PICOSUN REPRESENTS THE BRIGHTEST OF THE LATEST IN ALD

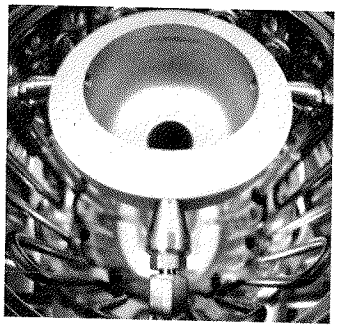
Picosun Is The ALD Powerhouse

Picosun is a direct descendant of the very beginning of Atomic Layer Deposition. ALD was invented in Finland in 1974 by Dr. Tuomo Suntola, Member of the Picosun Board of Directors.

"We have chosen an ALD system from Picosun because of the flexibility in design, impressive process control and easiness to handle."
Professor Jan Otto Carlsson, University of Uppsala

Our CTO Sven Lindfors has designed outstanding ALD systems continuously since 1975. Combined, Picosun people share over 200 hundred years of ALD experience forming what many describe as "by far, the best ALD team ever". We have contributed to more than 100 patents on ALD, and our people have been instrumental in developing each and every one of the fifteen different generations of ALD reactors produced so far. There is not a single ALD company in the world with credentials matching Picosun's.

ALD is only at the beginning of its usefulness for industrial production use. Devices, especially electronics, are shrinking in size almost exponentially. With this, completely new scale production techniques will be needed. ALD, as the most reliable atom scale method of thin film deposition will offer solutions to these emerging industrial needs.



ALD is already being used in HVM production and Picosun believes that it will be the key enabling thin film technology in many future micro- and nanotechnology applications.

One of the biggest strengths of Picosun's Atomic Layer Deposition tools is the ease with which they can be scaled up from R&D to production, thanks to the fact that all its reactor models share the same basic construction. The PICOSUN™ R-series ALD reactor has been optimized for research, product development, and pilot production, while the PICOSUN™ P-series offers fast and reliable compact reactors for production purposes. Picosun's mission is to develop and produce the highest-quality ALD tools for the world-wide markets.

For scientific institutions, and business enterprises funding their research, using Picosun's equipment spans a bridge connecting research and production. The Picosun Bridge crosses the all-too-usual technology gap between what was accomplished in research laboratories and what can be turned into high volume production on the factory floor.

Key objective of Picosun is to be the powerhouse of ALD technology. This means several things to us:

1) that ALD is our specialty and that it is ALD to which we dedicate our efforts and expertise to the exclusion of all else,

2) that we maintain a team of the most knowledgeable, experienced, and skilled ALD professionals who are experts in their respective areas, which has resulted in Picosun having a remarkable 200+ person-years of experience amongst our managerial and development teams, and

3) striving to be continually an innovator in our field by developing new solutions to cutting-edge ALD challenges, while offering a robust, versatile, and mechanically superior ALD tool with an unmatched level of reliability.

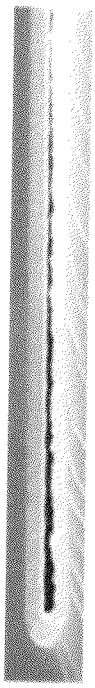
To elaborate on the first of these points, it is the strong opinion of the Picosun executives that to become and remain a powerhouse in any demanding endeavour, a company should remain focussed. While some of our competitors may choose to dabble in multiple fields, we have stayed devoted specifically to ALD technology, as we have realized that it is a technique which will grow to become a "critical enabler" for advanced nanotechnology and requires a high degree of dedication and vision to remain on track. We feel that our commitment to ALD truly represents that required of an industry leader and helps keep us at the forefront.

Secondly, having the right team is essential. As mentioned above, we have amassed over 200 person-years of impressive ALD know-how. The inventor of ALD, Dr. Tuomo Suntola, is a member of our Board of Directors and is a Senior Technology Consultant at Picosun. He is the inventor of more than 30 patents in ALD. Mr. Sven Lindfors, CTO and Founder of Picosun Oy, is the author of numerous publications and inventor in 32 published patents and patent applications in the field of ALD and electroluminescent displays. Sven Lindfors has been designing and building ALD reactor systems since the inception of the technique back in 1975. A considerable percentage of the ALD systems on the market today—regardless of vendor—depend directly on innovations originally put into place by Mr. Lindfors.

