



SOLAR APPLICATIONS

*Enabling you to increase throughput,
cell efficiencies and yields*

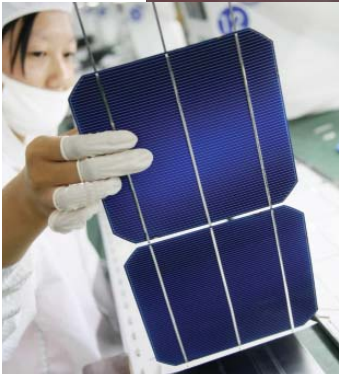
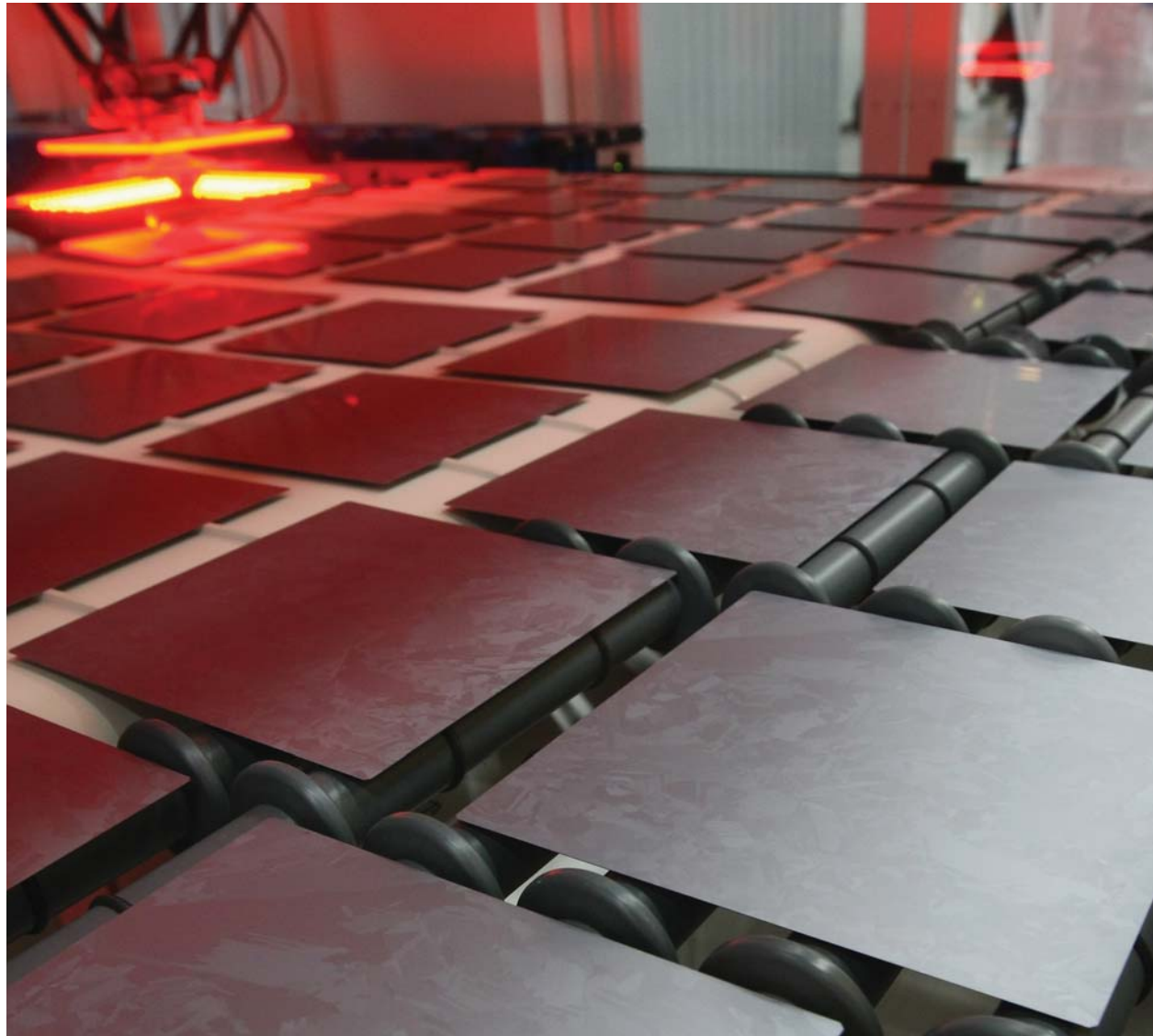


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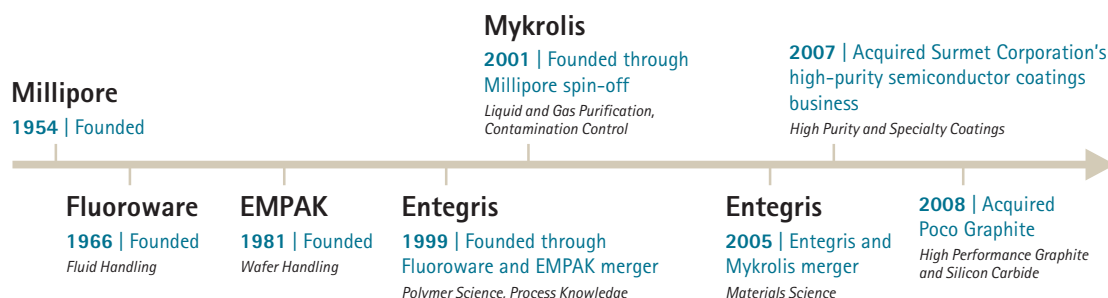
Visit www.pvprocesssolutions.com for the latest technical papers and application notes to improve your processes.

Why Entegris?

