# 4SPIN®

LABORATORY ELECTROSPINNING DEVICE

CONTIPRO

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LABORATORY ELECTROSPINNING DEVICE

4SPIN® LAB is a versatile device suitable for use in different fields of research and development of novel materials using various types of emitters and collectors to produce both **2D and 3D nano or microstructures**. Due to the patented technology, the device is able to work with a wide range of polymers, some of which can be difficult to spin.

## FUNCTIONALITY

production of 2D and 3D nanomaterials
processing synthetic and natural polymers
more than 16 emitters and collectors

## SAFETY & RELIABILITY

automatic discharge system
high-quality components
electronic safety lock

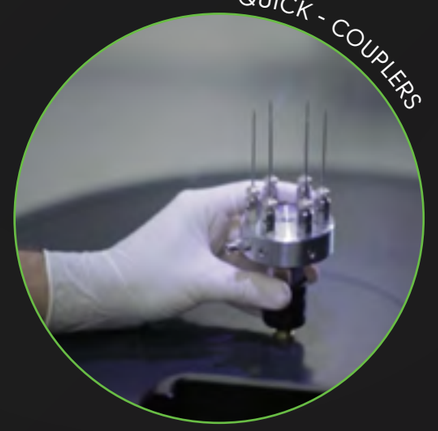
## CONTROLLABILITY

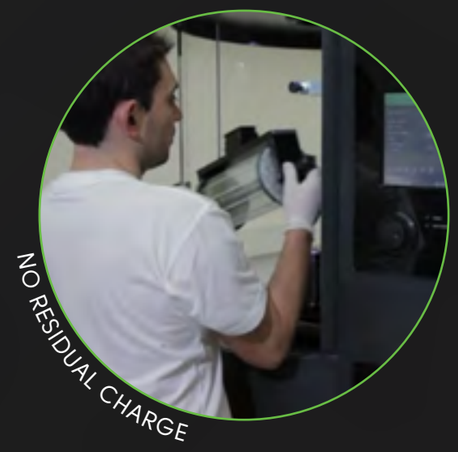
7 controllable process variables
3 measurable process variables
integrated dosing system

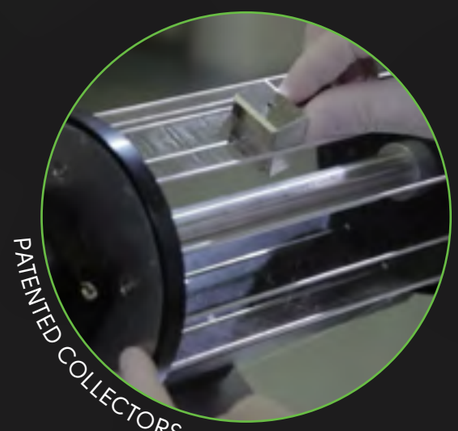
## PERFORMANCE

laboratory to high productivity
high voltage up to 60 kV
distance & speed configuration

The device is **easy to control and highly productive**. The closed dosing system can save costs when working with expensive materials. Selected process parameters are fully controlled by a central system with intuitive handling based on a touch screen and one multifunctional knob. The device is bundled with its own unique data monitoring and logging PC software.



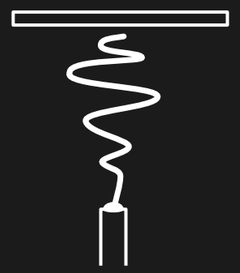


nanofacturing

# Technology

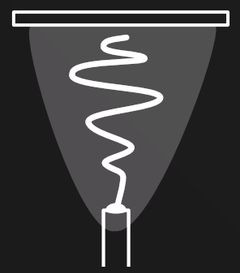
4SPIN® technology relies on three fundamental methods of production:

