

## Precision Ultrasonic Coating Systems for Sustainable Manufacturing



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# Who We Are

*Sono-Tek has 80+ employees working in our corporate headquarters location, in addition to worldwide distributors and support personnel in dozens of countries.*



Sono-Tek was founded in 1975 by **Dr. Harvey L. Berger, Ph.D.**  
*Inventor of the ultrasonic nozzle*



All of our products are designed and manufactured at Sono-Tek's corporate headquarters in Milton, New York. This facility houses our factory as well as a full staff, including engineering, sales, accounting, manufacturing, quality control, technical support and shipping departments.

Sono-Tek became ISO certified in August 1998 and is presently ISO 9001:2015 certified. We are committed to the highest standards for manufacturing in our Milton, New York facility.



Sono-Tek became a publicly traded company in 1987 and currently trades on Nasdaq under the symbol **SOTK**.



## Sustainable Manufacturing

Manufacturing that minimizes negative environmental impacts while conserving energy and resources.

Integrates environmental, economic and social factors to produce goods responsibly.

Achieves products that are environmentally sound across their life cycle.

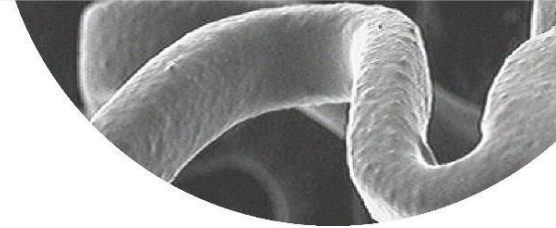


# Ultrasonic Coating Sustainability Advantages



- ✓ *We invented ultrasonic coating technology.*
- ✓ *Over 50 years expertise in the development and application of ultrasonic spray technology.*
- ✓ *Numerous patents and intellectual property.*
- ✓ *Provide customized coating solutions.*
- ✓ *Worldwide distribution and support network.*

*Environmentally-friendly coating technology*



## Top 10 special characteristics of ultrasonic spray technology

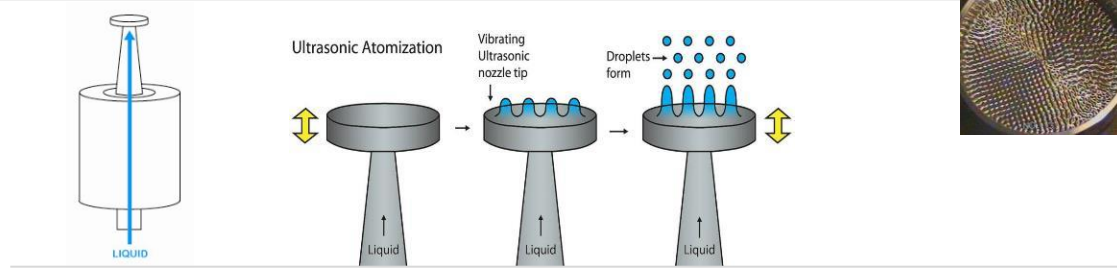
- Uniform drop size enables highly uniform nano layer coatings.
- Reduction in coating material by as much as **80%** compared to traditional coating methods such as pressure spray.
- Soft, low velocity spray has little kinetic energy, covers any geometry and readily adheres to surfaces.
- Dramatic reduction in overspray and atmospheric contamination leading to a **30-40% emission reduction**
- Independent control of process variables including flow rate, deposition and air shaping.
- Very high transfer efficiency and excellent repeatability.
- Self-cleaning, non-clogging, low maintenance nozzles.
- Spray envelopes range from .015" to unlimited widths using multiple nozzles in tandem.
- Titanium nozzle construction results in high reliability and long life.

