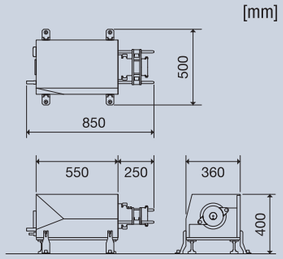
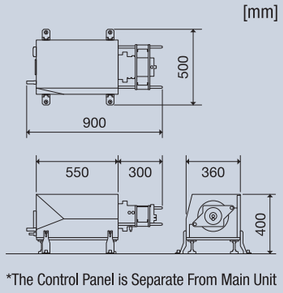
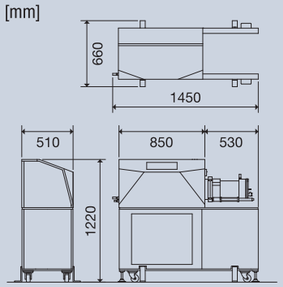
Taylor Vortex Flow Nano Reactor

TVF® Series

Spec.

	TVF-001	TVF-01	TVF-1
Model	TVF-001	TVF-01	TVF-1
Gap height	2.0 / 1.0 / 0.5 / 0.2 mm	5.0 / 2.5 / 1.0 / 0.5 mm	10.0 / 5.0 / 2.5 / 1.0 mm
Capacity	20 / 10 / 5 / 2 ml	106 / 56 / 23 / 12 ml	1.0 / 0.5 / 0.25 / 0.1 L
Max. rotation speed	6000 rpm	3000 rpm	1500 rpm
Size	W850 × D500 × H400 mm	W900 × D500 × H400 mm	W1450 × D660 × H1220 mm
Weight	Main unit:120kg (excluding control panel)	Main unit:120kg (excluding control panel)	700kg (with integrated control panel)
Power supply	4kVA / 200V	4kVA / 200V	6kVA / 200V
Material	SUS316L HASTELLOY® Fluorine resin , FFKM	SUS316L HASTELLOY® Fluorine resin , FFKM	SUS316L HASTELLOY® Fluorine resin , FFKM
Dimensions	 *The Control Panel is Separate From Main Unit	 *The Control Panel is Separate From Main Unit	

● The specifications of machines may be changed for improvement without prior notice. ● Custom Specifications are available upon request.

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TVF-01

TVF-1

TVF-001

Continuous crystallization and chemical reactions

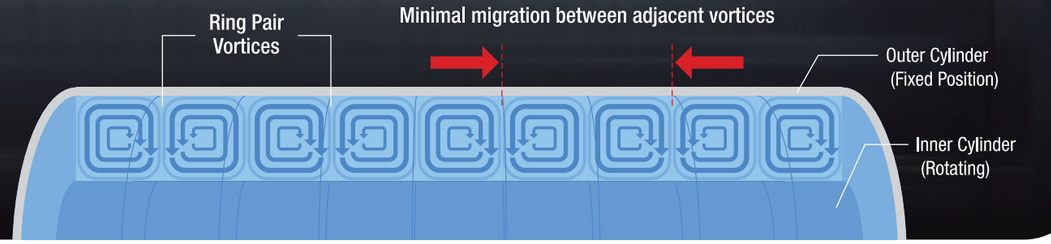
Patent WO2023017819 JP7498487 JP7522444 WO2024085149 JP7522443 JP2022-045587

Design JP1653241

Taylor Vortex Flow Nano Reactor

Principle

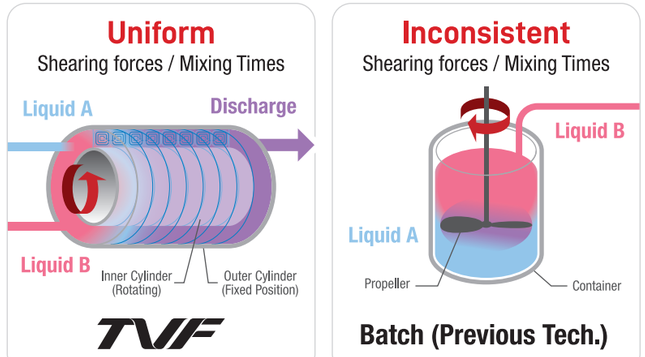
When a liquid fills the gap between the inner and outer cylinders the inner cylinder is rotated to form a stable vortex. A Taylor Vortex is characterized by its vortices that alternate between clockwise and counter rotations; known as a Ring Pair Vortex Flow.
Liquid rarely migrates between vortices as each of the vortices flow independently in a donut shape and are not connected in spirals.



