



FOM
TECHNOLOGIES

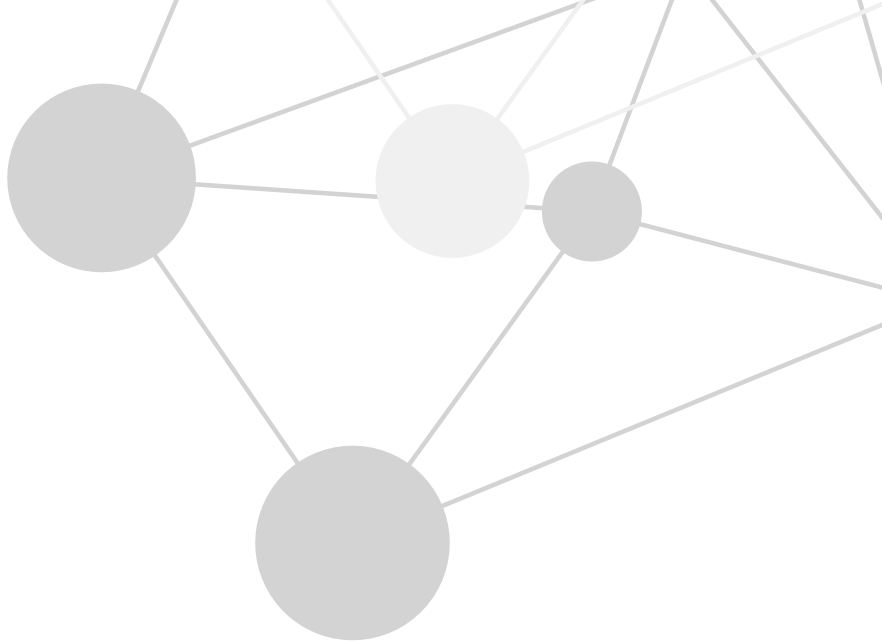
PRODUCT BROCHURE



WELCOME TO **FOMTECHNOLOGIES**

FOM Technologies is a leading supplier of lab- and pilot-scale slot-die coating tools for thin film materials research. We provide precise, flexible, user-friendly equipment to the world's finest companies and universities to advance the state of energy, medical and other diverse smart surface technologies. Our "MO" is to work closely with our clients and suppliers to deliver high quality, cutting edge solutions to coat a bright and sustainable future together.

FOM Technologies is a publicly traded company. The company was listed on the Nasdaq First North Growth Market in June 2020 (ticker: FOM).



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DISCOVER SLOT-DIE COATING

Industrial history

Slot-die coating is a proven technology for the precise, scalable production of thick and thin films of almost any material. It was originally invented in the 1950's and is widely used in commercial roll-to-roll manufacturing of photographic films, Li-ion batteries, ceramic capacitors and many other products.

R&D applications

Many of tomorrow's most exciting inventions, such as printed solar cells, solid-state batteries and lab-on-a chip medical diagnostics, rely on large scale deposition of high quality thin films and coatings to reach their full potential.

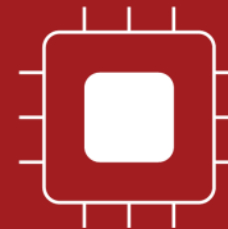
However, today's conventional lab-scale coating techniques cannot deliver the required combination of precision and scalability to R&D professionals. Slot-die coating meets these needs, and FOM Technologies is making this technology available in a lab-scale form factor for the first time.



Energy harvesting such as tandem- and thin film solar cells



Energy storage such as Li-ion, solid-state and post-lithium batteries



Smart surfaces such as OLED, ECD, conductive foils and molecular sensors



Novel **medical diagnostics** such as perovskite x-ray detectors and microfluidic lab-on-a-chip devices