Precision nano layer coatings

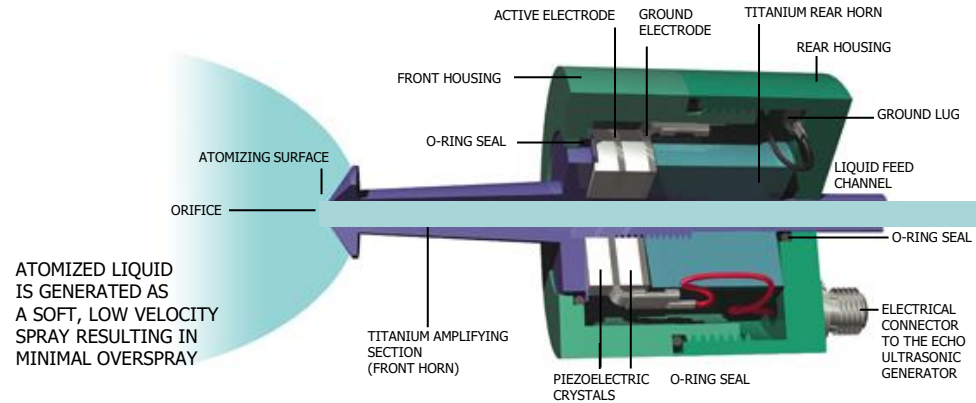
# How Ultrasonic Nozzles Work

## Wave formation and atomization

- When liquid is added to a resonating nozzle, waves are formed on the atomizing surface perpendicular to the axis of vibration underneath.
- An ultrasonic generator provides the electrical energy required to create atomization.
- Increasing the power of electrical energy causes the wave peaks to get so high that droplets simply fall off the tips of the wave. These droplets have a mathematically definable size, with very little size variance.



*Cross section of Sono-Tek ultrasonic nozzle*

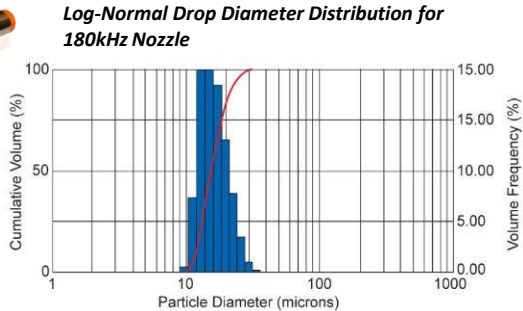


# Drop Size Distribution

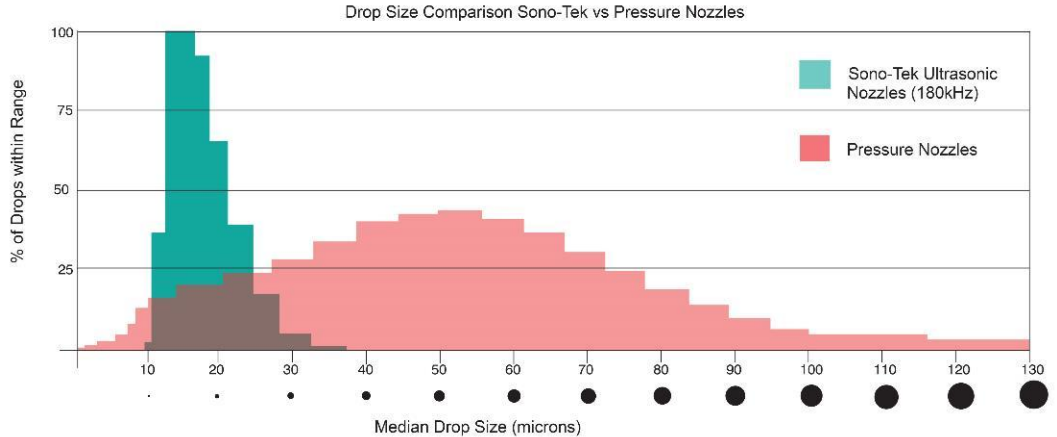
The frequency of the nozzle determines drop size, with the highest frequency producing the smallest drop size. Sono-Tek ultrasonic nozzles are available in the following operating frequencies (kHz): 25, 35, 48, 60, 120, 180 The tight drop distribution of ultrasonic nozzles is key to providing uniform ultra-thin, controllable coatings.



**180 kHz Nozzle** - With a median drop size of 13 microns, the 180 kHz ultrasonic nozzle has the smallest drop size of any ultrasonic nozzle.

