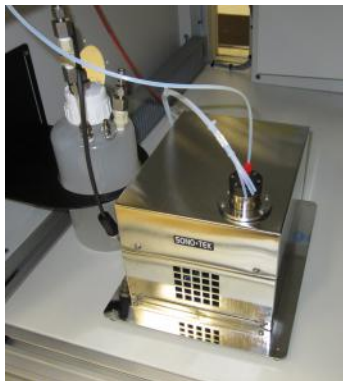
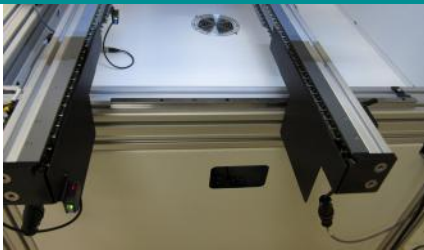


Ultrasonic Coating Systems

A Complete Line of Equipment Solutions

Repeatable, Uniform Thin Film Coatings



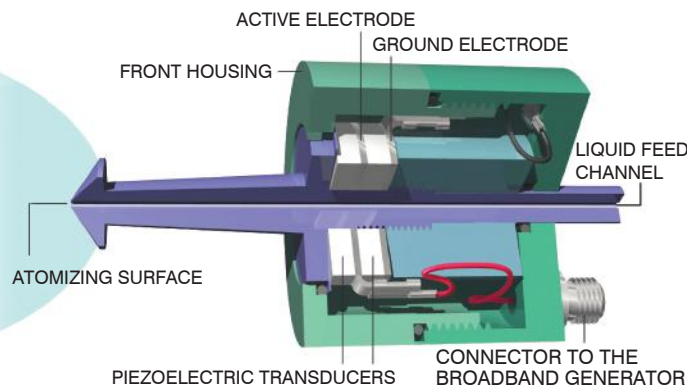
SONO•TEK Corporation

www.sono-tek.com

The Ultrasonic Advantage

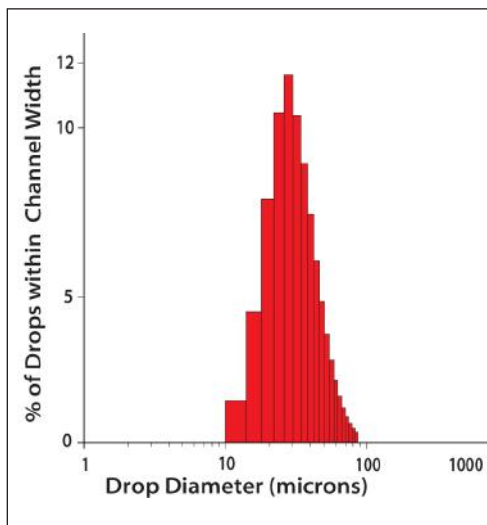
Ultrasonic Nozzle Technology

The illustration shows a cross section of an ultrasonic nozzle. Liquid travels down the center of the nozzle and is atomized at the nozzle tip by high frequency vibrations. The soft, atomized spray mist created is easily directed toward the substrate, producing highly uniform ultra thin films with very little overspray.



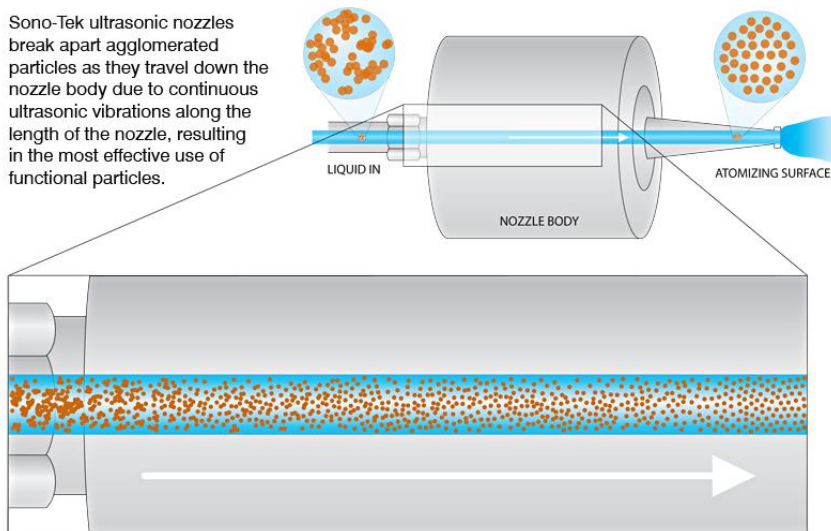
Sono-Tek ultrasonic coating systems are recognized around the world as being one of the most advanced deposition technologies on the market. Systems are available from small R&D to high volume production.