For more than 40 years, many high-tech industries have relied on Entegris to ensure the safety and purity of their technologies throughout the supply chain, from the raw chemicals to the final products. A portfolio of more than 17,000 products offers you a reliable, single-source provider with global manufacturing, customer services and technical support. With a broad product offering, advanced manufacturing capabilities, worldwide infrastructure and unmatched technical expertise, Entegris provides proven performance, efficiency and reliability in your processes.



Entegris leverages experience between Solar, Semiconductor, Energy, LED, Life Sciences, Consumer Electronics, Data Storage, Display, Petrochemical and Aerospace markets.



Broad Offering

Over the last 40 years, Entegris has developed a broad offering of high-purity materials, process control solutions and material handling to purify, protect and transport the critical materials that enable the world's leading technologies.

This experience offers you process solutions in contamination control, high-performance applications and product transportation requirements to meet your needs and provide a single source of flexible product offerings.



Experience You Can Count On



To ensure product performance throughout the production process, we have extensive capabilities in chemical, mechanical and physical property analysis.

Contamination control is critical to your manufacturing processes and has a direct impact on production yields, productivity and the cost of manufacturing. Entegris focuses on understanding your processes, sources of contamination and on developing material-enabled solutions to ensure the cleanliness and integrity of your process.

To support your vital applications, Entegris utilizes more than 200 methods and applications, 300 analytical instruments and 17 collaborating laboratories focusing on separation and materials science to provide you with the highest-purity, quality and robust products.

Separation Science: Utilizing advanced knowledge in separation-science techniques to facilitate the separation, purification and analysis of complex mixtures of organic and inorganic compounds offers solutions to precisely control micro and molecular contamination. Incorporating these techniques into your process improves your manufacturing flexibility and decreases your costs, providing you with the highest level of contamination control.

Materials Science: By studying the characteristics and uses of high-performance materials such as polymers, metals, graphite, silicon carbide, coatings and carbon nanotube composites, we offer you high-quality products to improve performance, cost of ownership and your manufacturing yield. Sophisticated laboratory equipment and inspection techniques enable our scientists to thoroughly analyze materials for temperature capability, chemical compatibility, structural tolerance and maximum strength.

Proven Quality and Performance

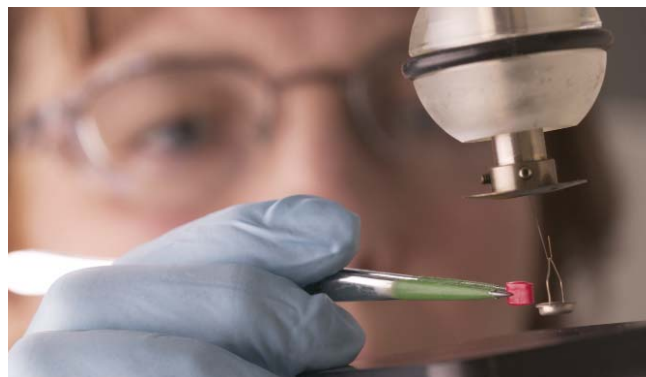
With over 900 patents, Entegris works directly with you to develop process knowledge and products that enable innovation and efficiencies. Combining advanced engineering and design expertise with tools such as Finite Element Analysis (FEA), Computational Fluid Dynamics (CFD) and Moldflow® analysis and modeling enables us to optimize product design and speed technological advancements. In addition to innovative design, Entegris also utilizes R&D and quality lab analysis and testing capabilities to develop dependable solutions.

QUALITY TESTING

- Vibration and shock
- Safety and industry standardization
- Trace metals
- Electrostatic charge

PERFORMANCE TESTING

- Particle testing
- Flow rate optimization
- Ion chromatography
- Failure analysis



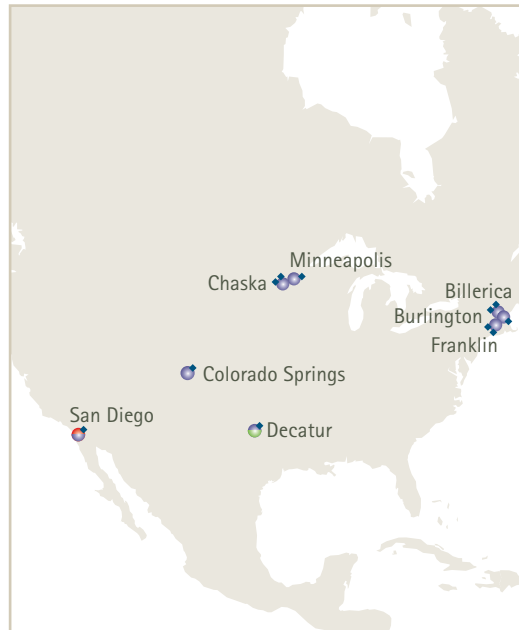
From the moment materials are delivered to Entegris to the time they are converted to products and installed in our customers' production lines, we ensure that they meet stringent specifications.

Ensuring product performance standards are met, proven techniques such as ISO 9001 certified manufacturing sites, documentation control, Lean Sigma processes and quality testing are utilized. Each manufacturing capability has been developed, tested and improved to create pure, durable, consistent and reliable products.

- | | |
|----------------------|-----------------------|
| • Injection molding | • Welding and flaring |
| • Rotational molding | • Sheetlining |
| • Blowmolding | • Overmolding |
| • Extrusion | • Prototyping |
| • Machining | • Tool design/making |



Asia and Japan



North America



Europe and Israel

Close to You

Our global direct sales team, sales channel partners and local applications engineers give you the support and expertise when you need it. This intimacy allows us to better understand your needs through direct feedback and roadmap sharing. By aligning our materials science, engineering and R&D initiatives, we can develop indispensable contamination control and high-performance solutions to solve your roadmap challenges.