Additionally, Professor Lauri Niinistö is a member of our Board of Directors. Professor Niinistö was one of the first academic researchers to have a laboratory specifically for the purposes of the development of novel ALD processes, where since the early 1980s many key contributions to the field have been made.

Our Managing Director, Mr. Juhana Kostamo, has 10 years of ALD experience in an industrial setting and is the author of several publications and inventor in several published patents and patent applications in the field of ALD. In our team we have more than a dozen PhDs, e.g. Dr. Charles Dezelah, Dr. Satu Ek, Dr. Wei-Min Li, Dr. Xiang Li, Dr. Marko Pudas, Dr. Minna Toivola and Dr. Tero Pilvi are all experts in ALD process and application development. In short, Picosun has accumulated a critical mass of excellent personnel who have founded their success on ALD.

"The SUNALE™ reactor system by Picosun shows excellent device characteristics."
Professor Makoto Kohda, Tohoku University



100% conformal ZnO:Al film, deposited in a trench with Picosun™ R-series system (Courtesy of VTT, 2010)

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"The ALD system from Picosun offers technically a more favourable solution."

Dr. Lun Maximov, University of Lund

The third point of central importance to our objectives is our goal of continual innovation. Since our inception in 2003, we have pressed forward through a series of progressions, with the aspiration of creating an ALD system that is both readily upgradeable and customizable. Rather than have a "one-size-fits-all" system where every precursor source delivery system is identical, we have developed an ever-increasing family of source systems, each designed to fulfill a certain role or to appeal to a certain customer niche. To a large degree they can be selected according to the customer's goal or mixed and matched according to required degree of versatility. From our Picosolution™ system designed to deliver the most accessible and routine of all source compounds, to our Picosolid™ Booster system assembled with the specific desires of the researcher who wishes for the delivery of the most difficult low-vapour pressure precursors in mind, we have considered the numerous ways to realize effective source delivery.

Recently we have introduced our Picohot™ 300 source system, which is centered around the concepts of maximizing the amount of source material available, maximizing the convenience of replacing the source bottle, and removing the need for chemical handling, all in a heated, fully-insulated source system that pushes the limits of source temperature range.
It is not only in the realm of source systems that Picosun excels; we have a highly innovative chamber-within-a-chamber design that allows for an inner deposition zone that can be swapped readily for ones of a different size or bearing custom features, all inside an outer cold-walled vacuum chamber that allows for excellent deposition temperature stabilization, while preventing exposure of hot surfaces to the laboratory environment. These are only a few examples of how Picosun is leading the charge in providing a stand alone tool that is readily upgradable from R&D to full production while creating countless options for future flexibility. All of this sets us apart from the rest when compared to our competitors.

Picosun presently has its main headquarters in the Micronova building at Tietotie 3, Espoo, Finland, FI-02150. A North American headquarters was opened in Detroit, Michigan, USA in 2007 in the historic downtown Dime Building. Picosun USA LLC is the U.S. subsidiary of the parent company Picosun Oy. In 2008, production and R&D facilities moved from the Micronova building into a much larger laboratory space in our new facility in Masala, Finland, which is located about 30 km west of Helsinki. Our Singapore office with both sales and R&D capabilities was opened in spring 2012.

Beyond our headquarters and production sites, we have distributers located around the world to offer both sales and support in our growing overseas markets: China, Japan, Brazil, Taiwan, India, Germany, Russia, and Israel, to name a few. The contact information for our worldwide distributors can be found from our website at www.picosun.com. Our worldwide presence has helped us keep abreast of the rapidly changing landscape of nanotechnology and identify new opportunities, while at the same time seeing firsthand the new directions of industrial ALD application.

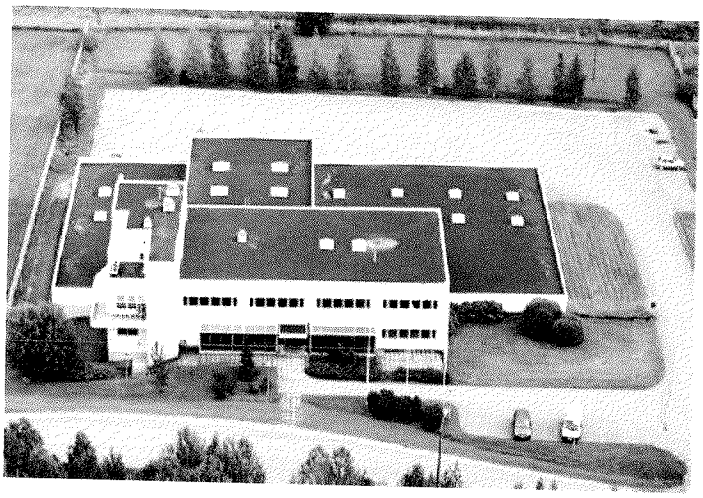
Picosun Oy is a private company and part of Stephen Industries Inc Oy, a private Finnish investment and management consultancy company, which holds most of the shares. Minority shareholders are CTO Sven Lindfors, Managing Director Juhana Kostamo, Picosun employees and Board members.