## ELECTROSPINNING



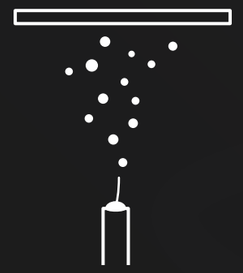
- Electric force is used to produce fibers from polymer solutions
- Fiber diameter ranges from 50 nm to several micrometers
- Suitable for wide range of polymeric materials

## ELECTROBLOWING



- Electrospinning is combined with airflow
- Accelerated evaporation
- Possibility to spin viscous polymers
- Reduces the need of surfactants and other solvent systems

## ELECTROSPRAYING



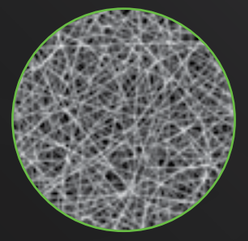
- Production of small beads with regular structure
- Diamater from tens of nanometers to several micrometers
- Used to spray thin layers of biological, organic and inorganic materials

# Applications

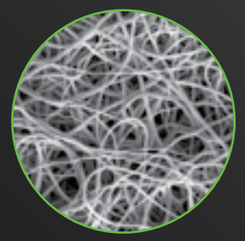
MEDICINE
TEXTILE INDUSTRY
DEFENSE
CHEMICAL INDUSTRY
ELECTRONICS
ENERGY
BIOFABRICATION
FILTRATION
ENVIRONMENT

The device is intended for use in different fields of research and development of nanofibrous materials. Its ability to process even the highly viscose solutions of natural polymers like Hyaluronic acid is crucial for the development of new applications especially in medicine, tissue engineering, drug delivery or wound healing.

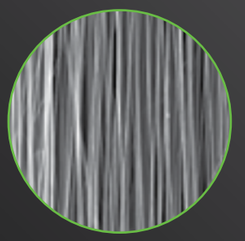
# Materials



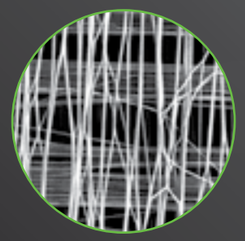
NATURAL POLYMERS



SYNTHETIC POLYMERS

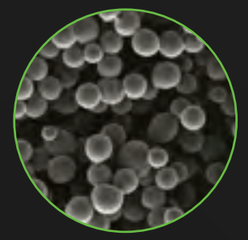


ALIGNED FIBERS

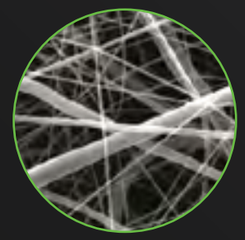


CROSSED FIBERS

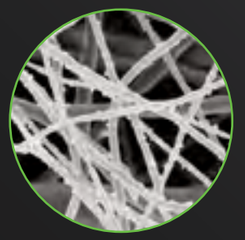
Nearly 30 raw materials from the group of natural and synthetic polymers have been electrospun by 4SPIN® technology so far. Every material can be processed in a number of ways to achieve different inner structure.



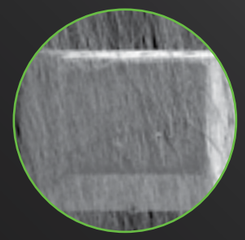
DROPLETS



COMPOSITES

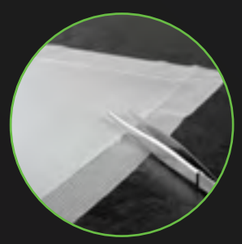


WITH ADDITIVES

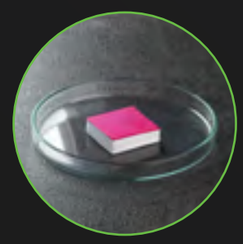


COATINGS

In the macro scale, the resulting materials come in various forms including simple nanolayers, large sheets, hollow tubes or composite layers. The whole process can be implemented as single or multi-step, with an even or gradient distribution of polymers or additives.