You'll receive strong technical support and training from our local service groups and engineers consisting of field applications engineers, technical service groups and applications development groups. Our global field applications engineers work directly with you on product qualification and process improvements in your facilities. Also, in response to your needs for local technical service and fast turnaround time, we maintain regional applications laboratories. These applications laboratories maintain process equipment that simulate your applications and provide product evaluation.

Entegris in Solar Applications

From increasing minority carrier lifetimes in silicon manufacturing to uniformity in thin film manufacturing, you rely on application experience and technology expertise from your suppliers. Whether utilizing our contamination control knowledge

in working with the leading original equipment manufacturers or developing innovative, high-temperature materials, Entegris provides proven performance, efficiency and reliability in your processes.

Entegris in c-Silicon Manufacturing

Chemical and Gas Delivery

Wet Processing

Doping/Diffusion

Antireflective Coating and Passivation

Substrate Shipping

Entegris in CIGS and a-Silicon Thin Film Manufacturing

Chemical and Gas Delivery

Transparent Conductive Oxide

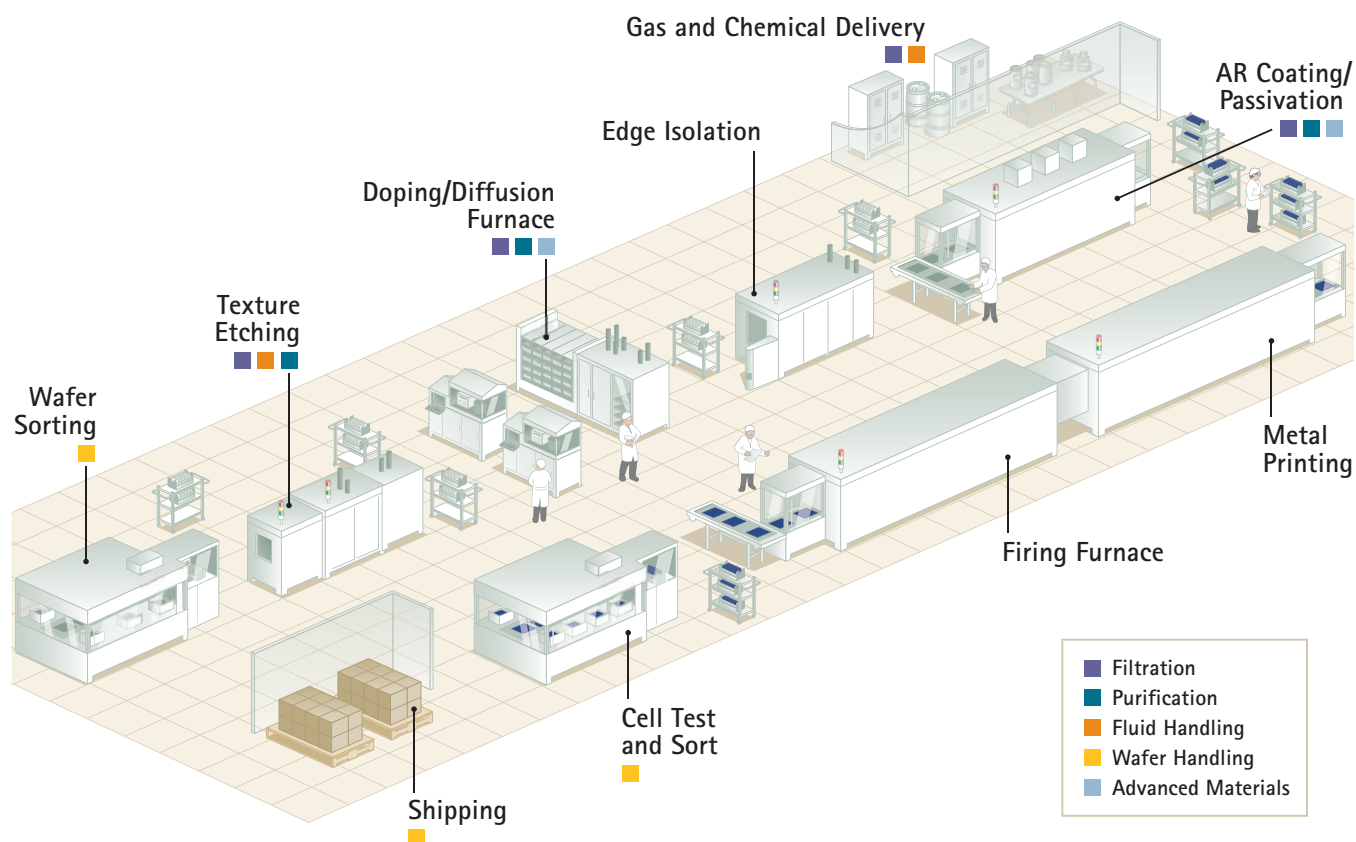
Absorber Deposition

Wet Processing

Chemical Bath Deposition

Sputtering Back Contact

Entegris in c-Silicon Manufacturing



As you strive for operational excellence, process stability and target cell efficiencies in your c-Si processes, incoming impurities in chemicals, as well as contaminants introduced during the process, need to be reduced to acceptable levels with chemical delivery, filtration and purification technologies. Additionally, your processing materials need to be stable and inert to reactive environments, while protecting your substrates. Entegris high-performance materials and technologies allow you to manufacture to your highest specifications, while providing contamination control, repeatability and process efficiency.