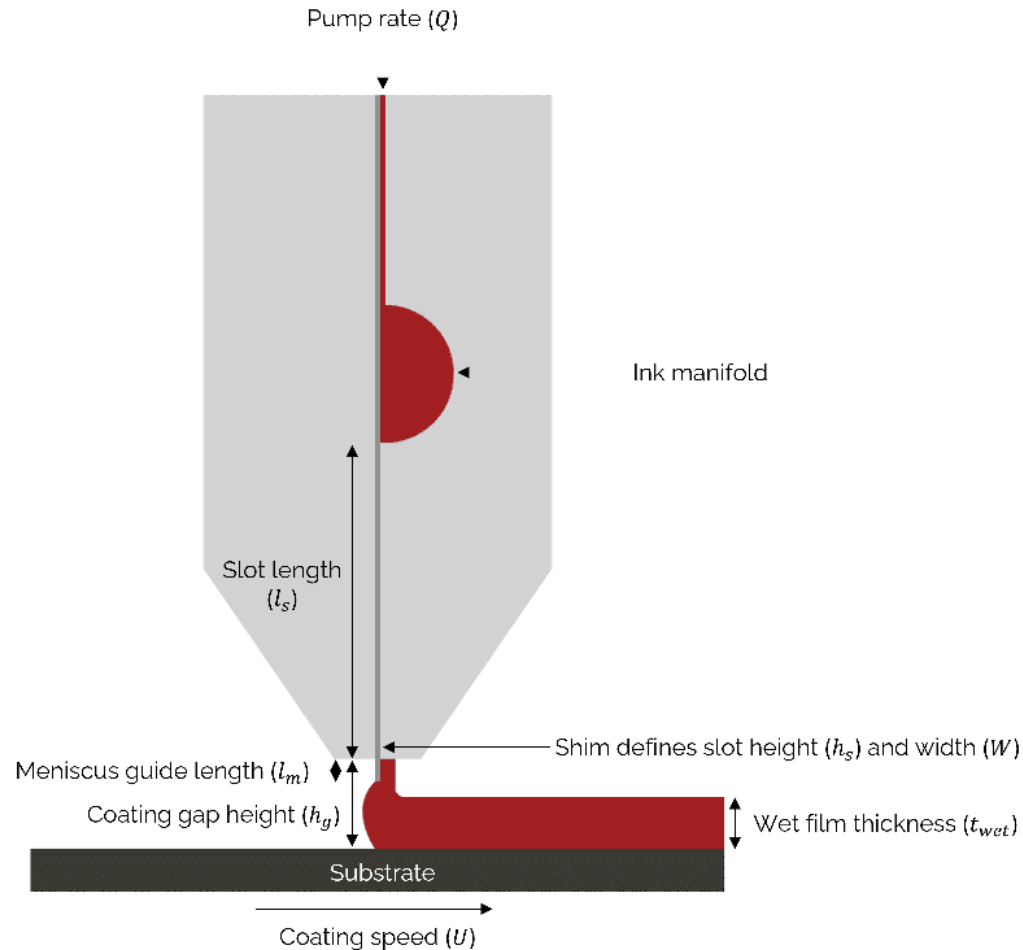


Novel **drug delivery** such as coating of microcapsules or thin film vaccines



Diverse applications in **additive manufacturing, printed and organic electronic components**

THE BASICS



How it works

Slot-die coating works by dissolving a desired thin film material into a coatable solution. This solution is pumped into the slot-die head component, where it becomes uniformly spread along the desired coating width. This results in controlled, continuous thin film production at the slot-die outlet, where the solution is received by a moving substrate. Because all of the solution that exits the slot-die ends up on the substrate, an optimized slot-die coating process affords nearly 100% material efficiency and allows us to pre-determine the film thickness simply by controlling the pump rate and substrate speed.

Our benefits in thin film R&D

- Uniform film thicknesses from 10 nm to 100 μm
- Quick to start & easy to use
- Simple, predictable film thickness control
- Easily scaled from a few cm^2 to tens of m^2 per minute
- Compatible with almost any material and viscosity
- Continuous, non-contact thin film coating process
- Closed system protects your materials
- More precise, efficient and scalable than spin coating, blade coating, screen printing & inkjet printing
- Compatible with R2R and S2S production methods
- Demonstrates upscaling and commercial potential for new processes
- Can downscale large processes for rapid iteration

Precise. Predictable. Scalable.

FOM Technologies brings industrial Slot-Die solutions to the R&D environment. Our tools simulate high-throughput, large-area coating processes in a convenient footprint. This enables our clients to couple fundamental R&D with commercial material and process optimization, without compromising quality or convenience in either respect. Compared to conventional lab-scale techniques, Slot-Die coating offers simply unmatched control, flexibility and scalability of thin film research.

PARAMETER	SPIN COATING	BLADE COATING	INKJET PRINTING	SLOT-DIE COATING
Thickness range	~ 10 nm - 100 μ m	~ 1 - 100 μ m	10 - 300 nm	~ 10 nm - 500 μ m
Coating speed (m/min)	-	0.1 - 1,500	< 1	0.1 - 500
Max. coating area (cm ²)	10 x 10 (typically << 25 cm ²)	400 x L	-	400 x L
Viscosity range (cP)	< 1,000	100 - 40,000	5 - 20	< 20,000*
Layer uniformity (%)	< 5	< 10	< 5	< 5
Web roughness effect	-	Large	Small	Small
Throughput method	Batch	Continuous	Continuous, intermittent and batch possible	Continuous, intermittent and batch possible
Delivery method	Volumetric, pre-metered	Mechanical, self-metered	Volumetric, pre-metered	Volumetric, pre-metered
Material waste	Very high	Moderate	Low	Very low
Thickness Predictability	Moderate	Moderate	Moderate	High

*Viscosity range depends on whether the application requires solution processed Slot-Die Coating versus melt based extrusion coating. Extrusion is achievable in a Slot-Die apparatus and functions with much higher viscosities.

