noanix®

Noanix Corporation connects the world with Creative Custom



INTRODUCTION

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Noanix Corporation manufactures and provides coating solutions and devices for medical devices. Main medical coatings are drug-eluting coatings, hydrophilic coatings, hydrophobic coatings(teflon coating and parylene coating), antimicrobial coatings and antithrombogenic coatings. Devices are coating machines, spray nozzles, pumps and friction testers. Noanix enjoys building custom designed products for your harsh and unique applications.

The company is ISO9001/13485 cetified.

Applications

□ Stent	□ Contact Lens
□ Balloon/Catheter	□ IOL Cartridge
□ Guide Wire	
□ Artificial Blood Vessel	□ Biochip
Syringe/Blood Collection Tubing	□ Medical textile
	□ and many more

| PRODUCT |

Materials(Noacoat[®])

• Hydrophilic Coating

Hydrophilic coating for medical devices are lubricious, abrasion resistant, Non-thrombogenic and biocompatible. Suitable for coating vascular catheters, guide wires and other medical devices, they can be applied to a wide range of polymeric and metallic substrates.

- Advantages

- Exceptionally hydrophilic
- Biocompatible
- Very thin, flexible coatings can be applied
- Lubricious when wet, preventing trauma and tissue abrasion
- Prevents adhesion of platelets, proteins, and microorganisms

- Properties

- Physical properties are readily adapted to meet the design criteria of medical device applications
- Thickness
- Storage stability
- Lubricity / flexibility
- Wettability
- Abrasion resistance



- Applications

- Catheters
- Micro-catheters
- Guide Wires
- Introducers
- Sheaths - Lead Wires
- Intraocular(IOL) Cartridges
 - Endoscopes
 - Vertebral Cages
 - Meshes

 - Sliding surfaces that require lubricity

Ex) Guide wire, Balloon catheter etc..



02



- Blood contacting surfaces that require antithrombogenicity



- Coat Selection

Base coats Substrates	NoaCoat_2	NoaCooat_V	NoaCoat_P
TPU	Excellent	Excellent	Excellent
PEBAX(hard)	Excellent	Excellent	Excellent
PEBAX(soft)	Excellent	*Good	Excellent
PP	Excellent	Moderate	Excellent
PC	Excellent	Excellent	Excellent
Silicone	Excellent	Not recommended	Poor
PE	Excellent	Excellent	Poor
PTFE	Excellent	Not recommended	Not recommended
SS	Excellent Excellent		Poor
Nitinol	Excellent	Poor	Poor
PMMA	Excellent	Moderate	Excellent
PVC	Excellent	Moderate	Excellent
PEEK	Excellent	Excellent	Good
Polyester	Moderate	Moderate	Excellent

* Pretreatment required

- Advantages and Disadvantages

	Coatin	Coating type		Curing	
	One Coating	Two Coating	Heat	UV	
Advantages	 Simple process Saving coat cost 	 High coating performance Free from toxicity 	 Inner coating possible Simpler system Low maintenance 	• Short curing time	
Disadvantages	 Can be toxic Containing harmful factors Low coating performance 	• Long process. • Less cost saving	 Long curing time Sensitive to temperature 	 Inner coating difficult Harmful UV light Harmful photo initiator High system and maintenance cost 	

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- Advantages and Disadvantages

	HA	PVP/PU
Advantages	 Extremely biocompatible(Natural polymer) Stable as a bilaminar coating Stable against water Very lubricious 	 Relatively inexpensive Flexible to formulate Easy to handle Short time of UV curing(PVP) Convertible to UV curing to thermal curing or in reverse(PVP)
Disadvantages	 Thermal curing only Contamination Relatively expensive No one(single) coating Inflexible to formulate 	 Low biocompatibility Low stability against water(particularly PVP) Highly viscous(PU)

* Substrates to be coated

Pebax	• PMMA
• PEEK	• Teflon
• PP	Silicone
• PE	Polyester
• PC	• Metals – Ni, SUS
• TPU	

* Noanix Bilaminar Coating's Advantages

- Most biocompatible (Only natural polymer among hydrophilic materials)
- Extremely durable(most durable method) and lubricious
- Various coating solutions(HA main, PVP and MA optional)
- FDA approved ingredients
- Very low particle account
- Custom coatings possible
- FDA Master file
- *Non-thrombogenic Coating(NoaCoat_H)
- *Antimicrobial Coating(NoaCoat_S)