PICOSUN™ ALD process tools have been selected by more than 100 universities, research institutes and companies across Europe, USA and Asia, e.g. IBM, Ohio State University, Vaisala Instruments, VTT Technical Research Centre of Finland and UC Berkeley.

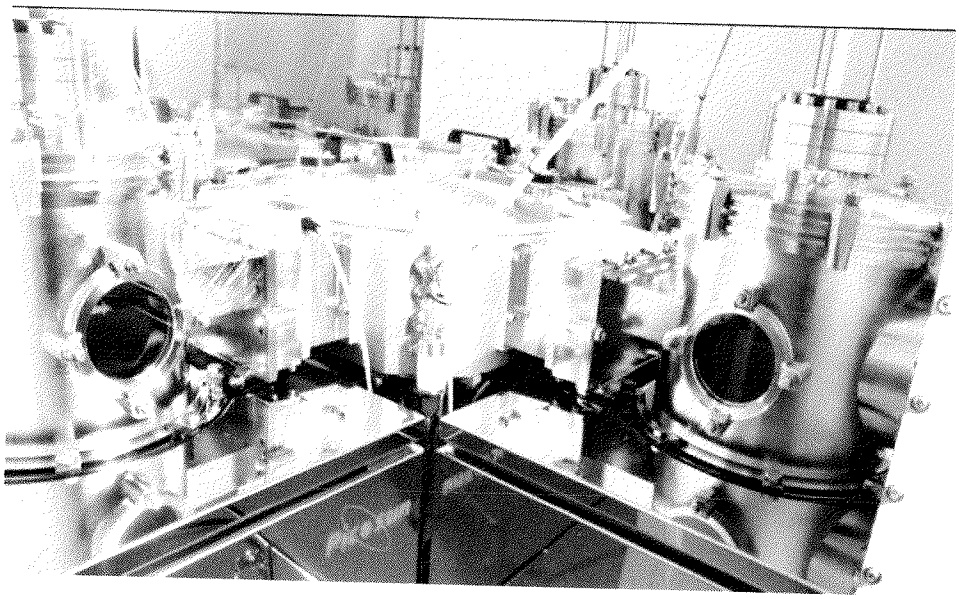
Most of our industrial customers we cannot name but more than 15 of the world's largest industrial companies are partnering with Picosun in the field of ALD production.

"For us, the Picosun tool represented the best combination of cost and capability."

Dr. Bill Flounders, Bridge Microfabrication Laboratory



Picosun's New Laboratory and Production facilities in Masala, Finland, some 30 km west of Helsinki



Picosun

Picosun SUNALE™ ALD System (Technical Specifications)

Key Features and Advantages

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1. Main frame

SUNALE™ ALD system main frame are made of polished stainless steel with reaction chamber, electronics and source system all inside frame

- Designed rule implements SEMI standards, compatible with class 10 cleanroom
- Modular system allows easy upgrade and replacement of different modules
- Small foot-print (normally < 1 m^2)
- Easy scale up to 300 mm wafer processing or beyond