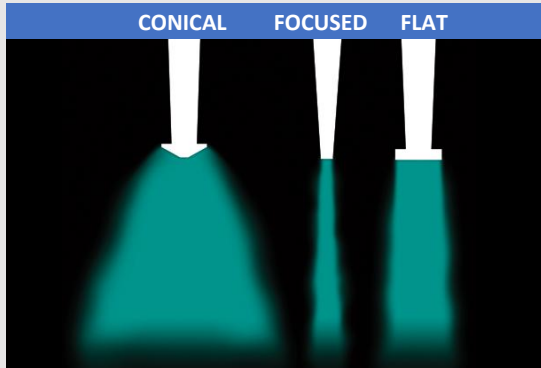


Ultrasonic Spray	Pressure Spray
<ul style="list-style-type: none"> <li>Liquid flows through a relatively large orifice using no pressure, and is atomized at the nozzle tip using ultrasonic vibrations. Spray variables are easy to control.</li> </ul>	<ul style="list-style-type: none"> <li>Liquid is forced through a very small orifice using high pressure to shear the liquid. Spray variables cannot be controlled independently (flow rate, deposition).</li> </ul>
<ul style="list-style-type: none"> <li>Drop distribution is dictated by the frequency of the nozzle with very tight drop distribution.</li> </ul>	<ul style="list-style-type: none"> <li>Wide range of unpredictable drop sizes. Difficult to predict and control drop size.</li> </ul>
<ul style="list-style-type: none"> <li>Very little bounceback (droplets bouncing off substrate) or overspray due to the soft “mist” ultrasonic spray</li> </ul>	<ul style="list-style-type: none"> <li>Large amount of overspray and satellite drops due to high velocity spray, as well as a large amount of bounceback.</li> </ul>



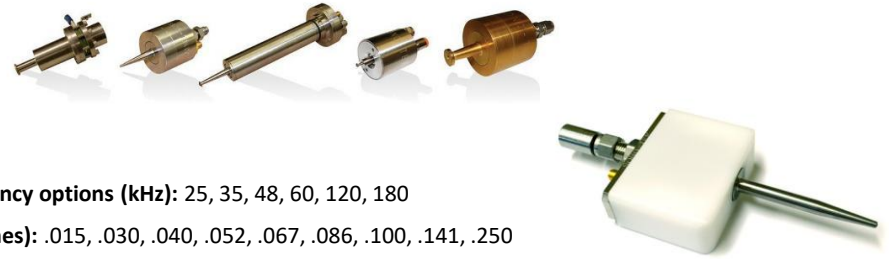
# 1000s of Patented Nozzle Configurations

Spray shape created by nozzle atomizing surface geometry



The shape of the nozzle tip creates a spray pattern that can be further focused using one of several air shaping methods shown on the right.

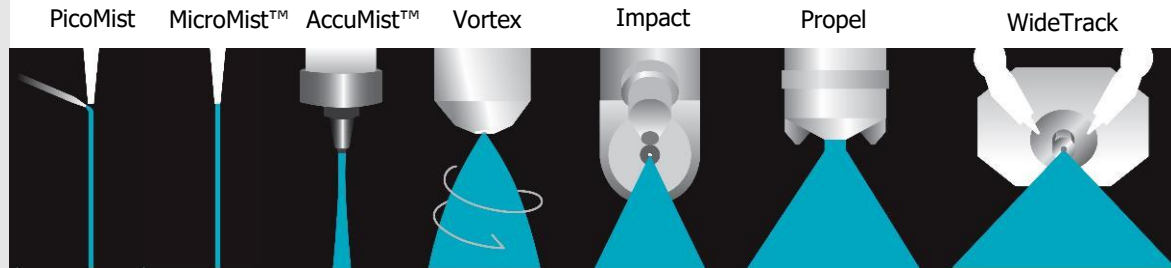
1000s of ultrasonic nozzle configurations are available to suit any spray process requirement. Nozzles are integrated into full coating solutions, from small R&D tabletop systems to wide area moving web conveyorized systems, with PLC process control and recipe storage capabilities. Advanced materials of construction enable spraying of corrosive materials and high temperature environments.



**Operating frequency options (kHz):** 25, 35, 48, 60, 120, 180

**Orifice Sizes (inches):** .015, .030, .040, .052, .067, .086, .100, .141, .250

**Air/gas spray shaping:** Low velocity air is used to further shape the spray and direct it toward the substrate when precise patterns are required. Spray patterns range from .010" to unlimited widths.

