



www.yflow.com

COMPANY PROFILE

▶ Yflow® products and services build upon our leading research expertise on the synthesis of nanoparticles by means of electro-hydrodynamic and micro-fluidic techniques. Manipulation of electrified micro and nanojets allows the formation of nanoparticles such as capsules, hollow spheres, hollow fibers and coaxial fibers, which are crucial for a variety of industrial and research applications such as food technology, drug encapsulation and delivery, bioengineering, materials science, general chemistry, catalysis, and nanosensors, to cite a few.

Yflow®, since it was founded in 2001, has developed an outstanding know-how in the theoretical basics and applications of EHD techniques. Electrospray and electrospinning processes are at the heart of our activities, which target both fundamental research as well as final products. Our technology has been used to generate nanoparticles such as compound and hollow fibers of ceramics, carbon precursors and organic polymers, as well as a variety of functional nano and microspheres. Yflow® know-how may be targeted from lab to industrial scale electrospray/electrospinning devices (EDs). Yflow® EDs are very competitive products that are manufactured following the criteria of scientists and engineers to fulfill customer requirements. We aim at inexpensive, easy to use equipment that allows scalable and clean operation while retaining full control of the running processes. Yflow® devices are the best choice to deal with electrospray/electrospinning research or massive nanoparticle production.

Yflow® technology has excited considerable interest, allowing the constitution of an Advisory Board that includes the 2002 Nobel Laureate John B. Fenn and some of the world leading scientists in EHD technology.

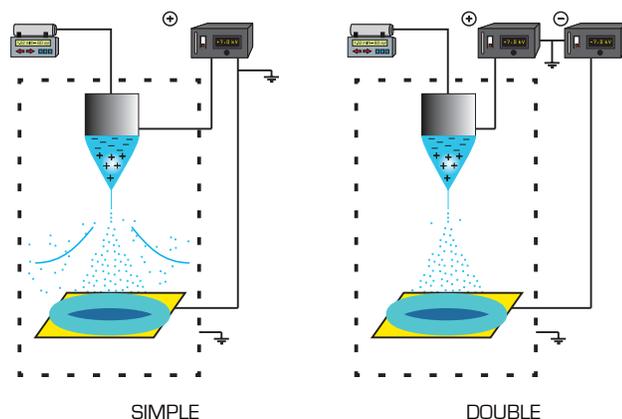
YFLOW® DEVICES

▶ Yflow® EDs use range from laboratory research to industrial production of micro and nanoparticles. Yflow® EDs can be customized to fulfill the requirements of our customers. The robust construction and modularity of Yflow® EDs make them an inexpensive alternative in laboratory and mid-scale applications.

Yflow® standard EDs are designed to work with polymer solutions. These devices allow processing of any of the polymer solutions reported in the electrospinning literature. The main advantages of Yflow® ED are:

DOUBLE POLARIZATION

When dealing with nanoparticles “flying” from an emitter to a collection surface, we risk inhaling a fraction of them. Sometimes, the charged nanoparticles produced in an electro spray/electro spinning experiment “escape” from the electric field during its travel from the emitter to the collector. Due to its nanometric dimension, they can be easily dragged by air flows and accidentally get inside human respiratory pathways. Yflow® double polarized EDs greatly reduce nanoparticle “fly out” and improve electro spray/electro spinning performance.



TAYLOR CONE VISUALIZATION

The Taylor cone is at the heart of EHD atomization. In order to get a steady electro spray/electro spinning process, Taylor cone steadiness is required. Thus, its visualization is crucial for checking the performance of the process.

PATENTED COAXIAL TECHNOLOGY

Yflow® patented coaxial technology brings you the possibility of core-shell nanoparticle production in one step. This technology is focused in delivery/controlled release applications, nanoencapsulation, ultrahigh specific surface area products, etc.



WIDE VARIETY OF ELECTROSPRAY-ELECTROSPINNING SOURCES

Yflow® develops multiplexed electro spray-electro spinning sources to increase the production rate of our devices. Modular electro spinning sources of up to 40 single nozzles and coaxial sources with up to 10 nozzles are available. Modular sources can be arranged in an appropriate number to increase the overall yield to meet the customer needs.

Yflow® multiplexed nozzle technology guarantees uniform size distribution throughout every modular source. This technology is simple, and offers clean operation and easiness of use.



FLOW RATE CONTROL



Steady flow rate is required to obtain high quality nanoparticles. Microstepping pumps allow precise flow rate control over a wide operation range. Syringes can be used as polymer reservoirs, allowing optimal flexibility and reducing time in changing polymer samples.