LARGE SHEETS



STACKED LAYERS

HOLLOW TUBES

# Emitters

The overall design of the emitters has a major impact on the ability to spin the prepared mixture and also plays a key role in the process throughput. The emitters are connected to the dosing system by Luer-lock fittings. The emitters and the quick couplers can be ordered from three different material types: POM, PP and PEEK.

## E1 SINGLE JET

- Initial experiments
- High spinnability
- Hamilton needles compatibility
- Electroblowing ready

## E2 MULTI JET

- Very high spinnability (six times greater productivity than E1)
- Hamilton needles compatibility
- Medium throughput

## E3 NEEDLELESS ROD

- Initial experiments
- High spinnability
- Easy to clean
- Electroblowing ready
- Typical dosing of 60 µl/min

## E4 MULTI NEEDLELESS

- High spinnability
- Electroblowing ready
- Typical dosing > 150 µl/min
- Electrode diameter Ø 45 mm

## E5 LINEAR MULTI NEEDLELESS

- Electrode width 128 mm with 16 channels
- Easy to clean
- Integrated electroblowing slit
- Typical dosing > 150 µl/min

## E6 COMPOSITE DOUBLE JET

- Initial experiments
- High spinnability
- Hamilton needles compatibility
- Two-polymer electrospinning
- Typical dosing of 15 + 15 µl/min

## E7 COMPOSITE NEEDLELESS ROD

- Two-polymer electrospinning
- High spinnability
- Easy to clean
- Simple construction
- Typical dosing of 60 + 60 µl/min

## E8 COMPOSITE MULTI NEEDLELESS

- Electrodode width 128 mm with 2 x 16 channels
- Two-polymer electrospinning
- High productivity
- Typical dosing > 75 + 75 µl/min

## E9 COAXIAL SINGLE JET

- Core-shell fibers
- High spinnability
- Hamilton needles compatibility
- Easy to clean

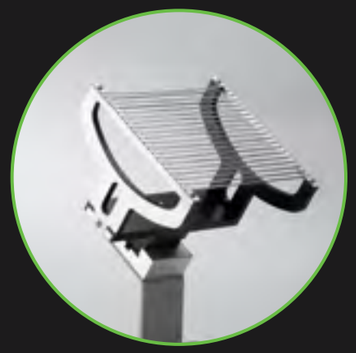
because variability matters

# Collectors

The construction of the collecting electrode has a significant impact on the properties of the resulting material. 4SPIN® Lab offers seven different types of interchangeable collectors. To achieve the best control over the result, several parameters such as speed of the rotation collector or emitter to collector distance can be easily controlled and changed using the multifunctional knob during the spinning process.

## C1 STATIC CONTINUAL

- Preparation of large samples
- Sample size of up to (23 x 23) $cm^2$
- Random order of individual fibers only
- Substrates can by fixed via magnetic attachments



## C2 STATIC PATTERNED

- Uniaxially aligned nanostructures
- High degree of fiber alignment
- Variable void gap size from 20 to 60 mm
- Patented collecting tools available

## C3 ROTATING CONTINUAL

- Sample size of up to (36 x 25) $cm^2$
- Average degree of fiber alignment at high revolutions
- Rotation speed 10 – 5000 rpm
- Homogenous layers

## C4 ROTATING PATTERNED

- High degree of fiber alignment at low revolutions
- Void gap size from 20 to 80 mm
- Rotation speed 10 – 2000 rpm
- Patented collecting tools available

## C5 TUBE COLLECTOR

- Production of hollow tubes
- 6 different sized removable rods (from Ø 2 to 7 mm)
- Rod length 220 mm
- Rotation speed 10 – 3000 rpm
- Easy manipulation and handling

## C6 ENDLESS BELT

- Production of larger mats of nanofiber layers (25 x 100) cm2
- Simulates roll-to-roll production
- Various types of substrates
- Easy deployment and stretching
- Substrate speed 2 - 500 cm/min

## C7 ROTATING THIN DISC

- Enables production of yarns
- Sharp edge available
- Customizable disc width: 0.1, 2, 5 and 10 mm
- Rotation speed 10 – 5000 rpm