 Best performance



Epishine [SE]

"I've been working with FOM since the company's early beginnings in 2012. Our relationship has evolved into more than just a customer/client relationship. We are running 3 machines from FOM's portfolio, from small scale lab tools to large area production machines. They're still in daily operation and play a key role in where our company is today."

Dr. Jonas Bergqvist, CTO

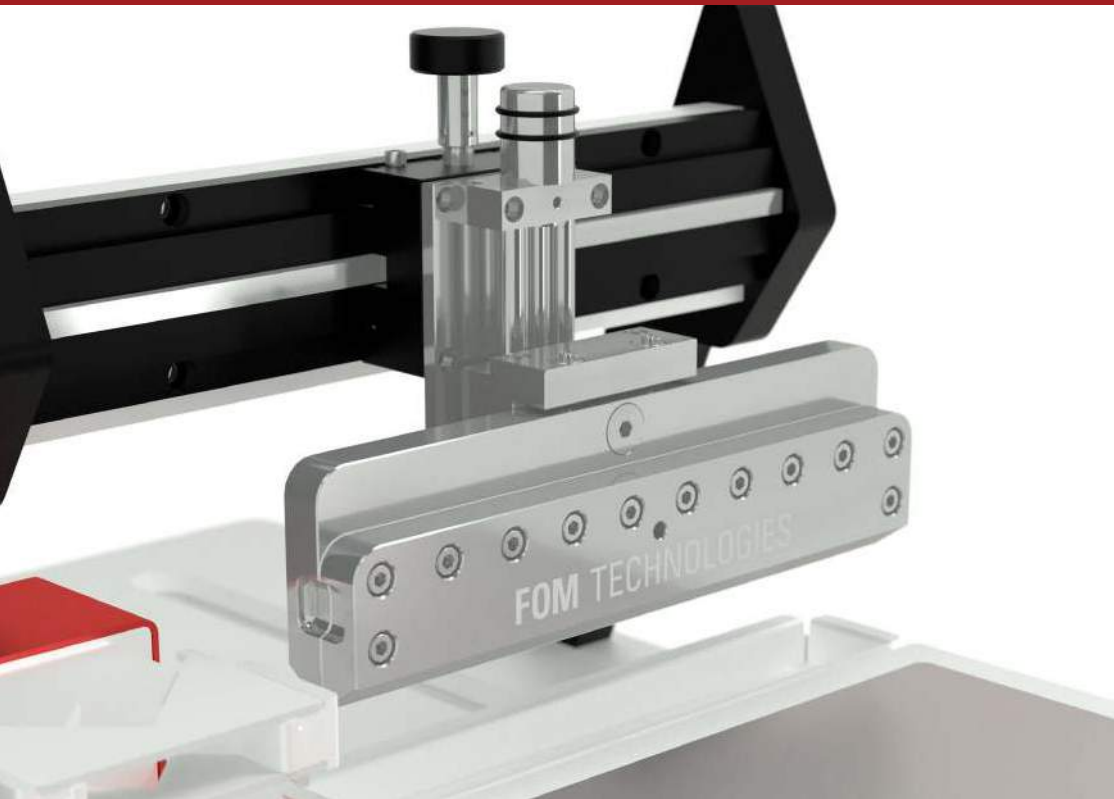
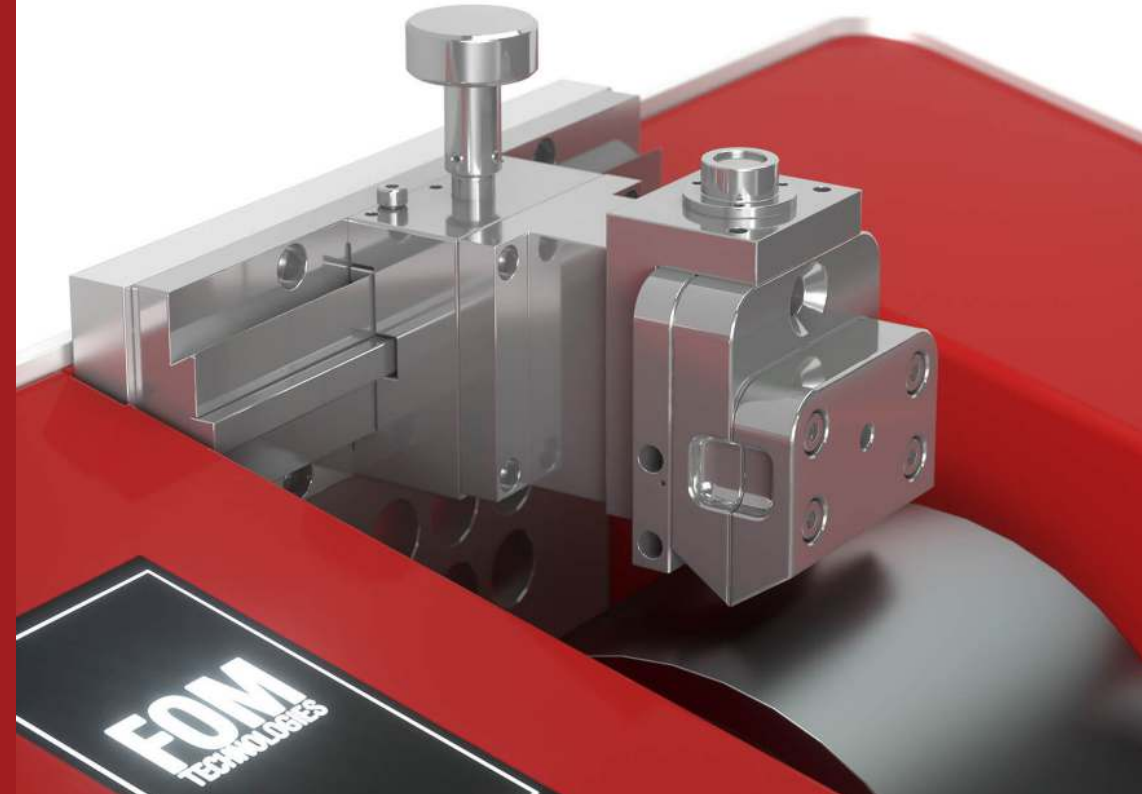
FOM
TECHNOLOGIES
NANO ROLL COATER