Chemical and Gas Delivery

Controlled manufacturing processes and facilities depend on many key parameters. The facilities department is the engine room and nucleus of the plant; a well-designed, well-maintained facilities area will ensure operational excellence and operational costs that meet expectations. With wafer and cell manufacturing, the facilities group has the responsibility to provide and distribute a number of key services in order for the plant to run effectively and efficiently. If one of these key components fails, it is inevitable that the end product will be impacted or some area of the production line will be closed down. The worst-case scenario is shutting down the entire production line until a solution is found. In a cost-competitive market, over-engineering or duplication of components is not possible due to the high investment costs and low return on investment (ROI). Making the right selection at the design stage of the facility is imperative.



The majority of photovoltaic manufacturing process lines rely on deionized (DI) water for wet manufacturing processes; the main purpose of the DI water is to quickly remove unwanted chemical or contamination from the surface of the substrate. DI water can also be mixed on-line with ozone to provide a solution for etching and cleaning the surface of the wafer or cell. This can be a cost-effective and safer solution than expensive, dangerous chemicals. To meet your challenging process and cost of ownership demands, Entegris offers a full range of contamination control solutions.



Liquid Filtration

Process chemistries vary and the appropriate filtration technology needs to be applied to achieve the most efficient and cost-effective solution.

Entegris has over 40 years of experience in filtration and offers a wide range of filtration technologies and products which are designed to meet the needs of all these chemistries. For the most aggressive chemistries, our all-Teflon® filters offer the best chemical resistance and retention performance. For less aggressive acidic or basic applications, we offer cost-effective Savana® filters based with polytetrafluoroethylene (PTFE), polysulfone (PS) or polypropylene (PP) filter media.



Gas Filtration and Purification

Many processes depend on various types of gases; these gases can be supplied from bulk systems or specialty gas cylinders.

They can be inert, corrosive, toxic or pyrophoric in nature, so design, safety and selection of

materials are of utmost importance. Entegris has a number of filtration and purification components that have been designed to meet the various customer requirements. GateKeeper® purifiers eliminate both particle and molecular contamination (e.g., moisture) from process gas. These purifiers are capable of removing contamination down to the ppt level.



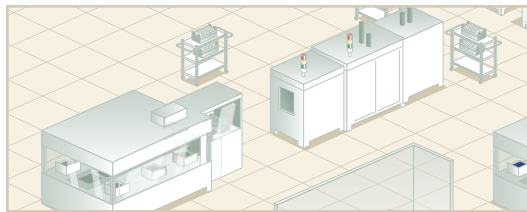
Chemical Delivery

Chemical delivery is just as important as the substrate to cell transport. Chemicals, while pure when delivered to the factory, may be contaminated

by process components as they are transported to and through the process tool. It is important that the correct components are selected to optimize chemical compatibility and function with other process variables such as pressure drop and operating temperatures. From valves, fittings and tubing to flowmeters, containers and dispense tubes, Entegris offers the highest-purity, best-performing fluid handling components available to meet these processing challenges.

Wet Processing

Wet processing is used extensively in the PV industry for saw damage removal, surface texturing, cleaning and etching of doped glass. Today's processes require optimum material handling and contamination control to achieve target cell efficiencies. These requirements will only become more stringent as the rapid advancement of cell technologies continues. Transport of wafers to the process and handling during the process requires solutions which are optimized for automation, chemical compatibility and performance during processing. Concurrently, delivery of the chemicals to the process requires that components in the fluid path are both capable with the chemistries



and do not add contaminants. Finally, both the incoming impurities in chemicals, as well as particles and molecular contaminants introduced during the process, need to be reduced to acceptable levels with the appropriate filtration and purification technologies. Entegris offers a full range of material handling and contamination control products to meet these challenging demands while meeting your cost of ownership needs.



Process and Transport Carriers

Solar substrates are mounted in process carriers for transport to the wet process tool and throughout the processing cycle.

Entegris offers a range of carriers to meet your needs for automation interface and chemical compatibility. Entegris carriers are designed to reduce unwanted process effects such as shadowing, which can be a result of poor carrier designs, leading to output that is not only aesthetically undesirable but may also negatively impact final cell performance. Additionally, Entegris carriers are designed for longevity and mechanical stability even after months of exposure to aggressive chemistries (which causes warping of competitive carriers). Finally, with Entegris you can be confident that your carriers are not contaminating your process from leaching of impurities.



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Filtration and Purification

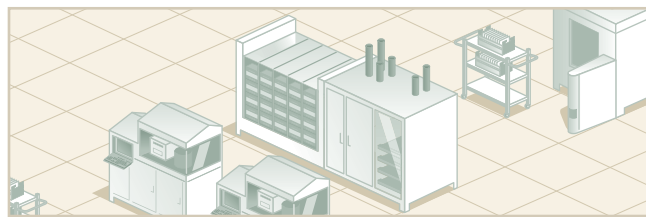
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needs to be applied to achieve the most efficient and cost-effective solution. Entegris has over 40 years of experience in filtration and offers a wide range of filtration technologies and products which are designed to meet the needs of all these chemistries. For the most aggressive chemistries, our all-Teflon filters offer the best chemical resistance and retention performance. For less aggressive acidic or basic applications, we offer cost-effective Savana filters based with PTFE, PS or PP filter media. In addition, we have purification products such as Protego® purifiers designed to remove metal ions from water, and a pHAsor® II membrane contactor which adds ozone to cleaning steps to efficiently remove organic contamination.

Doping/Diffusion

Whether using diffusion or ion implantation as the last step in the critical emitter layer process, you require process stability and critical contamination control for the greatest cell efficiency.