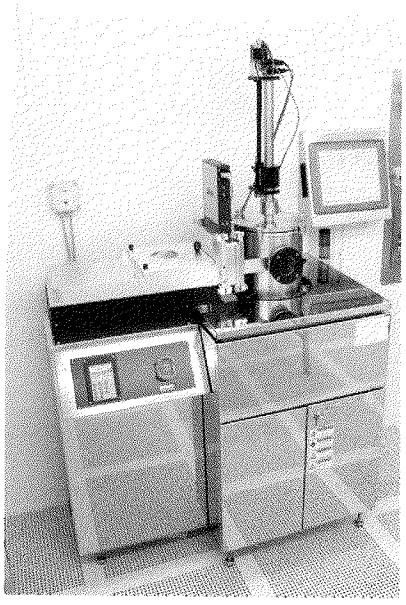

Figure An example of SUNALE™ ALD reactor in class 10 clean room

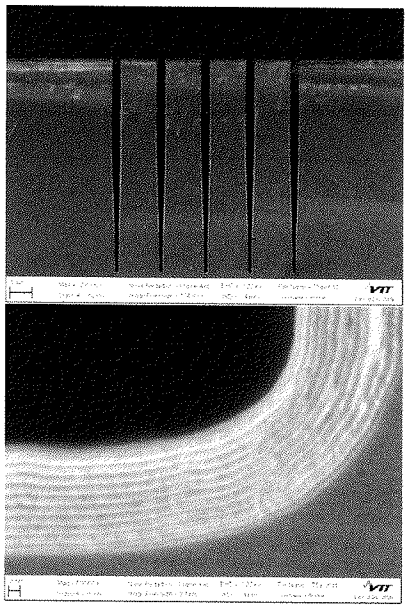

Figure An example of Al_2O_3/TiO_2 nanolaminate film deposited with SUNALE™ ALD reactor

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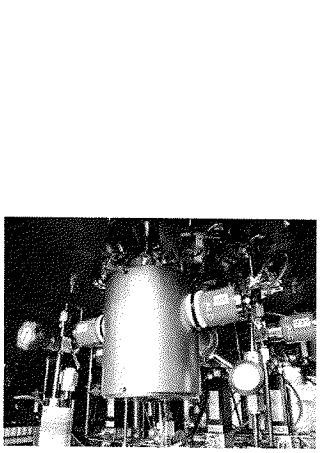
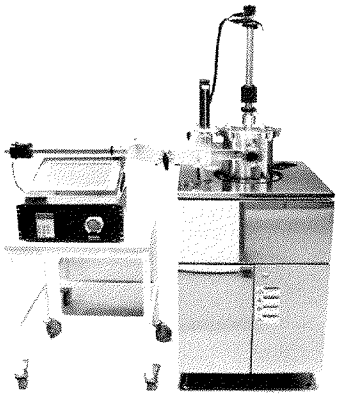
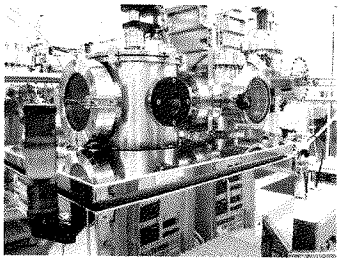


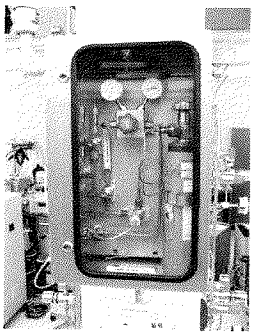
Complete gas, liquid, and solid source delivery systems



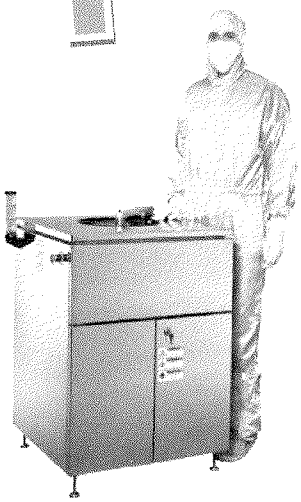
Manual loadlock



UHV system

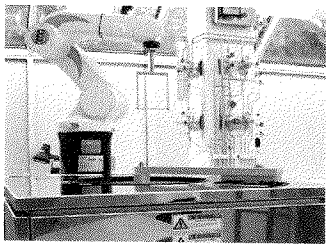


Separate source and gas cabinets allow multiple chemicals installed at the same time

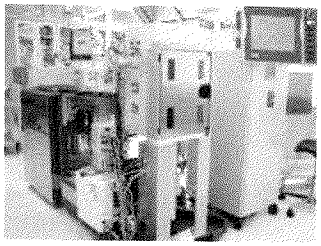


N_2 glove box

Other integrated modules including i.e. ellipsometry, quartz-crystal-microbalance, mass spectroscopy, etc.