MOTION

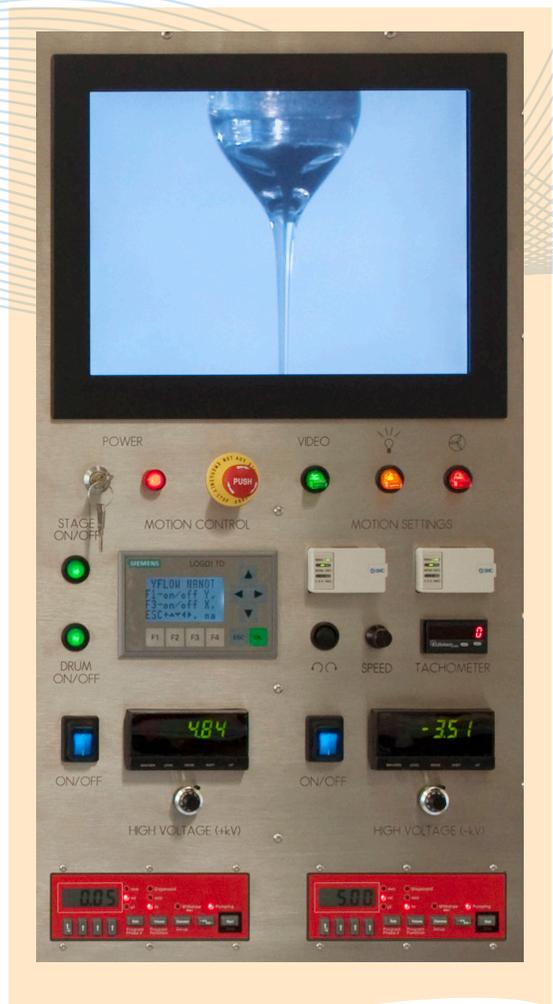
Yflow® EDs are available with fully programmable linear stages for moving the electro-spray-electrospinning sources. Our controlled motion and its range allow the production of nanofiber mats of up to 2000x2000 mm in size with optimal homogeneity. Moreover, our high speed drum collectors are the best choice for the production of aligned nanofiber mats.



EASINESS OF USE

Stainless steel panels are integrated in our products. Control labels are engraved for the best legibility and durability.

A myriad of functionalities are included in Yflow® EDs, such as ventilation, auxiliary lamps, visualization, integrated controls of motion (stages or drums) among others. Yflow® EDs may be customized under specific requirements.



PUBLICATIONS

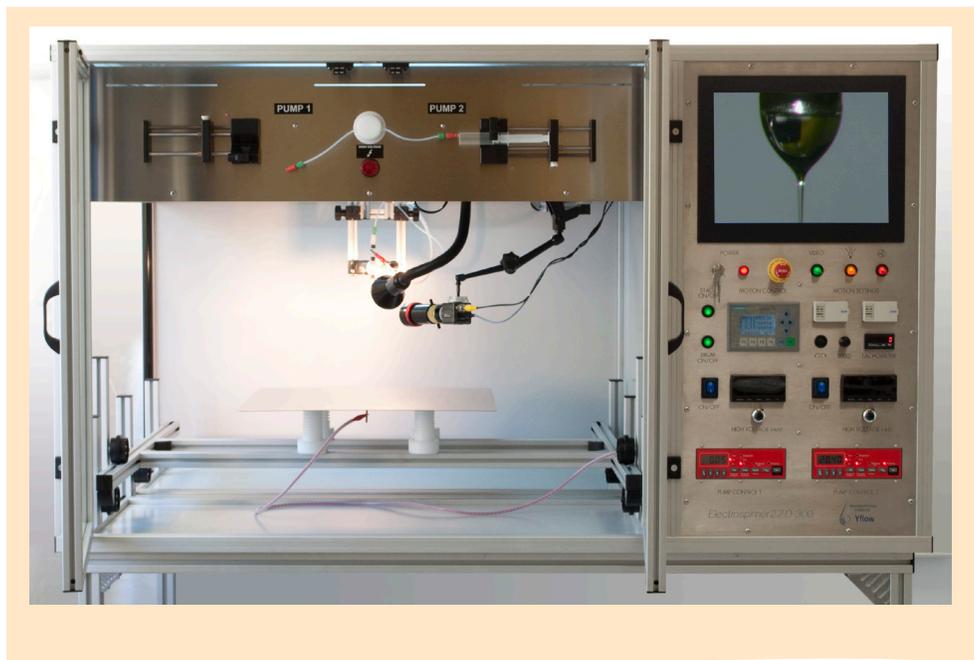
▶ Micro/nano encapsulation via electrified coaxial liquid jets. I. G. Loscertales, A. Barrero, I. Guerrero, R. Cortijo, M. Marquez, and A.M. Gañan-Calvo. **Science** 295, n. 5560, 1695-1698, 2002.