Very tight drop distribution means more uniform distribution of catalyst compared with air spray, screen printing, and other deposition methods.



Spraying Suspensions

Sono-Tek ultrasonic nozzles break apart agglomerated particles as they travel down the nozzle body due to continuous ultrasonic vibrations along the length of the nozzle, resulting in the most effective use of functional particles.

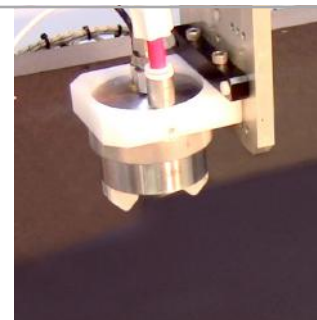


A close up view of liquid traveling through the nozzle orifice illustrates the deagglomeration of particles prior to deposition onto the fuel cell substrate.

Patented Low Velocity Air Shaping



Spray patterns range from 0.070 - 12" (0.18 - 30.5cm) wide per nozzle, depending upon the air shaping system used. Multiple nozzles in tandem are capable of spraying uniform thin films of unlimited widths.



Systems to Suit Every Need

From R&D to Roll to Roll Continuous Production

Systems are used to coat a myriad of different substrates for advanced energy, medical device manufacturing, glass manufacturing, precision semiconductor coatings and functional nanocoatings for R&D applications. Sono-Tek coating systems achieve more repeatable, uniform ultra thin films than pressure spray or other conventional coating technologies.



R&D Coatings

Exacta•Coat

Fully enclosed XYZ tabletop ultrasonic coating system.

Features include:

- Precise substrate uniformity with repeatability down to $\pm 2\%$
- Compact benchtop design that favors portability
- 400 mm x 400 mm x 100 mm (15.75" x 15.75" x 3.94") range of motion
- Windows®-based programming software with image import
- Remote trackball teach pendant
- Coordinated motion in all three axes simultaneously



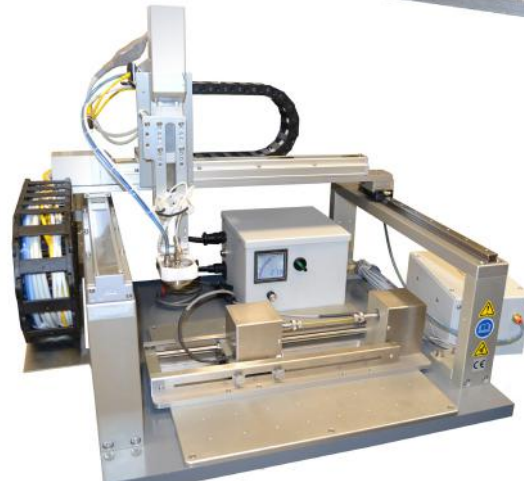
R&D Coatings

Exacta•Coat^{OP2}

Open platform XYZ motion ultrasonic coating system designed for glovebox integration.

Features include:

- Compact benchtop design that allows for flexibility of placement
- 400 mm x 400 mm x 100 mm (15.75" x 15.75" x 3.94") range of motion
- Windows®-based programming software (PC included)
- Remote teach device
- Coordinated motion in all three axes simultaneously
- Integrated analog nozzle power and pump control
- Optional wire/rod coating attachment



Systems to Suit Every Need

From R&D to Roll to Roll Continuous Production



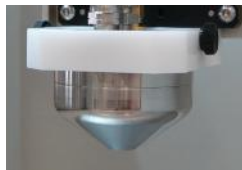
Low to Mid Volume Coatings

Programmable standalone XYZ coating system for photoresist deposition.



