

Europe – A powerhouse in III-V solar cells manufacturing

Evatec Europe Sales Manager, **Frank Wette** and Head of Sales Europe **Sandro Bertelli** explain how Evatec evaporation solutions on the BAK and the latest substrate handling options are helping customers deliver the process repeatabilities and high production yields essential for successful manufacture of III-V solar cells.

Why III-V semiconductors for space applications?

III-V semiconductor-based photovoltaics play a crucial role in space applications due to their unique properties. Here are just some of the reasons why III-V solar cells are favoured for use in space:

■ High Efficiency:

III-V multi-junction solar cells exhibit exceptional efficiency compared to traditional silicon-based cells. For instance, a combination of InGaP with a bandgap of 1.9 eV, InGaAs with a bandgap of 1.4 eV and Ge with a bandgap of 0.7 eV allows III-V cells to absorb a broader range of photons at energies close to the individual bandgaps, making them highly efficient. Higher efficiency translates to smaller arrays, reduced weight, and increased payload capacity for spacecraft.

■ High Voltage:

Due to the serial combination of several III-V semiconductor absorbers within a multi-junction solar cell, the output voltage of an individual cell rises considerably. The high thermal stability of the III-V cell voltage compared to Silicon allows for the design of relatively short solar cell strings on a satellite panel, making the solar array design more flexible and reliable.

■ Radiation Resistance:

Space environments expose solar cells to cosmic radiation, which can degrade their performance. III-V materials have demonstrated superior radiation resistance compared to other materials. Additional concepts, such as distributed Bragg reflectors (fully patent protected by AZUR SPACE) within the semiconductor stack further enhance the radiation resistance of the III-V solar cell devices. They maintain efficiency even in harsh conditions.

■ Space Heritage:

III-V solar cells have been widely used in space systems for decades. Their reliability and proven track record make them a trusted choice.

In summary, III-V-based solar cells offer a compelling combination of efficiency, radiation resistance, and historical success in space applications. Their lightweight and flexible nature make them ideal for powering satellites and spacecraft.

Thin film process repeatability is key

Of course each manufacturer has their own cell designs and process requirements but Evatec typically supports customers with process solutions for deposition of either dielectrics for antireflection coatings or with process solutions for metals. The high added value of typical 6 inch substrates prior to coating call for both coating systems and processes that are robust for the reliable and stable repeatable deposition of layers without failures. Secure wafer handling is needed to eliminate risk of substrate damage and even breakage and coating process technology itself needs to avoid substrate damage due to stray electrons / ions.

Europe – A solar cell production powerhouse

We are very happy that our European region already has a number of well-established manufacturers including **AZUR SPACE** and **CESI** supporting a strongly growing global market.

AZUR SPACE
A 5N PLUS COMPANY

“More than 11 MW space qualified solar cells & CICs in space”

www.azurspace.com

CESI
Inspired with innovation

“Enabling four junction cells with space efficiencies beyond 35%”

www.cesi.it/space-solar-cells



**The BAK Evaporator Family –
A long history and an exciting future**

The original BAK evaporator concept may well be 50 years old but its flexible tool architecture combined with modern process source and control technology enables customers to manage manufacturing and recording of actual production process data according to the strict standards of the solar industry.

BAK platforms are currently available in a range of sizes from 0.5 to 1.4 meters optimized according to customer’s substrate size, batch processing size and throughput. The layout of a BAK1101, a typical size used by the solar industry, is shown in Figure 1. In addition to the usual e-gun technology there is plenty of space for integration of additional equipment such as plasma sources plus process accessories like heating. Platform control and process data logging is managed by Evatec’s Khan and a host integration option gives customers the control they need within the fab.

Whilst the solar cell industry may call for rigorous long term process repeatability and stability of the manufacturing environment that doesn’t mean there is no appetite for improving efficiency. For many manufacturers the road to driving down costs involves the increasing use of automation for substrate handling. Figure 2 illustrates how the latest generation of BAK evaporators can be equipped with a range of different semi or fully automated load options according to the substrate and platform size.

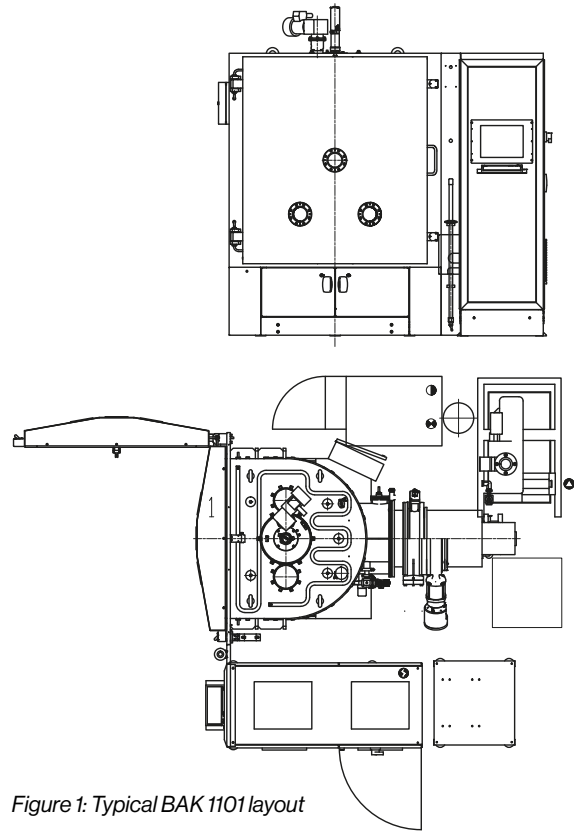


Figure 1: Typical BAK 1101 layout

A wealth of substrate handling options for the BAK family



Manual load / unload

- Either wafer direct to calotte in chamber or manual load of preloaded segment.



Semi automated

- Manual load of calotte-robot load / unload of calotte to chamber. Loading capacity per batch can be increased through unsegmented dome design.



Semi automated

- Manual load of calotte-robot load / unload of calotte to chamber via vacuum load lock. Reducing batch times through quicker unload / loading, faster pumping.



Fully automated

- Cassette-to-cassette (or FOUP to FOUP) via intermediate loadlock as featured on Multi BAK.

Increasing levels of handling automation

Figure 2: Semi or fully automated load options for BAK evaporators

Want to know more about the solar production solutions on the BAK platform?



Our application specialists would love to talk to you. Simply contact your local sales organization <https://evatecnet.com/about-us/contact-us/>



Access the latest brochure to learn more about the BAK family



Watch the Multi BAK video to learn how you can increase throughput and reduce energy costs