▶ Electrically forced coaxial nanojets for one-step hollow nanofiber design I.G. Loscertales, A. Barrero, M. Marquez, R. Spretz, R. Velarde-Ortiz, G. Larsen. **J. American Chem. Soc.** 126, 5376, 2004. Included in Chemistry Highlights 2004, a selection by Chemical and Engineering News of the 45 most relevant papers of the year, C&E News 82, no 17, p. 6, 2004; C&E News 82, n° 51, pp 53-61, 2004.

▶ Micro and nano particles via capillary flows. A.Barrero I.G. Loscertales. **Annual Review of Fluid Mechanics** 39, 89-106, 2007.

MAIN FEATURES

- Capable of processing a wide range of polymeric solutions | many examples have been reported in the literature.
- Electrospray/electrospinning sources | from one to 40 single or coaxial emitters per modular source.
- High voltage | double polarized system up to 60 kV (-30 kV, +30kV).
- Liquid feeding system | Micro-stepping based, fully programmable with linear forces from 80N to 300N and flow rates from 0.73 $\mu\text{l/hr}$ to 1257 ml/hr, depending on the syringe used. Dispensable volumes from a few micro-liters up to 60 ml.
- Modular source displacement | Fully programmable automated linear stages. Available from 200mm to 2000mm.
- Flat collectors | Standard plate-type stainless steel collectors from 200x200mm to 2000x2000mm.
- Drum collectors | Fully programmable high speed drum collectors with tangential velocities ranging from 0 to 30 m/s. Lengths up to 400mm.
- Continuous collection system | width from 200 mm to 2000 mm.
- Melt electrospay/electrospinning capabilities | Upon request, heated modular sources may also be manufactured.
- Visualization | Taylor cone visualization by a high working distance lens. TFT displays from 5.7" to 17" screen size.
- User friendly | Integrated touch panels are available for easy operation control.

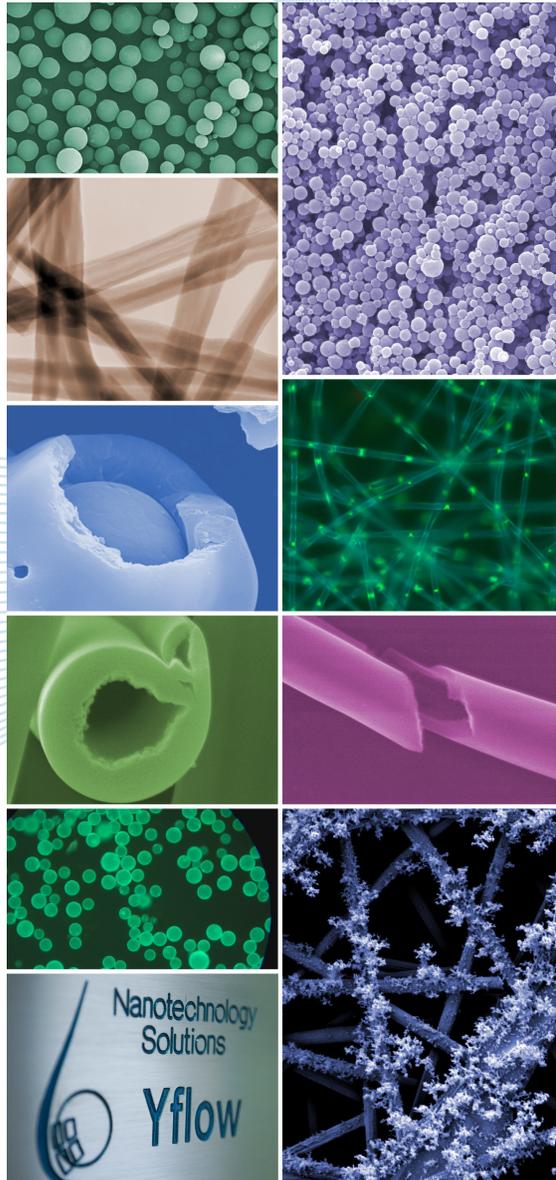


YFLOW® NANOPARTICLE
PRODUCTION AND RESEARCH

▶ Yflow® sells plain and core-shell nanoparticles (spheres and fibers) in a broad, selectable variety of materials with sizes ranging from 50 to 5000 nanometers. Yflow® also offers consulting services for resolution of technical problems and to provide creative and practical solutions associated with electrohydrodynamic (EHD) micro and nanoflows. Yflow® also collaborates with exclusive strategic partners in research.



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