In high-temperature thermal diffusion, compatible, high-performance materials provide the stability needed for highly conductive and uniform thermal transfer, while high-purity materials provide contamination control in this sensitive process. However, metal and ionic contaminants may be leached from the chemical delivery system's materials of construction. These contaminants, along with residual surface contaminants from cleaning and handling can change the local rate of oxidation on the wafer surface. Most contaminants may be removed by reaction with oxygen during the temperature ramp-up. However, if oxygen is not present, the contaminants will not



be volatilized and will generate localized film defects. In addition to surface contaminants, a native oxide will frequently form on the wafer surface after cleaning. In a hot furnace, this porous oxide layer, SiO_x , can volatilize and leave the surface with increasing roughness. All of these conditions can lead to haze, pitting and very poor electrical characteristics.

Phosphoric acid utilized in the inline diffusion process is also highly sensitive to metallic contamination, while the increased performance of the ion implantation process requires increasing levels of contamination control from other sources such as process gases, and critical specifications in advanced materials, such as graphite or silicon carbide.



Graphite/SiC/Specialty Coatings

High-temperature components produced from SUPERSiC® or POCO® graphite are inert in reactive environments and provide increased lifetime, reducing frequency of preventive maintenance and replacement.

The ultra high-purity materials can be custom designed to replace quartz, metals or other materials which either create added contamination or have a short lifetime in process. Specialty coatings combined with masking can be used for select components in implant to improve process efficiency. Additionally, high-purity SUPERSiC wafer carriers remain dimensionally stable throughout multiple process cycles and acid cleanings. Flexible design options provide alternatives to wafer positioning and pitch. Available in up to 140-slot capacity, they offer a cost-effective alternative for diffusion processing.



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Gas Filtration

To improve or maintain critical gas specifications and proper operation of your valves and mass flow controllers, as well as minimize particulate deposition on the substrate, Entegris provides gas filtration for a wide range

of gas applications including process gas filtration and bulk supply. The Wafergard® gas filter offers flow options greater than 1,000 SLPM with a very low pressure drop, small footprint options and a removal rating $\geq 0.003 \mu\text{m}$. Entegris has over 40 years of experience in filtration and a wide range of filtration technologies and products which are designed to enhance your process control.



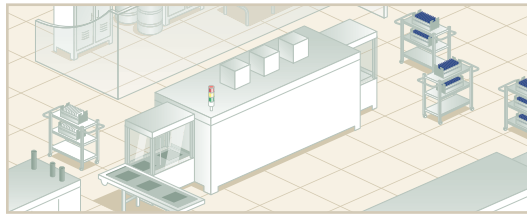
Gas Purification

Gas purification is critical to maintain process control in sensitive PV applications. Process gases vary in quality due to supply and gas delivery systems, which can contribute to contamination of the gases used in the process.

This gives process control, protection and assurance that the gas system is not decreasing performance of the doping equipment. Entegris GateKeeper purifiers contain a media designed to remove molecular contaminants using chemisorption from a gas. The inorganic media binds gas system impurities and contaminants that can be deposited during cell processing. Purifiers are targeted to process gases and remove contamination down to the ppt level.

Antireflective Coating and Passivation

Silicon nitride films produced by plasma-enhanced chemical vapor deposition provide a low reflectance coating and a front surface and bulk passivation for silicon cells. Gas filtration should be used to ensure proper operation of the valves and mass flow controllers, as well as minimize particulate deposition on the substrate. Purification of gas precursors such as silane and ammonia removes any contaminants that may affect uniform coating thickness and surface passivation.



Within these deposition tools, wafer carriers designed utilizing Entegris POCO graphite materials ensure thermal and electrical resistance uniformity across the plates and the wafers while in the process chamber for optimized plasma-enhanced deposition.



Graphite

Graphite wafer plates and boat assemblies are used extensively in batch PECVD processing. POCO graphites are known for their uniform microstructure

which translates into uniform heating and strength. In the case of these long, thin plates, this means reduced breakage during their removal and cleaning and improved uniformity during the deposition process. Direct replacements for original equipment manufacturer (OEM) parts for batch PECVD tools provide quality parts that are available from stock and are produced from graphite, which has been in use in PECVD process equipment for more than 20 years. Proven performance of POCO materials and consistent properties mean increased lifetime and cost savings, reducing cost of ownership.



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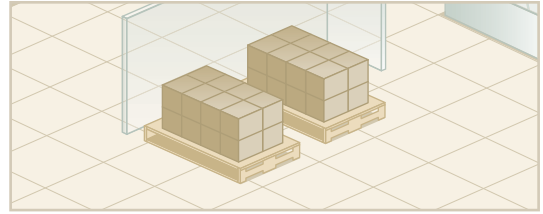
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Substrate Shipping

From shipping down the road to across the globe, you need to protect your substrate, improve productivity and decrease operating costs. Process improvements of automation, lower shipping costs, and reduced packaging and disposal waste are at the foreground, while cost-effective packaging materials for single or reuse transportation offer improved costs. Enabling automation or reducing the number of manual steps in the process will safeguard the product and improve productivity. Additionally, increasing the packing density of



more cells within the same shipment area allows you to reduce logistics and transportation costs. Entegris shippers provide wafer and cell manufacturers with increased protection, higher yields, improved throughput and lower costs.



Shippers

Entegris offers a variety of optimized shipping solutions from single-use, biodegradable solutions to multi-use, multifunction polymer-based shippers.