* Base Coating

- Primer
- Covalently bonded with HA Top Coating
- Generally no pretreatment required
- Custom tuning possible
- Several base coats versions available



- Antimicrobial coating(NoaCoat_S)
- Sample1 made by a local company in Korea
- Sample2(NoaCoat_S)
- Sample3 made by a local company in Korea Competitor in UK



Put Escherichia coli 1 X 10^5 (CFU)/mL into 40mL in the form 5cm cut and 24 hours culturing at 37°C, 120 rp m and then measure absorbance at 600nm * A600 = $1.0 \rightarrow 8 \times 10^8$ cell/mL

no. of microbe of comparison samples after 24 hours culturing – no. of microbe of testing samples

no. of microbe of comparison samples after 24 hours culturing

Reduction Ratio(%) =

P. C	S 1	S 2	S 3	Competitor N.	c
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Samples	Abs	no. of microbe	Reduction Ratio
S1	0.310	2.48 X 10 ⁸	-6.5%
S2(Noanix_S)	0.002	1.6 X 10 ⁶	99.31%
S3	0.028	2.24 X 10 ⁷	90.38%
Competitor	0.008	6.4 X 10 ⁶	97.25%

X 100

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Put MRSA 1 X 10^5 (CFU)/mL into 40mL in the form 5cm cut and 24 hours culturing at 37°C, 120 rpm and then measure absorbance at 600nm * A600 = 1.0 -> 8 x 10^8 cell/mL

no. of microbe of comp culturing – no. of r no. of microbe of comparis

Samples	S1	S2(NoaCoat_S)	S3	Competitor
Reduction Ratio	2.53 %	87.6%	85.3%	86.3%

no. of microbe of comparison samples after 24 hours culturing – no. of microbe of testing samples

no. of microbe of comparison samples after 24 hours culturing

X 100

0 www.noanix.com

80

www.noanix.com



E. coli



MRSA







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• Antithrombogenic coating(NoaCoat_H)

- * Platelet Adhesion Test
- Platelet Adhesion



Control (Co-Cr alloy disk)



Fucoidan



LLMWF







NoaCoat_H





LLMWA





SLLMWA







• Hydrophobic Coatings

The hydrophobic effect is the observed tendency of nonpolar substances to aggregate in aqueous solution and exclude water molecules. The word hydrophobic literally means "water-fearing," and it describes the segregation and apparent repulsion between water and nonpolar substances.

The hydrophobic effect is responsible for the separation of a mixture of oil and water into its two components. The hydrophobic effect is also responsible for the stability of cell membranes, drives protein folding as well as the insertion of membrane proteins into the nonpolar lipid environment and finally stabilizes protein-small molecule interactions. Hence the hydrophobic effect is essential to medical device.

Hydrophobic

- Properties

Self-Cleaning/Anti-Dust, Prevent surface contamination, Organic pollution prevention, Water Contact Angle: 150 <



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* Teflon Coating

One of the most common processes for medical device coatings is teflon coating. There are generally five steps to it:

- 1) Surface preparation/washing
- 2) Submersion of the device in a coating liquid (with a certain dwelling time in some instances)
- 3) Dip coating or Spray coating from the coating liquid, i.e. coating application/deposition
- 4) Drying and/or Curing of coating(Via heat)
- 5) Post processing, if any, especially with heat curing, this is a batch process. With proper system, the batches can be quite large, giving a decent effective throughput.



- Applications

medical equipment, textiles and all sorts of surfaces and substrates. However, the current state of the art for this technology is hindered in terms of the weak durability of the coating making it unsuitable for most applications. Newer engineered surface textures on stainless steel are extremely durable and permanently hydrophobic. Optically these surfaces appear a smooth matte surface but microscopically they consist of rounded depressions one to two microns deep over 25% to 50% of the surface. However, the hydrophobic coating was successful in noanix corporation.

