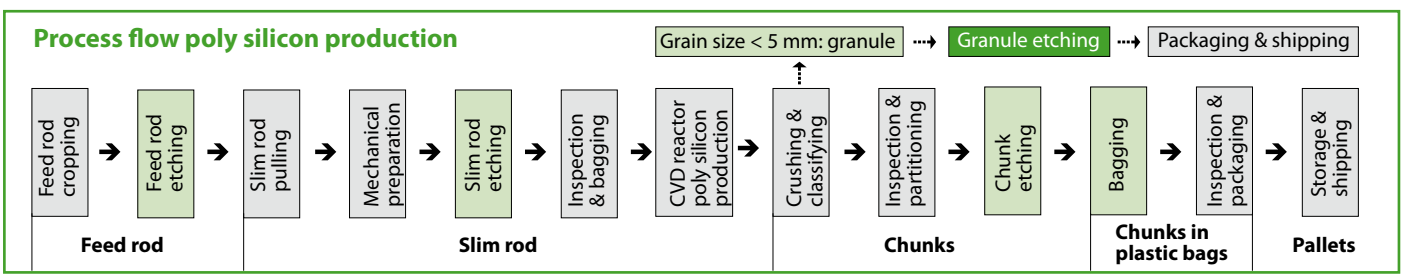


Silicon Granule

Recycling of Silicon Granule

In the course of polysilicon production as well as during wafer-manufacture and -processing, a considerable amount of scrap and waste in granular and bigger form is unavoidable.
DECKER's sophisticated equipment recovers this valuable material down to the fracture of 50µm. The silicon granule is cleaned by acid etching, rinsed , dried and packed. Now it can be sold or directly returned to the production process for new polysilicon.

The system has demonstrated its ability over several years of operation.


Process flow poly silicon production
Grain size < 5 mm: granule
Granule etching
Packaging & shipping
Feed rod cropping
Feed rod etching
Slim rod pulling
Mechanical preparation
Slim rod etching
Inspection & bagging
CVD reactor poly silicon production
Crushing & classifying
Inspection & partitioning
Chunk etching
Bagging
Inspection & packaging
Storage & shipping
Feed rod
Slim rod
Chunks
Chunks in plastic bags
Pallets

Key Benefits

- Profitable – shortest return of invest
- Effective – recycling capacity up to 450 metric tons of granule per year
- Economic - low chemical and rinse water consumption by spray and vacuum supported process
- Reliable - rigid, chemical resistant design for long term customer satisfaction
- Consistent – relevant process parameters are monitored continuously