OUR TOOLS

Roll coaters

FOM Technologies benchtop roll coaters enable researchers to simulate large-area coatings and R2R production during lab-scale research. Their compact size, user-friendly interface and adjustable slot-die angles allow for easy development of complex processes. Our unique heated drum design makes this possible without the need for the large ovens and messy handling of unwind/rewind rolls seen in pilot- and full-scale production.

Models: nanoRC, arcRC



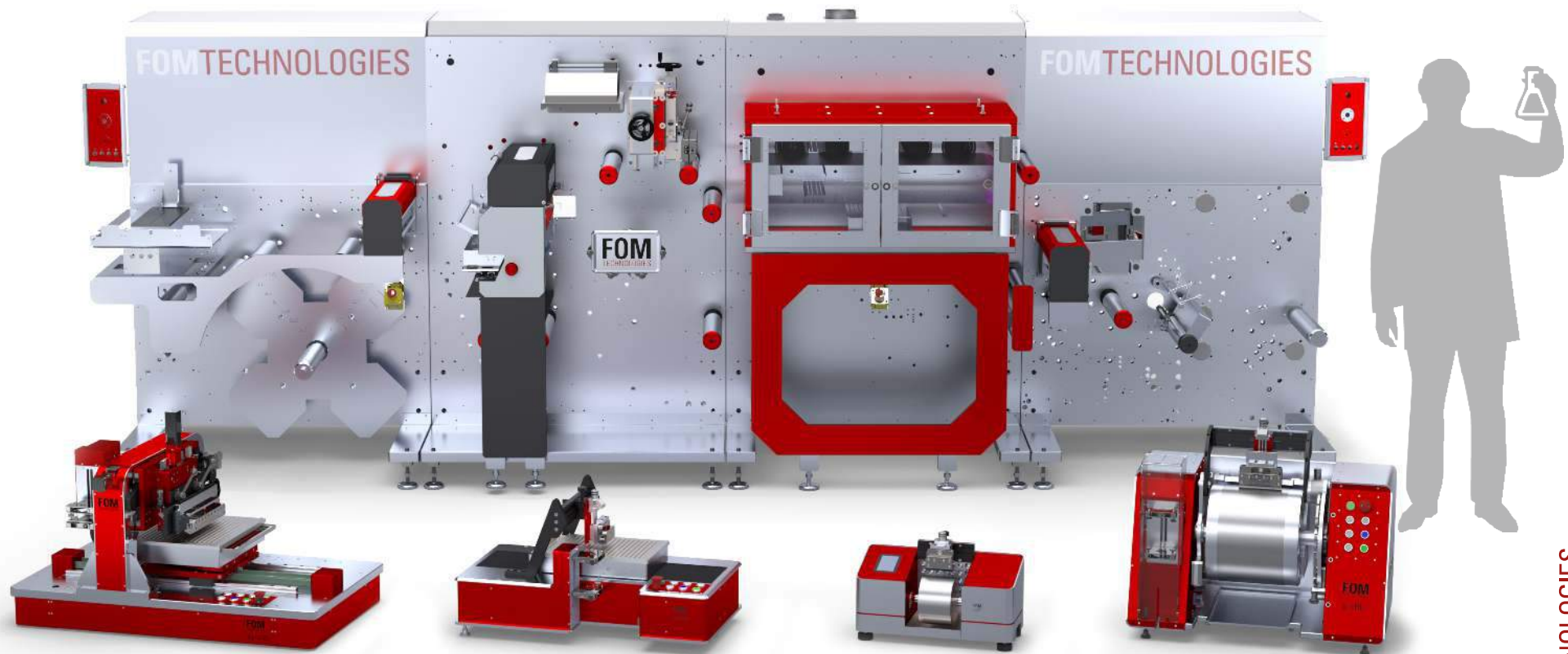
Sheet coaters

FOM Technologies benchtop sheet coaters represent the ultimate combination of precision and versatility as a lab-scale coating platform for almost any thin film application. Their sheet-based, heated vacuum chuck design enables coating on flexible or rigid substrates, simulating both R2R and sheet-to-sheet (S2S) processes in a compact form factor with easy sample handling for subsequent drying and analysis.

Models: vectorSC, alphaSC

PRODUCT PORTFOLIO

moduloR2R



alphaSC

vectorSC

nanoRC

arcRC

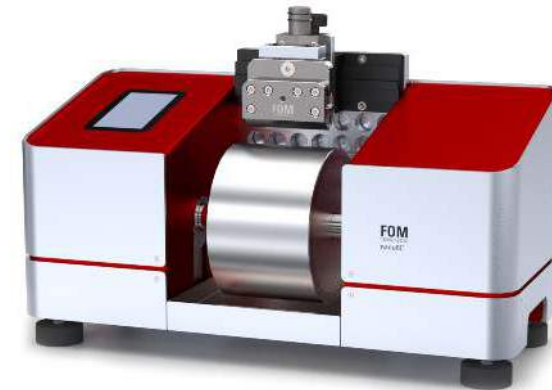
FOM nanoRC

Product description

The FOM nanoRC is the ideal entry point to begin scalable coating of functional thin films and devices. The FOM nanoRC has been designed to mimic the complex coating processes achieved on large scale roll-to-roll machines, while requiring a fraction of the cost and physical footprint. By leveraging years of experience in materials research and slot-die coating, the FOM nanoRC provides users with a simple route to precise, repeatable and scalable thin film production from any solution or slurry based precursor.

Key features

- Lab-scale simulation of R2R coating
- Simple film thickness control
- Uniform film thicknesses from nanometers to microns
- Entry-level price point
- Intuitive touch panel interface
- Plug n' play installation
- Compact size for easy moving and placement
- High material efficiency compared to blade & spin coating