Ex) Coated Surface





* Parylene Coating

Powder Parylene in the vacuum condition is vaporised and coated onto the substrates in the form of polymer. It is a kind of CVD(Chemical-Vapor Deposition)

- Process

Parylene Vaporisation \rightarrow Decomposition \rightarrow Evaporation



- Coating System Setting

- Vaporiser: Parylene Dimer is vaporised with 80-175 $^\circ\!\!\mathbb{C}$
- Pyrolyser: Dimer in gas into Monomer with 650~690 $^\circ\!\!\mathbb{C}$
- Evaporation Chamber: Parylene in the form of polymer is coated on the target substrates

- Benefits

- Hydrophobic, Chemically resistant
- Low leakage current and low dielectric constant
- A biostable, biocompatible, FDA approved
- Dense pinhole free, with thickness above 1.4nm Coating without temperature load of the substrates as coating takes place
- at ambient temperature in a vacuum
- Completely homogeneous surface
- Stable to oxidation up to 350C(Parylene AF-4, SF,HT)
- Low intrinsic thin film stress due to its room temperature deposition
- Low coefficient of friction Very low permeability to gases
- Highly corrosion resistant

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Devices

• Ultrasonic Spray Nozzle Systems

* Characteristics

- Overshooting Waveform deleted
- Sine Wave driven at Square Wave
- Minimising Overheating of Nozzle body by adding Power Control Method
- Very fast switching losses
- Frequent sloshing
- Single nozzle type and Double nozzle type provided















Long 40kHz(N040_A)

Long 40kHz(N400_B)



• USN (Ultrasonic Spray Nozzle)

- Specification

Model	Operating Frequency (kHz)	Maximum Flow Rate (ml/min)	Median Drop Diameter (microns)	Orifice Diameter (mm)	Weight (kg)	Droplet Uniformity (C.V)
LONG_ N040A	40	5	30	0.8	0.3	< 0.1%
LONG_ N040B	40	5	30	1.2	0.3	< 0.1%
N090	90	20	25	1.2	0.4	< 0.1%
N220	220	0.5	12	0.8	0.3	< 0.1%
N320	320	0.2	9	1.2	0.3	< 0.1%
N1	1(MHz)	0.1	5	0.6 (sidefeeding I.D)	0.3	< 0.1%

- Materials :

- Lead zirconate-titanate transducers

- Titanium alloy body

- 316 stainless steel housing

- Spraying material viscosity : < 50 cps

- Characteristics : Focus Width

Model	Focus Width (mm)
N220	0.4
N320	0.4
N1(1MHz)	0.2 or less

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* Wide Jet

- Orifice or nozzle-less spray forming tip on the ultrasonic head
- Sheet like spray pattern

- Wide Jet

Model	Spec
Frequency (kHz)	90(orifice type), 180(nozzle-less type)
Coating Pattern Width (mm)	50~250
Horn material	Titanium alloy





- Low pressure air shaping
- Expandable spray pattern with of air streams control No clogging

* Generator for ultrasonic spray nozzles

- Ultrasonic Wave Generator



	SPECIFICATION	
WxHxL	145 × 160 × 230 (mm)	
Frequency	20kHz ~ 1MHz	
Power	Max. 30 (W)	
Control	Feedback amplifier type	
Wave form	Sine wave	
Characteristics	 Output power level setting Enable control output power on time Real time display driving frequency Auto save driving condition 	

	U300 (analogue type)	New Wave (digital type)	
Frequency (kHz)	20 ~ 1(MHz)	20 ~ 220	
Output power (W)	20	30	
Wave form	Sine wave		
Operating condition	Factory setting	User setting	
Control type	·Open type ·Voltage leveling	 Feedback amplifier power frequency control type Power leveling Driving frequency auto set at setting power level Setting power level resolution: 0.1W Auto save operating condition 	

| PRODUCT |

• Electrospray nozzles/Air-assisted Nozzles

Noanix designs and provides custom electrospray nozzles/Air-assisted nozzles for mainly low flow rates applications.

* Custom

Noanix has designed and provided a lot of custom nozzles for specific applications. Below are some of examples.





150Bar high pressure, max. 20mL/min. flow rate for MicroMixing System

Nozzle for painting coating



Valve type air nozzle for PCB Coating

Long nozzle, 60cm, 1mL/min. flow rate for artificial vessel









Long Nozzle for Biomaterials Coatings

• Ultrasonic Syringe Pumps(USP)



* Features of the USP Family of Syringe Pumps:

- Designed for deagglomeration of particles and catalyst slurries that is difficult to keep evenly dispersed in suspension
- kHz and MHz two frequency versions available
- Fully programmable; automation capable
- Operates stand-alone or from a computer
- Infusion and withdrawal
- Set a single pumping rate and/or dispensing volume
- Program up to 41 pumping phases that change pumping rates, set dispensing volumes, insert pauses, control and respond to external signals, sound the buzzer
- Network, control, and monitor up to 100 pumps with one computer
- Worldwide power supplies available
- Motor stall detection
- Dispensing accuracy of +/-1%
- Unlimited lifetime technical support
- One year warranty