Features include:

- Precise substrate uniformity and process repeatability
- Integrated wafer lockdown
- Full process control with Windows®-based programming software
- Precise temp control
- Excellent for semiconductor MEMs photoresist applications



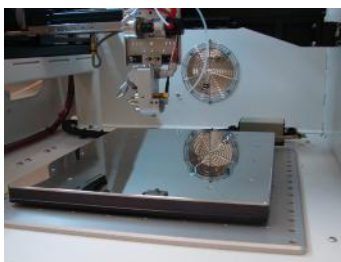
Mid to High Volume Coatings

Flexi-Coat

Inline automated programmable XYZ standalone small footprint platform ultrasonic coating system.

Features include:

- Offline programming capabilities
- 500 mm x 500 mm x 100 mm (19.7" x 19.7" x 3.9") range of motion (up to 1.2 x 1.2 meters available, 47.2" x 47.2")
- Programmable 3-axes coordinated motion via stepper motor drive
- Non-volatile memory for storage of up to 30 programs
- Windows®-based programming software with image import
- Remote trackball teach pendant



CONVEYOR





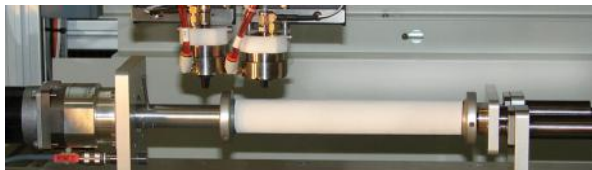
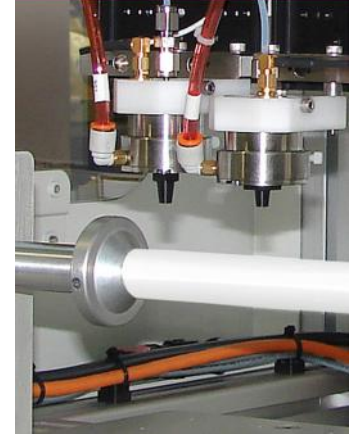
Precision Ultrasonic Coatings for Rods, Wires

Flexi-Coat^R

Programmable automated coating system for spraying onto tubes, rods or wires.

Features include:

- Can coat both rods and flat substrates with the same system
- Secure spring loaded attachment accommodates rods up to 1 m in length
- Coating area is customized to substrate size, max. 1m x 400mm (39 x 15.7")
- Programmable X and Y axes motion and speed of rotation (manual Z adjust)
- Dual nozzle configuration allows layering of different chemistries
- Large spray chamber has multiple coating areas



Low velocity atomized spray ensures that spray materials readily adhere with minimal overspray. Independent control of process variables including flow rate, rotation speed and axis motion.



Large Area High Volume Coatings

Flexi-Coat^{LAC}

Fully automated production volume programmable XYZ ultrasonic coating system capable of automated dual sided coatings.

Features include:

- Automated 2-side substrate coatings
- High throughput
- Auto substrate secure prevents warping of delicate flexible substrates



Systems to Suit Every Need



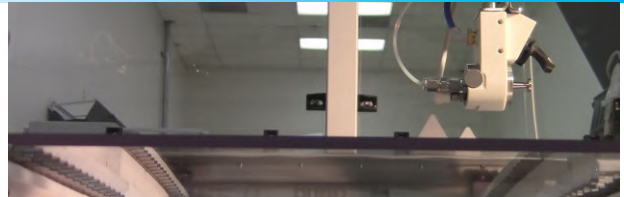
Wide Area Coatings

VersiCoat

Conveyorized system configured with 1-4 ultrasonic nozzles, depending upon spray width needed - an excellent solution for transitioning from R&D to production coatings, or for moderate volume precision coatings.