Batch reactor with automatic wafer laoding



Automatic cassette loading

Figure Picosun SUNALE™ ALD system unique modular features provide our customers with upgradable and productive ALD process tools

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2. Dual chamber hot-wall reactor system

SUNALE™ ALD system consists of a vacuum chamber and an isolated reaction chamber mounted inside of the vacuum chamber

Benefit of vacuum chamber:

- Different reaction chamber can be fit into the same vacuum chamber, allows easy scale up to batch process and deposition on different substrates, such as batch 3-D objects and particles/powders
- Reaction chamber can be easily disassembled and replaced for easy maintenance
- Source lines are pre-heated before entering the reactor chamber, improves deposition quality
- No maintenance needed for the vacuum chamber
- Prevents possible injuries by burning hands or equipment on the hot reaction chamber lid
- Option of ultra-high vacuum system by using metal seal flanges

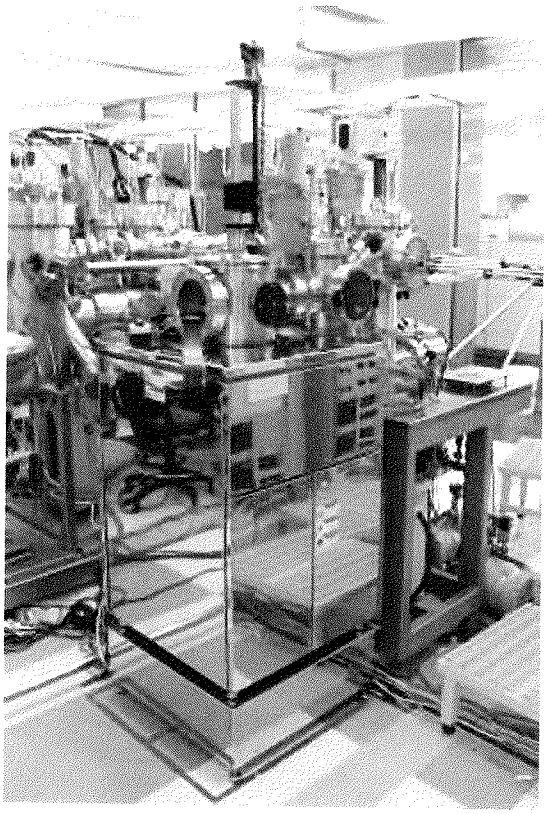

Figure UHV SUNALE™ ALD system integrated with MBE systems

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Benefit of hot-wall reaction chamber:

- Metal-metal sealing surface and pressure control keeps all process gases inside the reaction chamber and no condensation occurs in the vacuum chamber walls
- The reaction chamber walls are at the same temperature as the substrate that prevents secondary reaction routes inside the reaction chamber that would result in the loss of self-limited growth mechanism of ALD
- Ensures that no corrosion occurs on the vacuum chamber walls
- Ensures the best particle performance and long maintenance cycles
- Maximum deposition temperature of 500 °C

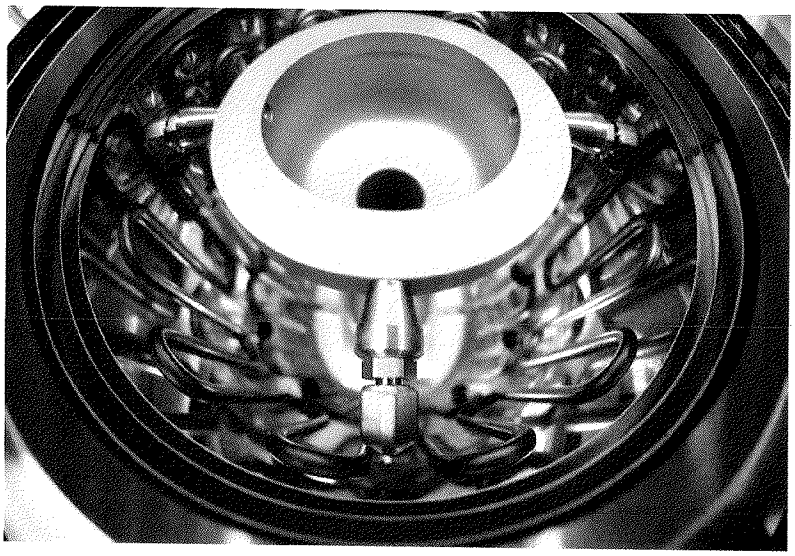
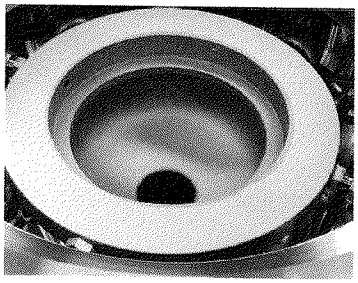
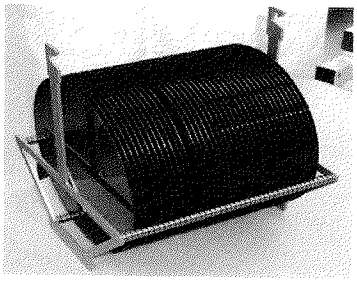