# Specifications

## 4SPIN C4S LAB

| | |
|---|---|
| Dimensions | 98 (l) x 66 (w) x 110 (h) cm |
| Deposition chamber dimensions | Ø 61 x 66 (h) cm |
| Weight | 120 kg |
| Power supply | 230 V ~ 50 Hz (standard) |
| Operating humidity | 20 – 40 % RH noncondensing |
| Shipping weight and dimensions | 220 kg, 120 (l) x 80 (w) x 150 (h) cm |

## PROCESSING PARAMETERS

| | |
|---|---|
| High voltage supply | 0 kV to 60 kV |
| High voltage current | 0 – 999 µA |
| collector rotations | 10 – 5000 rpm (according to collector) |
| Maximum solution volume | 2 x 30 ml |
| Feed rate | 0 – 9999 µl/min |
| Deposition time | 0 – 1400 min |
| Airflow | 3 – 99 l/min |
| Heated air temperature | 30 – 80 °C |
| Electrode distance | 5 – 25 cm |

## COLLECTORS

| | |
|---|---|
| C1 STATIC CONTINUAL | 23 x 23 cm |
| C2 STATIC PATTERNED | 23 x 23 cm, gap width 20 – 60 mm |
| C3 ROTATING CONTINUAL | Ø 12 x 25 cm |
| C4 ROTATING PATTERNED | Ø 12 x 25 cm, gap width 20 – 80 mm |
| C5 TUBE COLLECTOR | Ø 2 – 7 mm, rod length 22 cm |
| C6 ENDLESS BELT | substrate size (25 x 100) cm2 |
| C7 ROTATING THIN DISC | Ø 12 cm, 0.1 mm (blade), 2, 5, 10 mm |

Collecting sliding tools are available for the C2 and C4 collectors.

## EMITTERS

| | |
|---|---|
| E1 SINGLE JET | 1 x needle |
| E2 MULTI JET | 6 x needle |
| E3 NEEDLELESS ROD | Ø 18 mm |
| E4 MULTI NEEDLELESS ROD | Ø 45 mm |
| E5 LINEAR MULTI NEEDLELESS | width 128 mm (16 channels) |
| E6 COMPOSITE DOUBLE JET | 2 x needle |
| E7 COMPOSITE NEEDLELESS | Ø 18 mm |
| E8 COMPOSITE MULTI NEEDLELESS | width 128 mm (2 x 16 channels) |
| E9 COAXIAL SINGLE JET | 2 x needle |

An electroblowing attachment is available for E1, E3 and E4. The E5 emitter has it built-in.

| | | |
|---|---|---|
| Syringes | Luer Lock, male termination | 3 – 30 ml, PP body |
| Dosing tubes | Luer Lock, male/ female termination | PVC and teflon |
| Needles | Hamilton compatible | 10 – 34 gauge, 51 mm |

## ACCESSORIES

CLEANING TOOL FOR CAPILLARY NEEDLES
COLLECTING SLIDING TOOLS (VARIOUS SIZES FOR THE C2 AND C4 COLLECTORS)
ELECTROBLOWING ATTACHMENTS
SWIVEL HOLDER FOR UP TO FOUR COLLECTORS AND FOUR EMITTERS
DUAL SYRINGE CASING FOR TWO CHANNEL DOSING WITH ADAPTERS
COLLECTOR HOLDER FOR EASY SAMPLE MANIPULATION
PROTECTIVE PLATE PTFE 2 MM

## 4SPIN TRIAL PROGRAM

Contipro is proud to offer a one or two day trial program designed for you to experience the 4SPIN LAB in the comfort and presence of its creators. You are welcome to bring your own samples to test before you invest. Our purpose built 4SPIN demonstration laboratory is located 1.5 hours east of Prague. For further information including the T&C's please email us at support@4spin.info.

# 4SPIN®

www.4spin.info

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