Combining over 30 years of substrate shipping experience with user input allows us to offer a new Multifunction shipper, which reduces damage and edge defects during wafer or cell shipping. Constructed with cleanable polypropylene

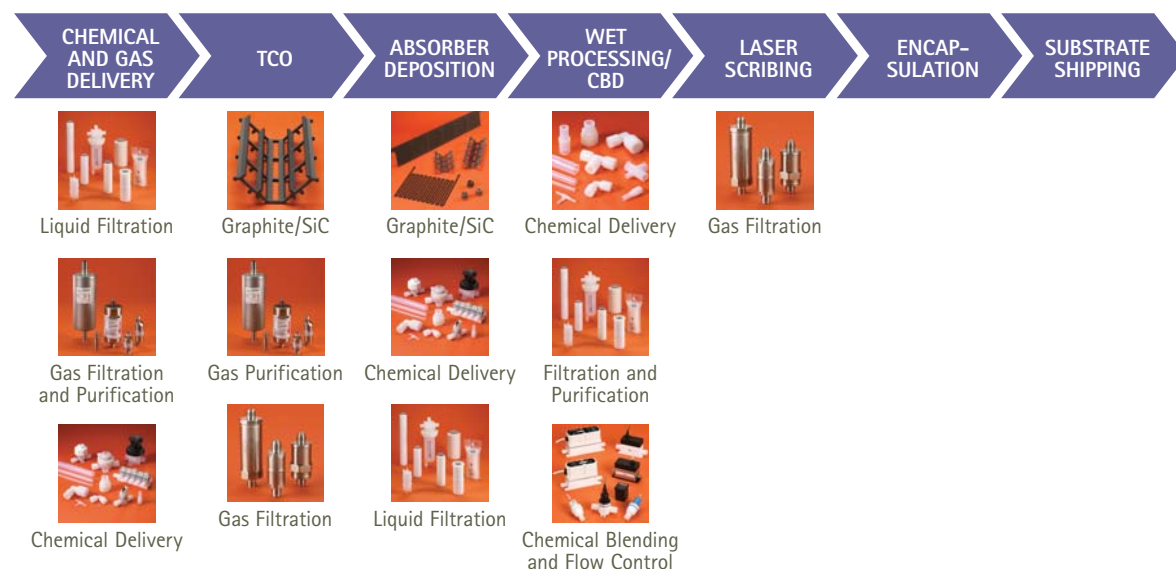
materials, the Entegris Multifunction shipper offers reuse and recycling capabilities, thus allowing manufacturers an environmental alternative to eliminate waste and reduce costs. By serving as both a sorting bin and a shipper, the shipper eliminates manual transfer steps, which endanger cells and wafers. These improvements increase yields, improve throughputs and reduce labor. The shipping system maximizes the number of cells or wafers on a pallet, thereby reducing your shipping and storage costs.

Entegris in Thin Film Manufacturing

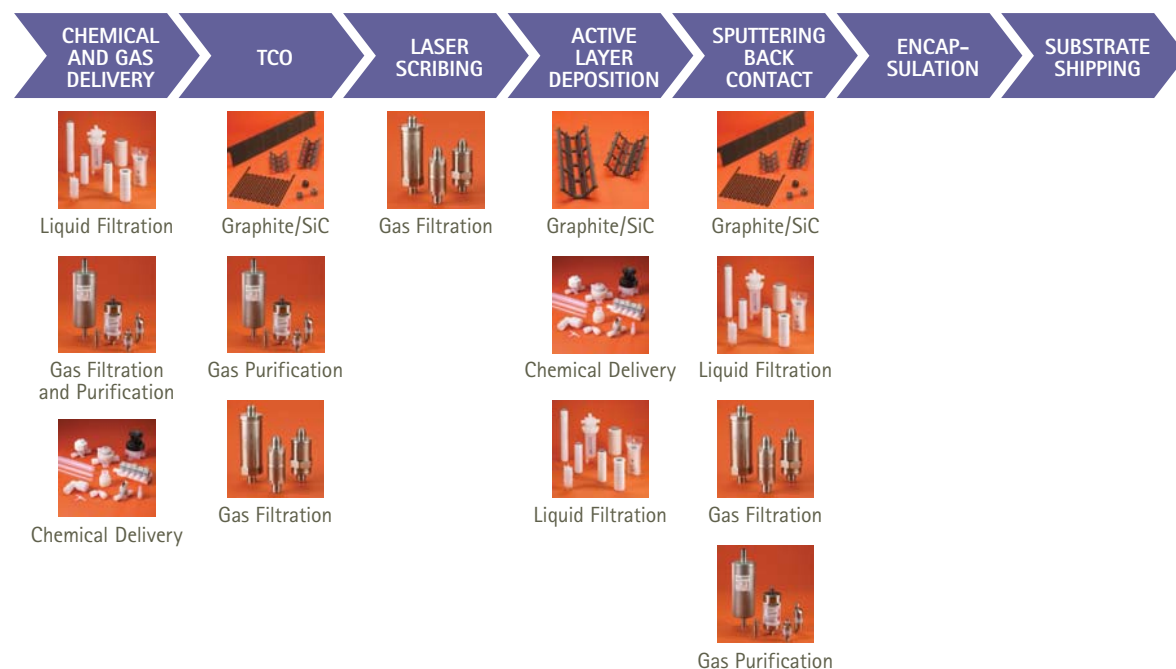
Reproducible quality films are your main goal in thin film manufacturing. Poor film layers may degrade the performance of PV devices if defects, pin holes or peaks form on the films. Entegris offers you a deep understanding of contamination

control, high-performance applications and materials science to meet your needs and provide a single source of flexible product offerings in your thin film processes.

Thin Film CIGS



Thin Film a-Silicon



Chemical and Gas Delivery

Controlled manufacturing processes and facilities depend on many key parameters. The facilities department is the engine room and nucleus of the plant; a well-designed, well-maintained facilities area will ensure operational excellence and operational costs that meet expectations. With wafer and cell manufacturing, the facilities group has the responsibility to provide and distribute a number of key services in order for the plant to run effectively and efficiently. If one of these key components fails, it is inevitable that the end product will be impacted or some area of the production line will be closed down. The worst-case scenario is shutting down the entire production line until a solution is found. In a cost-competitive market, over-engineering or duplication of components is not possible due to the high investment costs

and low ROI. Making the right selection at the design stage of the facility is imperative.

