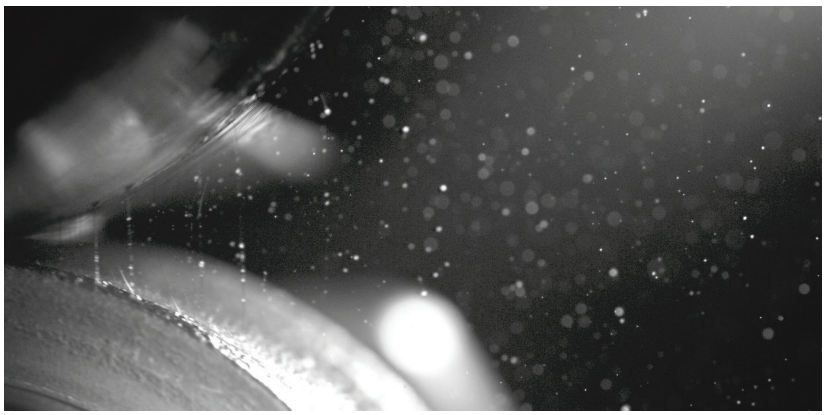
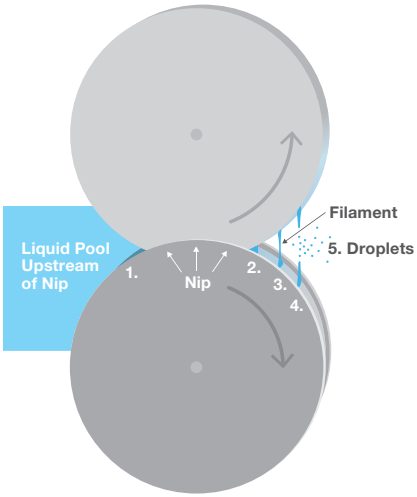
parc
A Xerox Company

Filament Extension Atomizer

Next-Generation Spray Technology for Difficult to Spray Materials

PARC has developed the Filament Extension Atomizer (FEA) to address problems arising from difficult to spray materials. This technology is capable of spraying materials previously either difficult or impossible to spray for a wide range of applications including spray coating, particle creation, spray drying, drug delivery, or powder coatings. It is also capable of spraying a wide range of extensionally hardening and high viscosity fluids with tight particle size distributions, tunable droplet sizes, and at a large range of scales depending on the application.





OVERVIEW:

Limitations of Current Spray Techniques

The creation of droplets can be quite difficult with materials known as extensionally hardening fluids. This non-Newtonian behavior causes the viscosity of the material to increase as the material is strained, which results in filaments forming. This behavior suppressed the creation of droplets in spray and printing systems, which makes it difficult to obtain high-quality spray. Extensionally hardening materials are common and include most materials containing larger molecules.

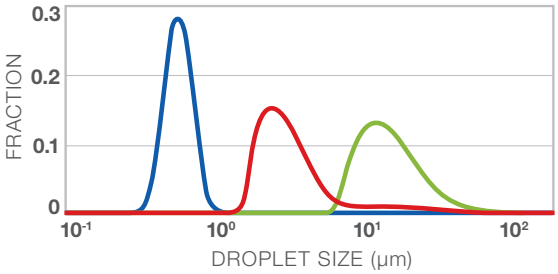
How FEA Works

The Filament Extension Atomizer is able to atomize materials by taking advantage of the tendency of these difficult to spray materials to form filaments. At the core of FEA, a fluid enters the nip, or contact area, between two high-speed rotary rollers. After the fluid exits the nip, multiple filaments are formed. These filaments are stretched and thinned as they move downstream until eventually they break into droplets. These droplets are harvested and can be shaped and directed to accommodate a wide range of applications.

FEA Performance

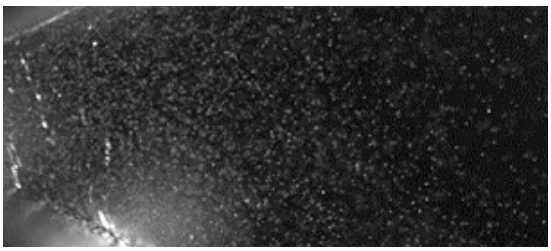
FEA technology is a broadly applicable technique for creating droplets. So far, we have beenable to test our system with solutions of polymers, injection molding thermoplastics at processing temperatures, thermosets, and a range of colloids. Through variation of operating parameters, the droplet size can be customized to meet particular application needs. Small particles can be produced for drug delivery applications and thin coatings or larger particles for particle production or thicker coatings. Additionally, FEA is readily scalable and can be scaled all the way from a handheld system to large-scale industrial systems capable of processing tons of material per year.

The applications for FEA are endless. The system can be used to reduce or eliminate the limitations on rheology and enable chemists to create new formulations. Companies can start to think about spraying products previously impossible to spray or consolidate formulations so that a single formula can be used for spray application and other methods of application. FEA technology can also enable better coatings through the generation of tightly distributed, small droplets. Additionally, FEA technology is capable of creating particles for a wide range of uses. Solvent-based solutions can be spray dried to produce fine powders for a range of applications and materials that can be melted, such as thermoplastics or some thermosets, and can be processed at elevated temperature and frozen.

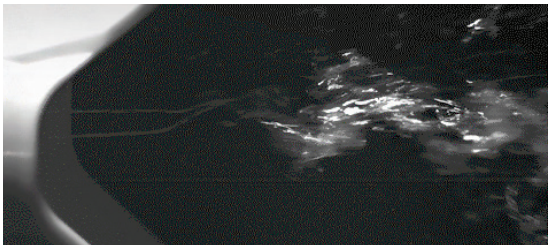


Comparison of drop size distributions of FEA (blue) and conventional atomization techniques (red/green)

FEA Performance Specifications	
Size of Particles or Droplets	<1µm to 200µm
Device Footprint	Handheld to industrial scales
Throughput	µL to L / min
Zero Shear Fluid Viscosity	Up to 200 Pa·s
Kinds of Materials	thermoplastics, high-viscosity fluids, solutions of large molecules, difficult to spray materials and others
PARC Processing Infrastructure	Single filament rheology up to 600 °C High temperature spray up to 300 °C



FEA creates spherical monodisperse drops from solutions of Polyethylene Oxide (PEO)"



Conventional atomizers create poor quality spray with filaments and irregular droplets from solutions of Polyethylene Oxide (PEO)"

For More Information

Go to www.parc.com/AMDS or contact us for more details on how FEA technology can impact your business. We are able to provide early-stage testing of materials to evaluate how FEA performs with your materials.

Contact PARC: engage@parc.com

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