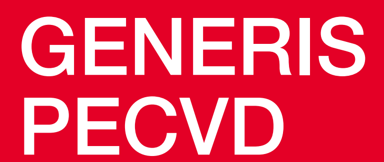


GENERIS PECVD

Inline Plasma Enhanced Chemical Vapor Deposition System for AlO_x and SiN_y on PERC Solar Cells

SINGULUS

GENERIS PECVD

Inline Plasma Enhanced Chemical Vapor Deposition System for AlO_x and SiN_y on PERC Solar Cells

Vacuum Deposition Technology at a Glance

SINGULUS TECHNOLOGIES has delivered far more than 8000 vacuum sputtering machines since its foundation in 1995. The machines range from standard sputtering systems to ultra-high vacuum deposition machines applying extremely thin layers of around 0.2 nm for the semiconductor industry as well as photovoltaic, data storage, decorative coatings and other applications.

In addition, vacuum thin-film technology is used in modern sensory technology for medical uses and in vehicle technology as well as for piezoelectric materials in mobile phone technology.

GENERIS PECVD

Inline PECVD System for AlO_x and SiN_y Deposition on PERC Solar Cells

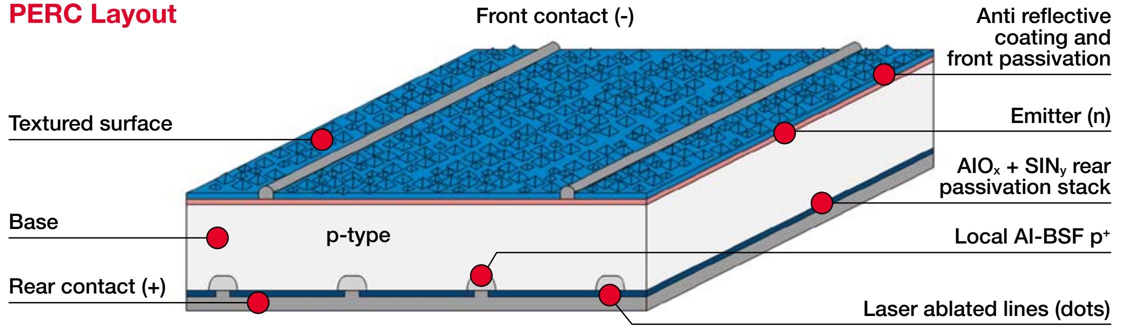
One main focus during solar cell production is on cost per W_p. Passivated emitter and rear cell technology (PERC) is a comparatively low-cost approach to achieve conversion efficiencies over 22 %. The newly developed GENERIS PECVD system is a horizontal inline tool designed for the special needs in photovoltaic mass production.

PERC solar cells are coated on both sides with dielectric passivation layers. Rear side passivation is achieved by deposition of a thin AlO_x-layer capped by SIN_y. On the front side, a layer of SiN_x serves for both, passivation and anti-reflective coating (ARC). The system is ideally suited for cost effective mass production with high uptime, short cleaning interruptions and maximum utilization of raw materials. Full substrate temperature control during the whole process enables optimum layer performance at temperatures in the range of 450 °C.

The GENERIS PECVD system allows for deposition on both sides of the wafer without vacuum interruption. The usage of both the processes of AlO_x and SIN_y, are realized by a gas separation chamber. Thus GENERIS PECVD can be configured to individual needs:

- → AlO_x + SiN_y on rear and SiN_x on front for the complete PERC process
- → AlO_x + SiN_y for PERC rear side passivation
- → SiN_x on front and/or rear for ARC and/or rear capping layer only

PERC Layout



Especially the first configuration in which all PECVD layers are deposited in one tool represents a cost attractive straight forward solution for newly installed PERC fabs.

The system is using an inline process in which the substrates are transported on specially designed carriers for wafer size up to M4. The carrier return system is located below the machine under clean environmental conditions. Different automation options for loading and unloading are available.

For the future, GENERIS PECVD is as well ready to serve in the production of more advanced and ultra high efficiency cell architectures like PERT, IBC, TOPCon/POLO for example by single-side deposition of doped a-Si layers.

Inductively Coupled Linear Plasma Sources (ICP)

- Mild coating process, no damage to emitter or interfaces
- High dynamic deposition rates for both AlO_x and SiN_y, thus reduced number of plasma sources, reduced power consumption
- Economic gas consumption and usage
- Shortest cleaning and maintenance interruption

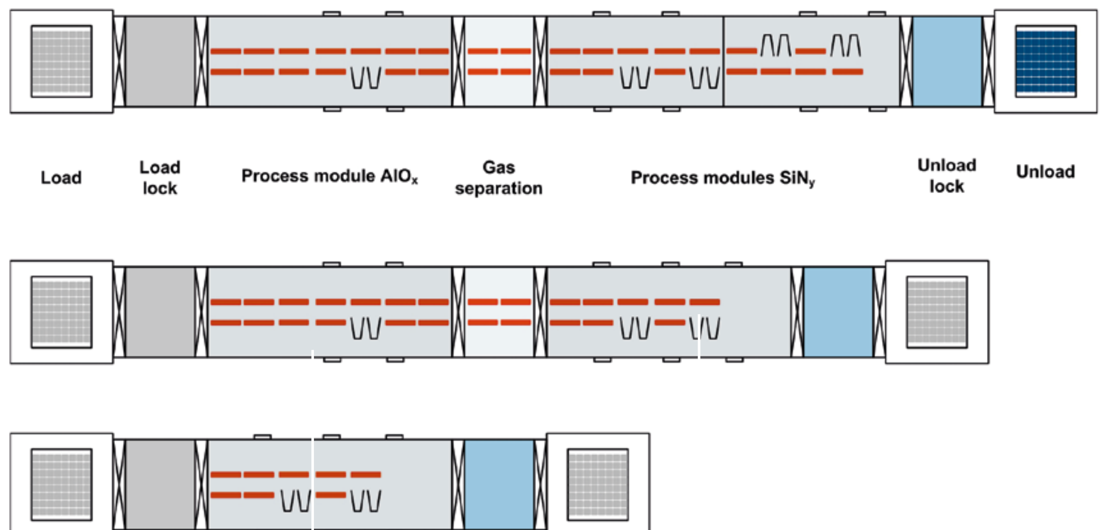
Summary GENERIS PECVD:

- Adaptable to every solar cell architecture
- Throughput scalable, number and sequence of process modules configurable
- IC-PECVD guarantees mild coating process, no damage to emitter or interfaces
- Full control on wafer temperature during the whole process sequence
- Complete PECVD sequence without vacuum interruption
- Economic gas consumption and utilization
- For wafer size up to M4
- Chamber and tray design to minimize parasitic deposition
- Tray return system under clean atmosphere
- 8000 wafer/h, uptime ≈ 97 %
- Ready for future cell architectures, e.g. passivated contacts

GENERIS PECVD

Typical Performance Characteristics

Wafer/tray	64 (8 × 8)
Cycle time	28.8 s/tray
Gross throughput	8000 wafer/h
Uptime	≈ 97 %
Scheduled downtime	≈ 2.5 %
MTBM	240 h
MTTM	4-8 h



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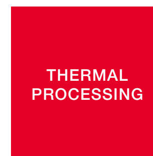
THIN FILM
DEPOSITION



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.

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