Silicon Granule

Scrubber

Scrubber

SA

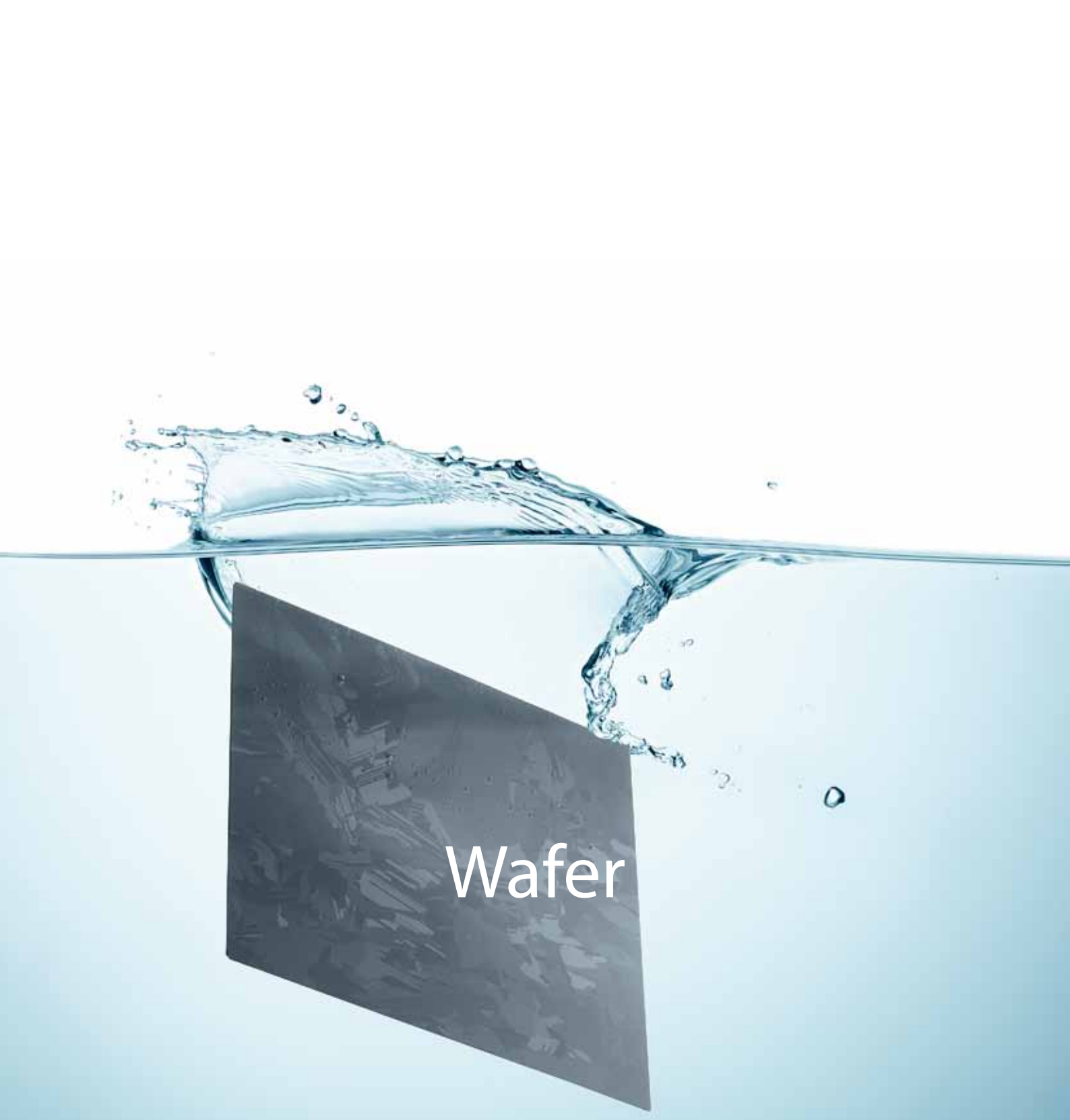
Waste Gas Treatment

DECKER's automatic scrubber system is optimized to clean polluted and hazardous waste gas from DECKER's silicon etching lines.
Particularly waste gas with NOx, HF and SiF4 -rates can be safely absorbed to a minimum.
Furthermore a special nitride detoxification station is included which reduces the nitride load to the waste water treatment.

Key Benefits

- Environment-friendly – scrubber absorbs hazardous gases from silicon etching equipment to a minimum
- Maintenance friendly – fully automatical chemical dosing with integrated pH- and conductivity measurement
- Completely - integrated nitride detoxification station for waste water treatment
- Flexible - automatic flow rate adjustment while coeval operation of several DECKER etching systems

Scrubber


Wafer

Gecko

Wafer Separation System

Wafer Separation

DECKER developed under the trade name Gecko a fully automated handling system for the separation of thin wafers (130 - 300 µm) from wet wafer stacks onto conveyor belts of following processing machines. A proprietary textured transfer-pad attaches the topmost wafer of a vertically oriented wafer stack by means of adhesion forces, removes the wafer with a motion and drops it gently on a conveyor belt. The areal contact of the transfer-pad with the whole wafer surface guarantees the reliable pickup of the wet wafers and eliminates wafer-breakage.

During that operation, the wafer does not touch any hard surface or is bent in any way. Even broken wafers or parts of them are picked up flawlessly. Each separated wafer is inspected by a vision system and damaged wafers, double-picks or wafer pieces are sorted out automatically.
The qualified separated wafers are fed into a buffer system that either loads an inline multi-lane final wafer cleaning machine or a wafer cassette for batch cleaning.

The Gecko system is modular designed. Two separation modules can be added to a base unit, called Gecko 1600 (1,600 wafers/hour gross throughput per module), forming a system of maximum three modules, which meets the throughput requirements of any factory.

Key Benefits

- Gentle, stress-free separation of wet wafers from stack onto conveyor belt
- A vision system sorts out damaged wafers, double-picks, and wafer pieces
- Broken wafers in wafer stack do not lead to system failure
- Can process mono- and multi-crystalline, square or pseudo-square wafers of any size
- Ability to process thin wafers (130 - 300 µm) with very low breakage rate (≤ 0.3%*)
- Modular concept to match throughput requirements of any factory
- Easy customized configuration for loading either a multi-lane wafer cleaning machine or wafer cassettes for batch cleaning

Cleaning / Etching of Wafers

DECKER concepts are aiming on removing surface impurities by chemical cleaning and etching. In terms of this treatment deficiencies induced by slicing, edge rounding and lapping are eliminated. Slurry, glass and adhesive residues are reliably removed. Our automatic etching systems incorporate the latest wet cleaning technology for short cycle-time while maintaining a high throughput. Beside modular and standardized equipment DECKER also offers completely customized systems for cleaning, etching and drying of all kinds of silicon or metal parts and components. Our focus is helping our customers to produce high quality parts environmentally-friendly by saving limited resources and water.