Features include:

- Easy integration with production conveyors
- Easy access to control modules and spray area
- Low maintenance system
- Enclosure dimensions: 98cm W x 120cm D x 166cm H (38.5 in W x 47.4in D x 65in H)



High Volume Continuous Coatings

WIDETRACK

Custom designed for high volume continuous production of wide area substrates such as roll-to-roll films 1-3 meters wide.

Features include:

- Proven reliability for continuous volume production
- Non-clogging, low maintenance system
- Custom widths available using multiple nozzles in tandem
- Seamless scale up production from R&D volumes, since the same ultrasonic spray nozzle technology is used



Patented Precision Liquid Delivery Systems

RESEARCH & DEVELOPMENT VOLUMES

Syringe Pump TI **Touch Interface Syringe Pump**



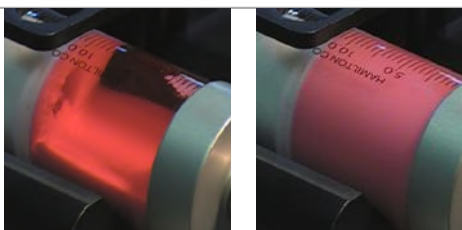
- Fully integrated with XYZ platform software for on-the-fly flow control
- Intuitive touch screen interface
- Wide flow rate range - 0.01-50 ml/min
- 1.8° precision stepper motor
- 25 ml syringe standard (100 ml max)
- Single shot or continuous operation
- Only need 10ml to prime



SonicSyringe **Ultrasonic Dispersion Syringe Pump**



- Fully integrated with XYZ platform software for on-the-fly flow control
- Intuitive touch screen interface
- Wide flow rate range - 0.01-50 ml/min
- 1.8° precision stepper motor
- 25 ml syringe standard (100 ml max)
- Single shot or continuous operation
- Only need 10ml to prime



Magnetic Stirring Syringe



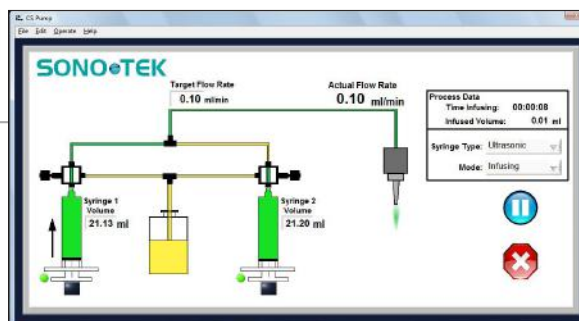
- Effective mixing of catalysts or slurries
- 25 ml glass syringe standard
- Control module displays alarm conditions
- 2 stir pills provided
- Only need 10ml to prime

LOW TO MEDIUM VOLUME PRODUCTION

SonoFlow **Continuous Syringe Pump**



- Continuous flow dual syringe pump
- Available with SonicSyringes or magnetic stirring syringes for dispensing suspensions that agglomerate easily.
- (2) 25 ml glass syringes standard
- Flow rates down to 0.5 ml/min



MicroFlow



- Wide range of flow rates - 1 ml/min to 25 ml/min
- High accuracy dispense +/- 0.5%
- Continuous flow capability
- Ceramic (ZrO₂) pump rotor for superior chemical resistance and liquid compatibility

Gantry Mounted Syringe



- Servo controlled precision dispensing syringe automatically refills from a separate reservoir, when necessary
- Automated dispense routine and refill using Pathmaster software
- Works with SonicSyringe or magnetic stirring syringe where required

HIGH VOLUME PRODUCTION

HyperFlow **High Volume Manufacturing Pump**



- Continuous or intermittent flow for highest volume applications
- Constant recirculation to nozzle from stirred catalyst reservoir
- Continuous flow keeps catalyst suspended
- Dual flow rate dispense. High flow recirc. or operational flow for better performance.