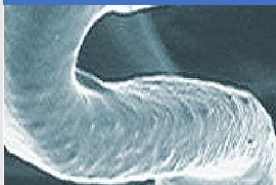


Spray patterns range from 0.070 – 12" (0.18 – 30.5cm) wide per nozzle, depending upon the air shaping system used. Multiple nozzles in tandem are capable of spraying uniform thin films of unlimited widths.

# Industry & Application Expertise

*Coating technologies for every day, in a multitude of precision applications and industries.*

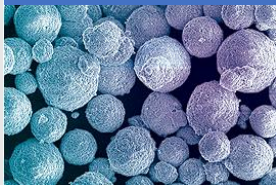
MEDICAL DEVICES



PRECISION ELECTRONICS



NANOTECHNOLOGY



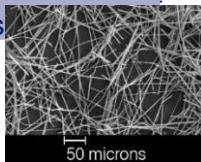
GLASS



Photochromic & AS lens coatings

Multiple smart phone applications

Nano conductive films



Stain repellent coatings

Automotive glass coatings

Medical implant coatings

Antimicrobial textile coatings



# Industry & Application Expertise

*Medical Device Coating Expertise*

## Stent & Balloon Catheter Coating Systems

- Anti-restenosis drug coatings onto cardiac, peripheral, biliary, and custom stents
- Anti-restenosis drug+plasticizer coatings onto balloon mounted catheters

## Other Medical Devices

*Lubricious, antimicrobial, hydrophilic, or other thin film coatings:*

- Implantable Devices
  - Orthopedic Rods, Pins, Screws
  - Surgical Implants
  - Sensors, Pacemaker Components
- Guide Wires
- Diagnostic and Reagent Coatings
  - Microfluidic/microarray devices, immunoassay kits
  - Cell culture vessels
  - Blood glucose monitors
  - Genetic testing devices
  - Blood collection and analysis kits
  - Molecular and protein diagnostic

## Antimicrobial Coatings Systems for Medical Textiles

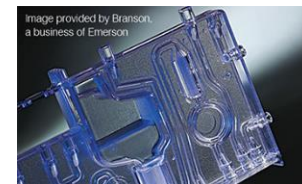
- Bandages, Topical Patches, Implantable Mesh, Wound Dressings
- Surgical Masks, Gloves, Hospital Textiles

## Blood Collection Tubes/Syringe Barrels

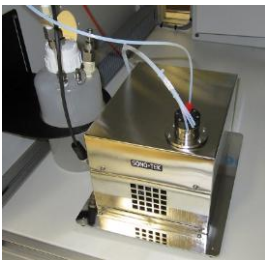
- Coatings onto syringe and tube side walls without collection of material at the base of the tube
- Coagulants, Anti-coagulants, Siliconization

### Common materials sprayed include:

- |                       |                  |                             |
|-----------------------|------------------|-----------------------------|
| • PFAS-Free materials | • Paclitaxel     | • Biological polymers       |
| • Hydrophilic         | • Rapamycin      | • Bioactive peptides        |
| • Heparin             | • Antimicrobials | • Enzymes                   |
| • Blood Plasma        | • Chloroform     | • Blood plasma              |
| • EDTA                | • Acetone        | • Preservatives             |
| • CNTs                | • Toluene        | • Lipids/Proteins           |
|                       | • DMAC           | • Ultra-thin bonding layers |
|                       | • THF            |                             |



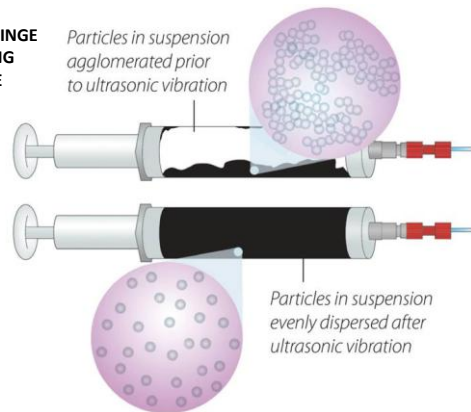
# Scalable Solutions Customizable Liquid Delivery Options



Sono-Tek fully integrates a variety of precision liquid delivery systems for the best liquid delivery performance, depending upon each application's needs. Specialized liquid deliveries include the **SonicSyringe™** ultrasonic dispersion syringe pump, designed to mix suspensions that agglomerate easily and hold them suspended during the entire coating process with continuous ultrasonic vibrations.