The majority of photovoltaic manufacturing process lines rely on DI water for wet manufacturing processes; the main purpose of the DI water is to quickly remove unwanted chemical or contamination from the surface of the substrate. DI water can also be mixed on-line with ozone to provide a solution for etching and cleaning the surface of the wafer or cell. This can be a cost-effective and safer solution than expensive, dangerous chemicals. To meet your challenging process and cost of ownership demands, Entegris offers a full range of contamination control solutions.



Liquid Filtration

Process chemistries vary and the appropriate filtration technology needs to be applied to achieve the most efficient and cost-effective solution.

Entegris has over 40 years of experience in filtration and offers a wide range of filtration technologies and products which are designed to meet the needs of all these chemistries. For the most aggressive chemistries, our all-Teflon filters offer the best chemical resistance and retention performance. For less aggressive acidic or basic applications, we offer cost-effective Savana filters based with PTFE, PS or PP filter media.



Gas Filtration and Purification

Many processes depend on various types of gases; these gases can be supplied from bulk systems or specialty gas cylinders.

They can be inert, corrosive, toxic or pyrophoric in nature, so design, safety and selection

of materials are of utmost importance. Entegris has a number of filtration and purification components that have been designed to meet the various customer requirements. GateKeeper purifiers eliminate both particle and molecular contamination (e.g., moisture) from process gas. These purifiers are capable of removing contamination down to the ppt level.



Chemical Delivery

Chemical delivery is just as important as the substrate to cell transport. Chemicals, while pure when delivered to the factory, may be contaminated

by process components as they are transported to and through the process tool. It is important that the correct components are selected to optimize chemical compatibility and function with other process variables such as pressure drop and operating temperatures. From valves, fittings and tubing to flowmeters, containers and dispense tubes, Entegris offers the highest-purity, best-performing fluid handling components available to meet these processing challenges.

Transparent Conductive Oxide

Reproducible quality films with strong electrical properties are the main goal in transparent conductive oxide (TCO) processes. When choosing the best deposition method, operating cost and throughput drive your process considerations to achieve high yields and reproducible uniform films. Being sensitive to process conditions, your film layers may degrade the performance of PV devices if pinholes or peaks remain after the deposition. The presence of oxygen in carrier gas can lead to a change in oxygen incorporation into the film through the grain boundaries, which causes a decrease in both mobility and carrier

concentration. Oxygen and moisture are known to be detrimental to the quality of TCO film depositions, resulting in decreased light transmittance and conductivity – an overall reduction in module efficiency. Today's processes require optimum materials and contamination control to achieve target process stability and device performance.

Entegris gas diffusers provide fast, uniform gas flows for load lock and process chambers, while gas purifiers reduce molecular and atomic contamination at the point of film deposition. Assisting with your increased yields, Entegris offers higher quality TCO depositions for higher module efficiencies.



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Gas Purification

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purifiers contain a media designed to remove molecular and atomic contaminants using chemisorption from a gas at the point of film deposition. The inorganic media binds gas system impurities and contaminants that can be deposited during cell processing. Purifiers are targeted to process gases and remove contamination down to the ppt level.



Graphite/SiC

Both graphite and silicon carbide provide excellent options for the creation of custom components for deposition tools. Pyrolytic carbon coated graphite

offers the advantages of graphite with a closed surface, eliminating particle shedding and blocking infiltration of source materials without a significant increase in cost. Silicon carbide can also be used to handle temperatures exceeding 1000°C in the presence of oxygen. Working with thin film engineers in other industries and in-house professional design assistance allows Entegris to ensure that components meet dimensional requirements as well as process requirements. This provides you with a wide variety of turnkey components designed to meet your thin film requirements.

Absorber Deposition

Prevalent absorber depositions are based on either evaporation or sputter methods. Thermal evaporation relies on the controlled release of material elements and the uniform heating of the chamber and substrate for optimal surface deposition conditions. Entegris specialty materials, such as graphite and silicon carbide, can be designed into high-temperature components in evaporation tools to enable controlled thermal conditions, reduced thermal budget and minimize shedding in challenging deposition conditions.

Sputter methods for CIGS require conformal and dense coverage of material film. Uniform film morphology for the active layer requires control of the flux and the plasma within the sputter chamber. Entegris gas diffusers provide gas filtration and uniform flow in load locks and process chambers. Entegris gas purifiers enable the removal of residual gases within the chamber, as well as molecular and atomic contamination at the point of film deposition.



Graphite/SiC

Both graphite and silicon carbide custom components are in use in a variety of deposition tools. Pyrolytic carbon coated graphite offers the advantages of graphite with a closed surface, eliminating particle shedding and blocking infiltration of source materials. Silicon carbide reliably handles temperatures exceeding 1000°C in the presence of oxygen. Design assistance helps to ensure that components meet dimensional requirements as well as process requirements. Entegris offers turnkey components designed to custom requirements, eliminating the costs and hassle of dealing with multiple vendors.

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Wet Processing

Wet processing is used extensively in the PV industry for saw damage removal, surface texturing, cleaning, and etching of doped glass. Today's processes require optimum material handling and contamination control to achieve target cell efficiencies. These requirements will only become more stringent as the rapid advancement of cell technologies continues. Concurrently, delivery of the chemicals to the process requires that components in the fluid path are both capable with the chemistries and do not add contaminants.

Finally, both the incoming impurities in chemicals, as well as particles and molecular contaminants introduced during the process, need to be reduced to acceptable levels with the appropriate filtration and purification technologies. Entegris offers a full range of contamination control products to meet these challenging demands while meeting your cost of ownership needs.