- Great for education and training environments



Roll-based



53x 23 x 35 cm



≤100mm width



Up to 2 m/min



Up to 150 °C



19 kg



Options available

FOM arcRC

Product description

The FOM arcRC has been designed from the ground up to mimic industrial roll-based coating in a smaller, lab-friendly form factor. By integrating industry-grade components and a user-friendly interface, the FOM arcRC provides a seamless, accelerated user workflow and excellent control for coating a wide variety of active materials. It is an ideal solution for users aiming to bridge the gap between fundamental research and pilot-scale production, with an emphasis on developing roll-supported coating processes.

Key features

- Lab-scale simulation of R2R coating
- Adjustable slot-die angles for flow and shear control
- Automated coating via intuitive laptop interface
- Turnkey glovebox compatibility
- Compatible with fluids up to 20,000 cP
- Simple film thickness control
- Uniform film thicknesses from nanometers to microns
- High material efficiency compared to blade & spin coating
- Simple scaling from lab to R2R on FOM moduloR2R



Roll-based



84 x 70 x 70 cm



≤200mm width



Up to 5 m/min



Up to 120 °C



115 kg



Options available

FOM scalarSC

Product description

The FOM scalarSC is the ideal entry point to begin scalable coating of functional thin films and devices. The FOM scalarSC has been designed to allow easy control over coating on both rigid and flexible substrates while requiring a fraction of the cost and physical footprint. By leveraging years of experience in materials research and slot-die coating, the FOM scalarSC provides the necessary freedom through a simplified design for everyday experimental runs. The FOM scalar SC will offer excellent precision and reproducibility for a wide spectrum of lab-scale materials and coating processes relevant to industry and academia.