Figure SUNALE™ hot wall reaction chamber inside of vacuum chamber with three separate source inlets. The reaction chamber can be easily removed for maintenance or changed to other types of reaction chambers.



Reaction chamber for single wafer and 3D objects



Batch process increases productivity

Sintered cartridge for deposition on powders or other fine particles

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Other key features/benefits of SUNALE reactor design:

Top flow design with gas flow perpendicular to the substrate

- Enables uniform film deposition with challenging precursor chemistries
- Enables deposition of thin film inside surface of through-channel substrates

Automatic opening of the reaction chamber controlled with a touch panel

- No need to touch the reaction chamber lid when the reactor is heated

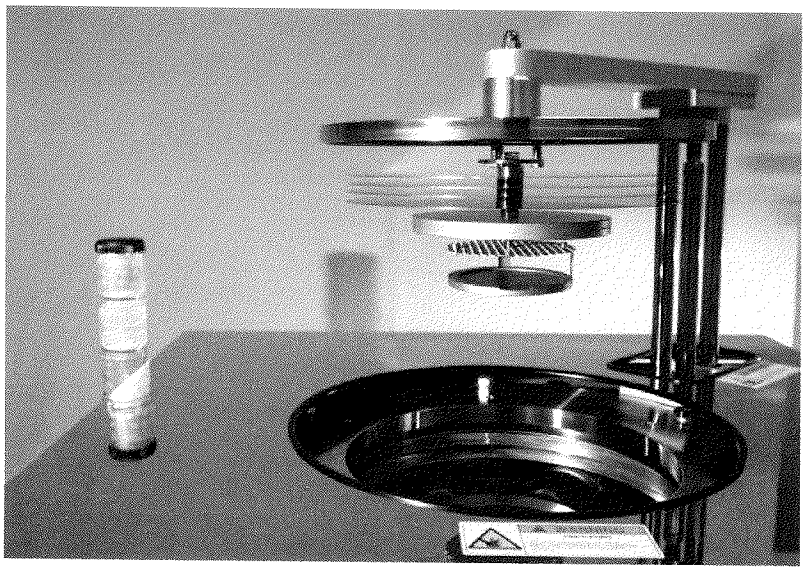
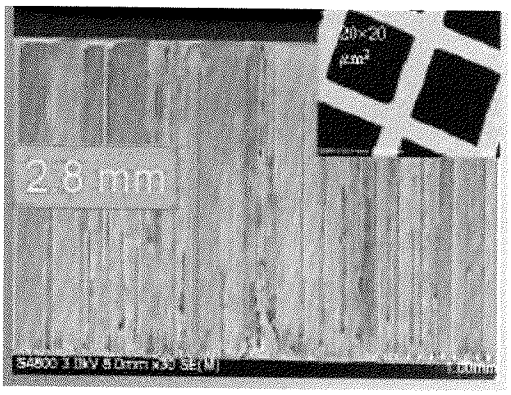


Figure SUNALE™ top flow reactor design ensures uniform film deposition with challenging precursor chemistries



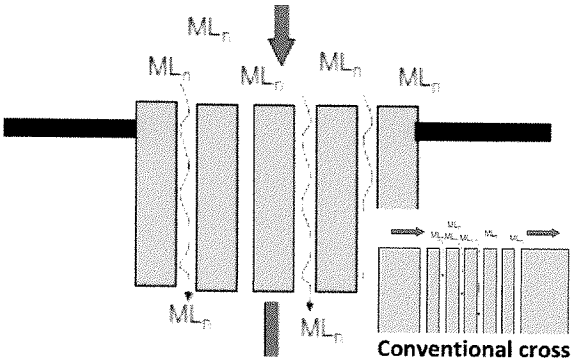


Figure SUNALE™ top flow reactor design is advantageous for coating inside surface of through-porous and micro-channel substrates and 3D objects

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