Customizable Options

Heat & Vacuum Plate



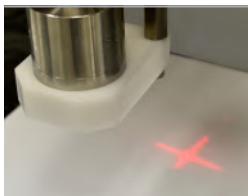
- Heat - Max 150°C**
- Redundant safety overtemp shutoff
 - Contact heat
- Vacuum - Max pressure 84kPa (12 psi)**
- Up to 4 zones - user controlled
 - Aluminum construction (SS316 available)

Dual Nozzle Configuration



- Dual nozzle configurations allow different spray patterns or reduced cycle time
- Allows layering of different liquids in the same coating cycle

Camera/Laser Pointer



- Passive vision camera
- Crosshair software package
- Adjustable focus
- Resolution: 752 x 480, 87 FPS
- Laser Wavelength: 650 nm
- Class II laser
- Crosshair

Substrate Holder



- SS316 construction
- Mounts directly to standard tooling plate
- 3 standard opening sizes available for substrates*
 - » 5cm x 5cm, 2cm x 2cm, or 20cm x 20cm
- * Custom sizes available upon request

Rod Spinner



- Removable secure spring loaded attachment accommodates hollow rods or wires up to 1 m in length
- Coating area is customized to substrate size, with a maximum 1m x 400mm (39 x 15.7") spray area
- Programmable X, Y, and Z axes motion and speed of rotation (manual Z adjust)

Nozzle Rotate/Tilt



- Rotate**
- 0 - 90° adjustable two position pneumatic rotate
 - 360° servo motor controlled rotation also available
- Tilt**
- Automated tilt with variable Z position angle adjust
 - Two-position programming (vertical+one angle) per recipe

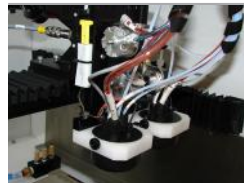


Low Oxygen/High Nitrogen Environment



- When the Cycle Start button is pressed in Auto cycle mode the machine is flooded with inert gas until a set point % of O₂ is reached and maintained for approx. 10 seconds.
- Exhaust is baffled and a secondary purge regulator is used to maintain gas level.
- Typical gas consumption: Initial purge - 250 LPM, Maintain - 20 LPM

Aggressive Materials Upgrade



- Replacement of standard titanium nozzle with Cobalt series nozzle
- Protective bellows on gantry slides
- Teflon Impact/AccuMist air shaping (where applicable)
- Teflon coated tooling plate
- Protective motor covers

2-Drawer Production Configuration



- User friendly low-to-mid volume production in a compact tabletop configuration
- Sensor driven drawer lock prevents plate movement during processing
- Fully integrated software control allows seamless loading/unloading of substrates
- Spray area is 13.8 x 7.9" (350 x 200mm) for each plate.

Flow Rate Monitoring



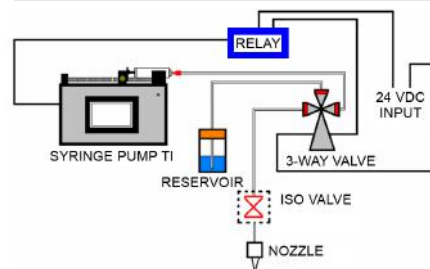
- Programming will output both the Volume Dispense in the spray cycle and the Total Volume Dispense*
- * Total Volume Dispense can be reset to zero

Plasma Treatment System



- Pretreatment of substrates immediately prior to coating
- Enhances wettability/coating receptiveness

Syringe Pump Auto Refill



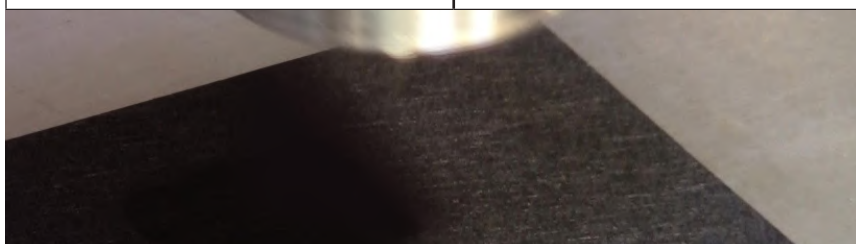
- Designed for hands off and automated filling of syringe
- Syringe pump infuses and fills from separate reservoir
- Allows user to program syringe refill set points in the recipe

Note: Depending upon individual configurations, there may be limitations on the number of options that can be integrated together on a single machine.