Key features

- Reduced footprint for cost-competitive research
- Chuck enabled with uniform heating
- Substrates up to 300×200 mm (A4)
- Coating stripe widths from 1 to 200 mm, stripe lengths up to 300 mm
- Coating speeds from 0.01 m/min to 5 m/min
- Precise control of all coating parameters – pump rate, coating speed, coating gap, and drying temperature
- Infinite-step height and lateral position manual dial for accelerated user workflow
- Seamless glovebox integration option
- Plug & Play installation



 Sheet-based



87 x 48 x 47 cm



≤200mm width



Up to 5 m/min



Up to 200 °C



50 kg



Options available

FOM vectorSC


Product description

The FOM vectorSC has been designed from the ground up to allow for easy control over coating on both rigid and flexible substrates. By integrating industry-grade components and user-friendly recipe features, the FOM vectorSC provides a seamless, accelerated user workflow and excellent control for coating a wide variety of active materials. It is an ideal solution for users aiming to bridge the gap between fundamental research and pilot-scale production, with an emphasis on versatility in compatible substrates and coating fluids.

Key features

- Compatible with both rigid and flexible substrates
- Excellent flatness and fixation on microporous vacuum table
- Automated coating via intuitive laptop interface
- Turnkey glovebox compatibility
- Compatible with fluids up to 20,000 cP
- Simple film thickness control
- Uniform film thicknesses from nanometers to microns
- High material efficiency compared to blade & spin coating
- Simple scaling from lab to R2R on FOM moduloR2R



 Sheet-based



87 x 50 x 63 cm



≤200mm width



Up to 5 m/min



Up to 200 °C



50 kg



Options available

FOM alphaSC

Product description

The FOM alphaSC represents the ultimate combination of control, functionality, and versatility in thin film research and production. All elements of its hardware, software and premium features have been tailored to eliminate experimental error and increase usability with both flexible and rigid substrates. The FOM alphaSC delivers an uncompromising package, providing users with unmatched versatility and control of their lab-scale materials and coating processes.

Key features

- Fully motorized for precision motion and positioning
- Advanced coating automation functions
- Compatible with both rigid and flexible substrates
- Excellent flatness and fixation on microporous vacuum table
- Turnkey glovebox compatibility
- Compatible with fluids up to 20,000 cP
- Simple film thickness control
- Uniform film thicknesses from nanometers to microns
- High material efficiency compared to blade & spin coating
- Simple scaling from lab to R2R on FOM moduloR2R



 Sheet-based  119 x 69 x 68 cm  ≤500mm width

 Up to 5 m/min  Up to 200 °C  250 kg

 Options available

FOM moduloR2R

Product description

In addition to our standard products, FOM Technologies supplies a wide range of custom slot-die solutions. The moduloR2R represents a highly flexible, modular R2R line that can be used as a basis for diverse pilot-scale coating applications. Ovens, web guide, web cleaners, plasma treatment, gas knives and many other printing or coating modules can be applied and configured as required. Each moduloR2R is a unique construction built on a standardized platform, designed in close collaboration with our clients to deliver an R2R pilot line that meets their specific requirements.