* Example Flow Rates: USP

Model	USP
Syringe Size	0.5 μL to 60ml
Power	100-240 VAC: 50/60 Hz, 50 W. 0.5 A fuse
Motor Drive Control	Microprocessor with 1/16 microstepping
Linear Force(Maximum)	13.6kg(30 lbs) @ 100% Force Selection
Number of Microsteps per One Revolution of Lead Screw	15,360
Step rate(Minimum)	27.5 sec/µstep
Step rate(Maximum)	26 µstep/µstep
Drive Motor	0.9 degree Stepper Motor
Pusher Travel Rate-(Minimum)	0.15 μm/min
Pusher Travel Rate-(Maximum)	159 mm/min
Flow Rate-(Minimum)	1.26 pl/min(0.5 µl syringe)
Flow Rate-(Maximum)	88.28 ml/min (60 ml syringe)
Dimensions	22.6 × 19.05 × 15cm(9 × 7.5 × 5in)
Weight	2.66kg(5.9lbs)
Connectors	RS-232 - 9 Pin D-Sub Connector, RS485 - IEEE-1394 6 pos, USB - Type B

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O Coaters

- * Spray Coaters(SoniCoater®)
- SoniCoater for DES(Drug- eluting Stent)



- SoniCoater for Balloon



- SoniCoater for Artificial Blood Vessel







- SoniCoater for Blood Collection Tubing/Syringe



- Coating Systems for Industrials











* Dip Coaters(NoaCoater®)

Dip Coaters are used mainly for hydrophilic Coatings and hydrophobic coatings(teflon coating). Their spec and design depends on coating process and coating solutions.







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* Inner Coaters

- Inner coater for internal coating





Model Inner Coater

Description Internal Coating System for hydrophilic and hydrophobic coatings(for one coating or two coating)

Includes

Requirements

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- Size of 950 x 750 x 1150(Customised) - Produces 9 Tubes at one time(Customised) - Self-drying/curing System - For Inside Coating of medical devices

System Specifications

- Control : PID Control - Reservoir Volume : 1.5 L (Customised) - Device & Coating Length : max. 550mm (Customised) - Coating Inner Diameter : 3~35mm(Customised)

- Power: 110-220VAC, 50/60hz 20A(Customised) - Air Operating : Minimum 20 psi

Housing Specifications

- Construction 316 stainless steel, aluminum



* Parylene Coaters



- System Design

- Uniform Pumping Deposition Chamber
- Q.C.M. Control & S/W
- Main Control S/W
- System Design & OEM Cold Trap.

Real time thickness monitoring by QCM(Option) Adhesion promoter injection(Option) Fully Automatic Control by Recipe Storage & Good G.U.I by Touch PC

- Research Applications

- Link layers for bio sensors
- Organic / Inorganic hybrid material research
- Implant for medical devices
- Piezoelectric material research
- Electronics(dielectric layer, wave guide)

- DIMER

- FDX-NH2 : 4-Amino-di-p-xylene
- FDX-CHO : 4-formyl-di-p-xylene
- FDX-COOH : 4-Carboxy-di-p-xylene
- FDX-CH2NH2 : 4-Aminomethyl-di-p-xylene

| PRODUCT|

• Friction Testers(FTFC)

Friction Tester for hydrophilic coatings and teflon coating It shows coating's lubricity and durability.

- Testing length : max.400mm
- Sample diameter : max.18mm
- Testing speed : 1-500mm/min.
- Clamp force : 1-3N
- Data printable
- Various functions, conditions and figures input possible
- Including a PC, Printer, Air compressor

Manufacturer	
Product Name	
Model	
S/N	
Rated Voltage	
Frequency	
Power	
Short Circuit Current Rating	
Dimensions	
Weight	
Manufactured Date	
Address	
Drawing No	
Tel/Fax	



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NOANIX Corporation

Friction Tester

FTFC

TBA

100 - 240Vac (FREE VOLTAGE)

50/60 Hz

Max. 750W

2.5kA

530(W) 460(D) 1035(H) mm

50 kg

TBA

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