Coating Equipment Worldwide Reference List

The following is a partial list of reference sites

WORLDWIDE		USA
Imperial College of London – UK	TOBB University – Turkey	South Dakota School of Mines
IMEC – Belgium	King Abdullah University – Turkey	Brookhaven National Laboratory
University of Liège – Belgium	Technion Institute of Technology – Turkey	University of Syracuse – New York
University of Lisbon	Fujikara – Japan	Virginia Tech
SINTEF – Norway	NKK – Japan	University of Florida (Gainesville)
DTU/Technical University of Denmark	Toshiba – Japan	LANL (Los Alamos National Laboratory)
ZBT – Germany	Panasonic – Japan	Northwestern University – Illinois
INM – Germany	Tokyo Institute of Technology	NREL – Colorado
Fraunhofer ISE – Germany	Kaneka – Japan	University of South Carolina
TU Chemnitz – Germany	Mitsubishi – Japan	University of Texas at Austin
Max Planck Institut for Solid State Research, Stuttgart – Germany	Tokuyama – Japan	Texas A&M
Forschungszentrum Jülich – Germany	UNIST – Korea	University of Washington State
IMTEK Dept of Microsystems Engineering University of Freiburg – Germany	NCKU – Taiwan	Hunter College – New York
Paxitech – France	CSIR – India	University of Louisville – Kentucky
University of Paris – France	NRC (National Research Council) – Canada	Iowa State
Melbourne University – Australia	Simon Fraser University – Canada	Oak Ridge National Laboratory – Tennessee
Dicle University – Turkey	University of Alberta – Canada	University of Delaware
METU – Turkey		Lawrence Berkeley National Laboratory – California
		University of Wyoming



Laboratory Testing Capabilities

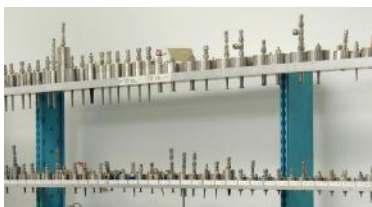
A Full State-of-the-art Laboratory Facility

Sono-Tek's in-house testing laboratory enables atomization testing and process simulation for many different applications. This allows customers to see coating examples and perform small experiments with variations in process variables, usually on their actual substrates. Our application engineers guide customers in basic testing and use of coating equipment in order to evaluate and specify the best coating solution.



SEM MICROSCOPE: *On-site analysis of coatings provides important process optimization data.*

The ability to analyze precision nanocoatings immediately following coating ensures that customers get the most out of their testing experience and are able to accomplish a significant amount of critical process optimization in a short amount of time.



Advanced Energy Application Engineering Expertise

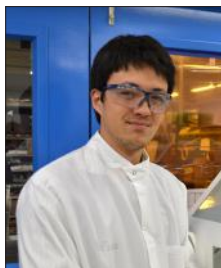


Sono-Tek's experienced team of application engineers and lab technicians have expertise in several areas, including fuel cells, solar cells, thin film batteries, glass coatings, medical devices, and a multitude of functional nanocoating applications. The expertise of our staff has helped hundreds of customers develop processes utilizing our knowledge of how to optimize the performance of our coating systems.

Members of Sono-Tek's Application Engineering Team



Chris Cichetti
Applications Engineering Manager
BS - Electrical Engineering,
Worcester Polytechnic Institute
Areas of expertise: Fuel cells,
solar cells, glass coatings,
medical device coatings



Fielding Water
Applications Engineer
BS - Chemical Engineering,
Rensselaer Polytechnic Institute
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blood collection tubes



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BS - Mechanical Engineering,
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device coatings



Bryan Hartz
Applications Engineer
BS - SUNY New Paltz
Areas of expertise: Fuel cells,
solar cells, semiconductors,
photoresist coatings,
TCO layers, sensors



Global Solutions in Ultrasonic Coatings

Sono-Tek's corporate headquarters are located in Milton, NY USA, with additional offices in Hong Kong. Our extensive global support and distribution network provides factory trained personnel with local language support in dozens of countries worldwide.



SONO•TEK Corporation

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