Roll-to-roll



N x 2 x 2 x 1.8 m



≤300mm width



Up to 20 m/min



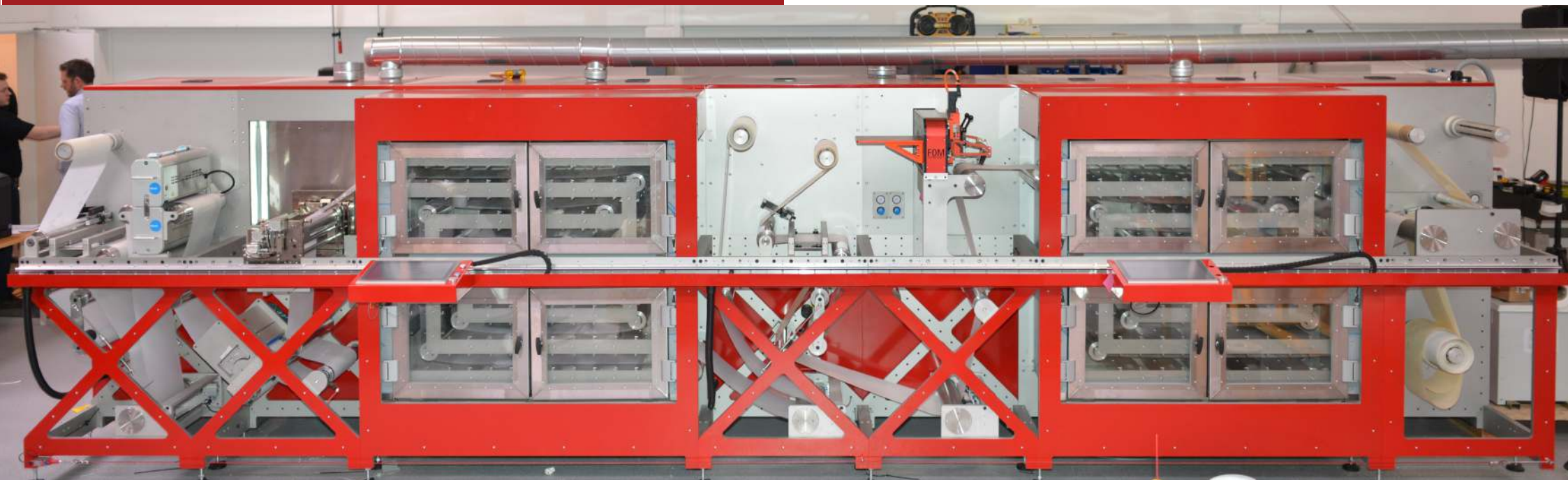
Up to 200 °C

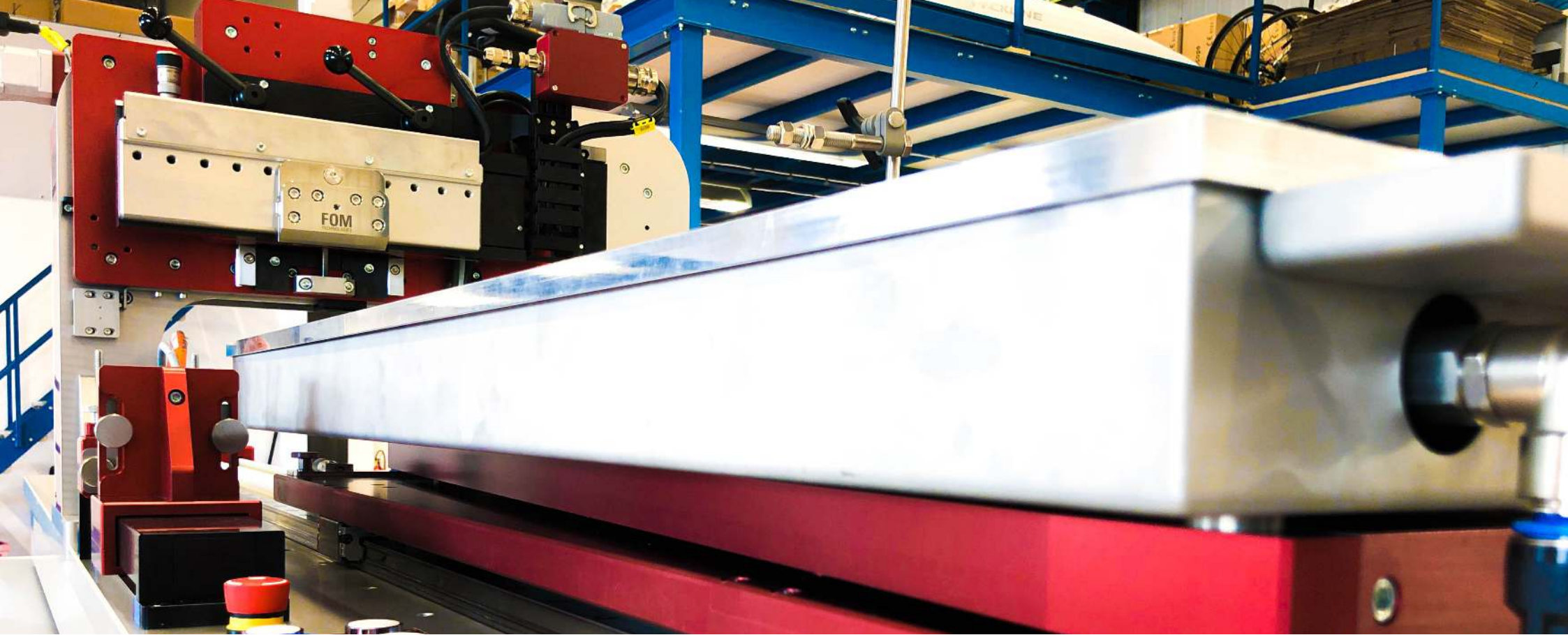


N x 300 kg



Options available





Custom projects

At FOM Technologies, we understand that thin film researchers represent a huge variety of subject areas, goals and needs. We design our tools with a researcher-centric mindset to meet as many of these needs as possible with our standard configurations. Even so, customizations are sometimes required to enable processes that wouldn't otherwise be possible. In these cases, we pride ourselves on our ability to adapt our designs, or even design entirely new tools from the ground up to meet the needs of our clients. Whether you require custom dimensions, multiple coating stations, in-line processing and characterization, or something new altogether, we welcome all requests and look forward to the chance to bring your custom project to life.

FOM slot-dies

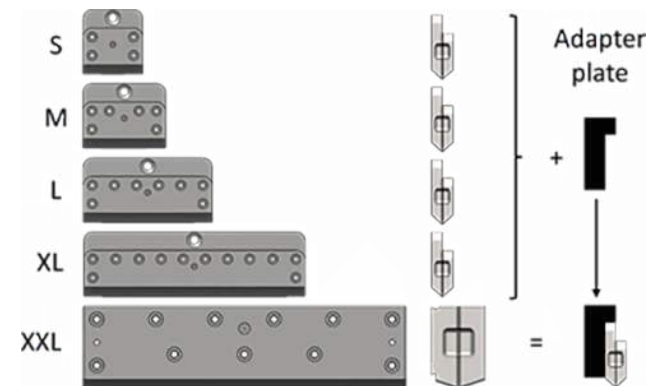
Product description

Our internationally acclaimed slot-die heads have been optimized to provide excellent flow properties, robust chemical resistance and a user-friendly operating experience every time. We use only the finest materials to craft our dies and apply a unique physicochemical treatment process to ensure outstanding performance and longevity. This, combined with our flexible shim width control system, makes them the ideal choice for R&D coating applications.

Models: Research Series, Industrial Series

Key features

- Outstanding flow properties
- Simple compatibility with FOM coating machines
- Variable head sizes and viscosity ratings
- Flexible shim thickness and stripe pattern options
- User-friendly assembly and cleaning
- Excellent durability and chemical resistance



CONSUMABLES & ACCESSORIES



High-temperature PET tape



Handheld web cleaner & flattener



Precision level



Allen key set



Beginner-friendly foils & inks



PTFE tubing, syringes & fittings



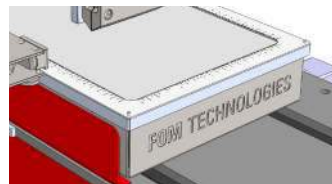
Feeler gauges



Slot-die convenience holster



Custom shims & meniscus guides



Custom substrate positioning templates



Custom flexographic sleeves



