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Multiplexed Electro spray System Eliminates or Reduces Clogging

UCF researchers have invented a multiplexed electro spray (MES) device with a novel atomizer that can atomize high viscosity solutions and suspensions into quasi-monodisperse droplets at scalable, fast flow rates with minimal clogging and low pressure drop. Due to the electrically charged droplets, this device has a deposition efficiency close to 100% and can deposit films or coatings ranging in thickness from 1-1000 micrometers. This MES system has tested liquids with solid particles as large as 50 microns—suspensions that could easily clog an inkjet printer or a conventional atomizer. This novel system can be used for specific applications such as protective coatings, manufacturing photovoltaic cells, and energy storage devices.

Unlike currently available technologies, which are complicated and expensive in terms of equipment and expertise required, this device has a low cost design for operating a linear array of electro spray sources and is greatly simplified through the use of computer numerical control (CNC) machining processes at the micron scale, using micron-sized cutting tools, allowing for the design to be quickly prototyped from 3D CAD models and to be cut out from inexpensive panel materials.

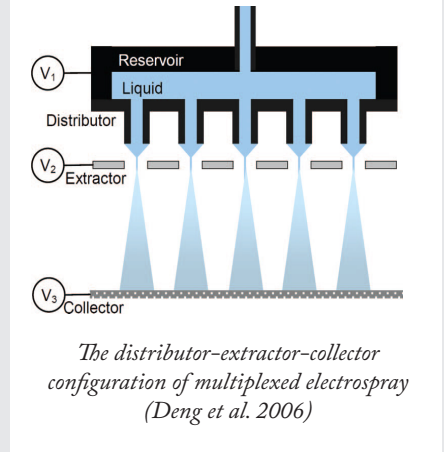
This invention contains custom-designed, shorter MES nozzles with a larger inner diameter which can process liquid with over 1000 times more viscosity than water and with mass concentrations higher than 50%. It also implements a continuous slot for a line of nozzles, versus a line of concentric holes, simplifying the manufacturing process.

Technical Details

This MES design consists of five main parts: an integrator, a distributor, a spacer, an extractor, and a collector. The integrator holds the spacer and distributor together, sealing the fluid route from the main line to each electro spray source on the distributor, the electrical connections to the distributor and extractor, and mechanically fixturing the assembly. The distributor evenly spreads the flow of liquid from the single liquid feed line from the back of the distributor to the multiple electro spray nozzles located at the front of the distributor. The spacer maintains a close tolerance spacing and electrical insulation between the distributor and extractor. The extractor, with a stepped slot design, guards the cone-jet at the tip of each electro spray nozzle from the space charge generated by the electro sprayed droplets and divides the system into two electric field regions, the cone-jet forming region and the spray driving field region. The collector provides a potential to generate a sufficient driving field for elimination of droplet fly-back and space charge effects.

Related Publication

Lojewski, B., Yang, W., Duan, H., Xu, C., & Deng, W. (2013). Design, Fabrication, and Characterization of Linear Multiplexed Electro spray Atomizers Micro-Machined from Metal and Polymers. *Aerosol Science and Technology*, 47(2), 146–152. <http://doi.org/10.1080/02786826.2012.734936>



Benefits

- Low cost design
- Nearly 100% deposition efficiency
- Fast deposition rate
- Eliminates or reduces clogging
- Wide range of deposition thickness

Applications

- Protective coatings
- Photovoltaic cells
- Energy storage

Tech Fields

Microfluidics and Nanofluidics

Keywords

multiplexed electro spray, MES, atomizer, monodisperse, high mass concentration

Patent Pending

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