**SONICSYRINGE  
OPERATING  
PRINCIPLE**

Particles in suspension  
agglomerated prior  
to ultrasonic vibration



Particles in suspension  
evenly dispersed after  
ultrasonic vibration

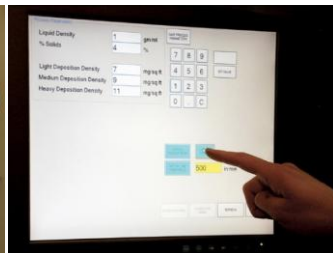
# Scalable Solutions



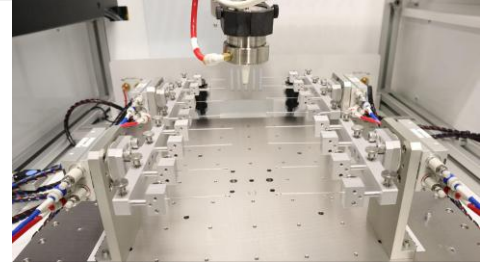
## CLEARLY BENEFICIAL

A comparison of a float glass pressure nozzle coating system (left) and the Sono-Tek ultrasonic coating system that replaced it (right). Both systems are depositing the same amount of spray material.

Tabletop R&D spray systems, turn-key systems, or custom configurations... Sono-Tek offers full coating solutions that can be customized to each spray application. The same core ultrasonic nozzle technology is employed in R&D and high volume manufacturing systems, making scaling from R&D to production volume a seamless transition.



# Custom Systems & Automation



Custom engineered solutions are tailored to meet specific coating requirements, including full inline automated production systems. Some available customizations include:

- Custom fixtures and tooling
- Process development and optimization
- Batch automated part handling
- Pre and/or post processing stations for heat/curing
- Installation, training, and ongoing support

Leveraging our standard systems as a foundation, we ensure optimal performance and efficiency, with reduced integration time and cost. Capabilities include complex Programmable Logic Controllers (PLCs) like Allen Bradley for advanced process control and automation. System sizes and capacities are engineered to meet production volume.



Equipment + Knowledge + Support =  
Success



Great technical support.  
**Johnson Matthey Fuel Cells – UK**



The support with the set up was better than any supplier I have purchased from.  
**Rochester Institute of Technology – NY USA**

## Sono-Tek's Applications Engineering Team



*Sono-Tek's team of application engineers provide direct customer support throughout every step of the process.*



Process Knowledge

1

Discuss and  
Spec in



Lab Testing

2

Prove  
Concept



Coating Services

3

Produce  
Coated  
Product



System Design

4

Personalized  
Build for  
Application



Installation & Support

5

Lifetime  
Process  
Support

# Full Coating Solutions

## Problem Solving is Our Business

*Full coating solutions means everything you need to create the coatings you require is provided. Ensuring our customers' success is the foundation of everything we do at Sono-Tek. Our systems are known worldwide for producing the highest quality, most effective medical coatings possible.*

### People



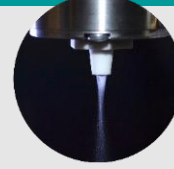
- ✓ Applications engineering team of 6 professionals
- ✓ Highly knowledgeable and experienced technical staff
- ✓ Lifetime process support
- ✓ Worldwide distributors and support.

### Company



- ✓ The leader in ultrasonic coating technology since 1975
- ✓ Publicly traded since 1987
- ✓ 7 worldwide applications testing labs
- ✓ ISO 9001: 2015 Certified
- ✓ Systems built in-house.

### Technology



- ✓ High transfer efficiency
- ✓ Reducing waste and emissions
- ✓ Easily scalable from R&D to roll-to-roll production
- ✓ Enabling PFAS-free coatings.