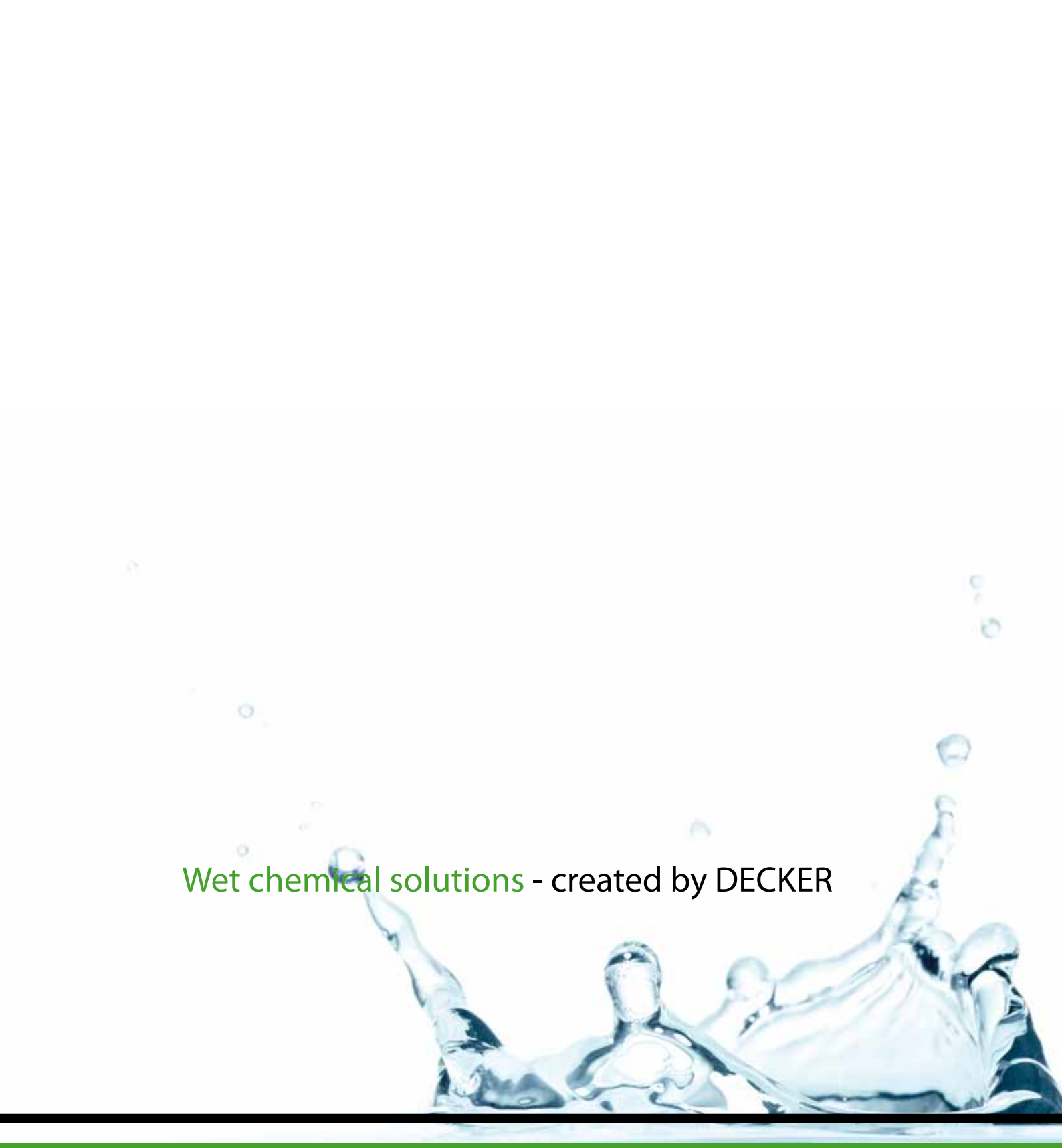
Key Benefits

- Completely customized systems according customers requirements
- Enclosed equipment for protection against hazardous vapours and reduction of exhaust volume

Special Application of Wafers

Referring to DECKER's automatic etching lines the latest wet-cleaning technology demands new methods for cleaning and treating pure silicon and silicon compounds. A high degree of galvanic know-how combined with some twenty years of experience in the field of wet chemical cleaning and etching equipment are the base to fulfil all customer requirements; such as passivation of semi-conductor thyristors. These thyristors are used as highly efficient rectifiers controlled by laser light to deliver a voltage up to 400kV.

Wet chemical solutions - created by DECKER



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