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Chemical Bath Deposition

The CdS or ZnS layer in II VI PV devices acts as an n-type (the emitter) in the p-n junction of the solar device. For optimal results in the chemical bath deposition process, the II VI photoconductive absorber layer must be covered thinly, but completely, by this n-type layer. Poor film quality may degrade the device performance, so a thin layer covering completely produces better results than a thick layer with holes. Defects within this layer or the interface surface appear as voids or agglomerations. In turn, these defects either become holes at the absorber layer or cause holes in other

layers of the device. Being sensitive to process conditions, these defects result from poor chemical bath design or process control of the deposition chemistry.

Entegris high-performance fluid handling components, filtration, chemical blending and flow solutions deliver effective and repeatable results in Chemical Bath Deposition (CBD) systems. Today's processes require optimum materials and contamination control to achieve target process stability and device performance.



Chemical Delivery

Chemical delivery is just as important as the substrate to cell transport. Chemicals, while pure when delivered to the factory, may be contaminated

by process components as they are transported to and through the process tool. It is important that the correct components are selected to optimize chemical compatibility and function with other process variables such as pressure drop and operating temperatures. From valves, fittings and tubing to flowmeters, containers and dispense tubes, Entegris offers the highest-purity, best-performing fluid handling components available to meet these processing challenges.



Liquid Filtration

CBD uses several chemical constituents in the process reaction and subsequently can benefit or may require by standard practices and

laws the waste processing or recycling of the unused chemistry. Entegris has over 40 years

of experience in filtration and a wide range of filtration technologies and products which are designed to meet the needs of all these chemistries. For the most aggressive chemistries, our all-Teflon filters offer the best chemical resistance and retention performance. For less aggressive acidic or basic applications, we offer cost-effective Savana filters based with PTFE, PS or PP filter media.



Chemical Blending and Flow Control

Highly reactive chemicals in competing reactions challenge CBD. The resulting agglomerations cause nonuniform deposi-

tions and waste product that reduce process yield and efficiency, with the added difficulties of in-situ measurement. Entegris NT® flow controllers and custom manifolds provide precise real-time blending of chemicals to provide optimal deposition conditions and control of the reaction kinetics of the process. These technologies offer optimal yield of film growth, tool efficiency and reduced chemical waste, resulting in overall increased PV economics.

Sputtering Back Contact

Metalized conductive contacts provide the inter-connection and the anode back contact for most thin film PV devices. Sputtered metals such as Mo, Cu or Au provide the back contact mechanism requiring uniform and well-adhered layers to the absorber layer. While utilizing your chemical or gas etch methods to prepare the interface surface from the absorber to the back contact, gas purities can be compromised within the bulk storage delivery system to the process tool.

Entegris purifiers located at the point-of-use provide assurance to remove atomic and molecular contaminants that may negatively affect the etchant gas or conformal adhesion of the sputtered metal. Entegris purifiers enable reproducible results in high-volume manufacturing processes.



Liquid Filtration

Process chemistries vary from the first clean, through texturing and final rinsing; the appropriate filtration technology needs to be applied to achieve the most efficient and cost-effective solution. Entegris has

over 40 years of experience in filtration and a wide range of filtration technologies and products which are designed to meet the needs of all these chemistries. For the most aggressive chemistries, our all-Teflon filters offer the best chemical resistance and retention performance. For less aggressive acidic or basic applications, we offer cost-effective Savana filters based with PTFE, PS or PP filter media. In addition, we have purification products such as Protego purifiers designed to remove metal ions from water, and a pHasor II membrane contactor which adds ozone to cleaning steps to efficiently remove organic contamination.



Gas Filtration

To improve or maintain critical gas specifications and proper operation of your valves and mass flow controllers, as well as minimize particulate deposition on the substrate, Entegris provides gas filtration for a wide range

of gas applications including process gas filtration and bulk supply. The Wafergard gas filter offers flow options greater than 1,000 SLPM with a very low pressure drop, small footprint options and a removal rating $\geq 0.003 \mu\text{m}$. Entegris has over 40 years of experience in filtration and a wide range of filtration technologies and products which are designed to enhance your process control.



Gas Purification

Gas purification is critical to maintain process control in sensitive applications. Process gases vary in quality due to supply and gas delivery systems, which can contribute to contamination of the gases used in the

process. This gives process control, protection and assurance that the gas system is not decreasing performance of the deposition equipment. Entegris GateKeeper purifiers contain a media designed to remove molecular and atomic contaminants using chemisorption from a gas at the point of film deposition. The inorganic media binds gas system impurities and contaminants that can be deposited during cell processing. Purifiers are targeted to process gases and remove contamination down to the ppt level.



Graphite/SiC

Both graphite and silicon carbide provide excellent options for the creation of custom components for metallization and as etch electrodes. Pyrolytic carbon coated graphite offers the advantages of graphite with a closed

surface, eliminating particle shedding. It also reduces metal adhesion to tool components without introducing potential contaminants to the substrate and without a significant increase in cost. Working with thin film engineers in other industries and in-house professional design assistance allows Entegris to ensure that components meet dimensional requirements as well as process requirements. This provides you with a wide variety of turnkey components including a variety of coating options designed to meet your thin film requirements.

Are You Reporting Increased Cell Efficiencies and Yields?

Delivering proven knowledge in materials science and contamination control, Entegris allows you to maximize productivity, automate cell transportation and reduce costs in your manufacturing.

- Wafer/Cell Handling
- Specialty Materials and Coatings
- Chemical Delivery
- Purification/Filtration
- Process Control
- Chemical Blending

For More Information

Visit www.pvprocesssolutions.com for the latest technical papers, application notes or the Customer Service Center nearest you and discover how to start reporting increased performance, efficiencies and yields today.

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Multifunction shipper – patent pending.

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