Complete starter pack

COURSES & TRAINING

We partner with leading institutions worldwide to provide access to unrivaled training facilities and instruction. Our slot-die coating workshops provide new users with the opportunity to jump start their knowledge with a hands-on introduction to all aspects of precise, continuous and scalable thin film production via slot-die coating. Experienced users will also benefit from a chance to sharpen their skills, fill knowledge gaps and discuss their most pressing challenges with world-leading instructors during these extensive training sessions.

Key benefits

- 2-day guided workshops
- Hands-on coating, characterization and process optimization
- Insights into scalable production of OPV, perovskites, OLED, batteries and more
- Full access to supplementary video lectures
- Q&A access to expert instructors
- Bring your own materials!



WASHINGTON
Clean Energy Testbeds

University of Washington Clean Energy Institute



University of
Southern Denmark



Helmholtz Innovation Lab





QD Solar [CA]

Two days at a FOM Technologies workshop clearly demonstrated the value of slot die coating in rapid iteration and upscaling of solution processed thin film devices. The WCET facilities were excellent, the program was flexible and the guidance I received was spot-on. It significantly accelerated and substantiated my understanding of the slot die coating process.

I left the workshop with tangible benefits for our process and a better understanding of how to move forward in our large-area coating and testing.

Dr. Armin Fischer, COO

Activities

- Training in tools and methods for next generation energy devices and printed electronics
- Introduction to advanced materials and suppliers
- Ink formulation and optimization (viscosity, surface tension, contact angle and particle size)
- Film characterization (thickness, absorptivity, conductivity and defects)
- Functional device coating and testing
- Q&A access to expert instructors

FOM Technologies & the US government – US National Labs collaborations & funded programs via DOE & NSF



U.S. DEPARTMENT OF
ENERGY



SELECTED REFERENCES



FOM
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