Features

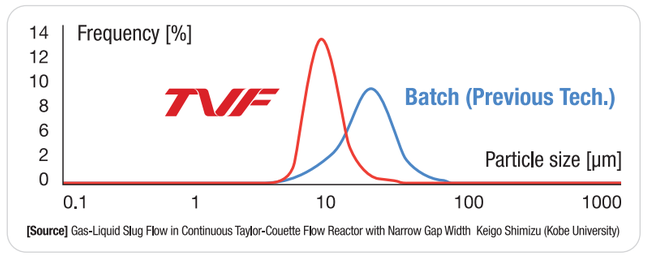
1 Continuous manufacturing = Higher productivity

- Previous technology for batch production required huge tanks for long agitation (stirring) times. As chemical reactions and blending happen rapidly inside TVF®'s Taylor Vortices the device has been made compact.
- As there are only a few parameters to scale up preparation time for mass production can be significantly shortened.
- The gap for chemical reactions is narrow and tightly closed off allowing for the safe handling of harmful substances. It also allows for inline Cleaning in place (CIP).



2 High extrudability = Uniform particle size

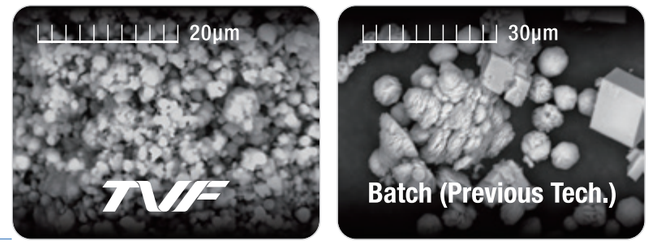
The minimal migration of substances between vortices (due to its high extrudability) creates consistent mixing times. This allows for uniform particle sizes with little variation. The tightness of the gaps clearance increases its extrudability for more consistent particle sizes.



[Source] Gas-Liquid Slug Flow in Continuous Taylor-Couette Flow Reactor with Narrow Gap Width Keigo Shimizu (Kobe University)

3 High shearing force = Better Refinement/sphericity

Our original design utilizes narrow gap with a tight clearance of 0.2mm and 6000RPM high speed rotation. This generates stronger shearing force inside the vortex making it possible to further refine and sphericizing particles. This increases the shearing force in the center of the vortices which further refines and sphericize.



Fields and Applications

Medicine

- Pharamaceutical Ingredients
  - Reactive Crystallization
  - Refinement
- DDS LNP
  - Dispersion
  - Refinement

Chemistry

- Secondary battery
  - Reaction
  - Sphericalization
- Semiconductor
  - Refinement
  - Stabilization

Food

- Dairy/Oil-Rich Products
  - Emulsification
  - Refinement
- Health foods
  - Emulsification
  - Refinement

Others

- Paint pigment
  - Refinement
- Cosmetics
  - Emulsification
  - Refinement

Options

With more than 80 years of experience and know-how as a machine manufacturer we offer custom designs to meet your needs.

Extra Upgrades for Special Orders

- Support for solvents strong acids and strong alkalis by using suitable materials
- Integration and interaction between process pumps and temperature / pressure / flow sensors
- Additional ports (sensors inlets outlets sampling)
- Jacket temperature control system
- Scaled Up Design for larger volumes

Glass outer cylinder

The transparent outer cylinder is made with special high-precision glass. Allows for its internal conditions, such as the formation of vortices, to be observed.

Inner and outer cylinders made of HASTELLOY

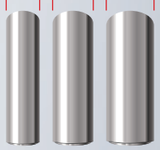
Available for high-precision machining of inner and outer cylinders made of acid-resistant Hastelloy. Also available for additional machining of middle ports and temperature control jacket.

Outer cylinder with middle port

Available for sampling at the middle port and installing monitoring sensor. Also available for installing temperature control jacket.

Customable Gap Clearance (Our Replaceable Inner Cylinder)

The gap's clearance can be adjusted by exchanging the inner Cylinder. The shearing force, extrudability, productivity, etc of this device is directly controlled by the size of the gap's clearance. Replacing the inner cylinder is easy. After understanding the process, it can be done in mere seconds (patent pending). Users do not require help from the manufacturer.



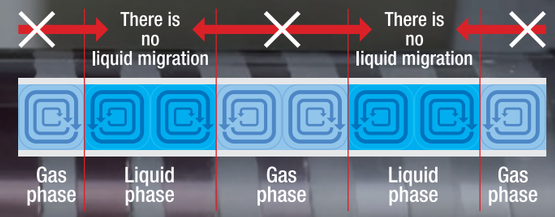
Slug flow (Joint research and development with Kobe University)

Patent | WO2023017819

Gas-liquid slug flow refers to the generation of alternating bands of liquid and gas phases by rotating the inside cylinder while continuously infusing gas and liquid at a constant rate. Because the gas phase completely separates adjacent liquid phases no liquid moves in the axial direction and the variation in reaction time is ultimately small.

Experiments conducted at Kobe University show that the diffusivity of gas-liquid slug flows is about 1/250 compared to the ordinary liquid-only Taylor vortex making further uniformity of particle size possible.

Especially in processes with longer processing times the effect of axial diffusion is more likely to occur so the gas-liquid slug flow is more effective if the goal is to homogenize mixing and particle size both quantitatively and qualitatively.



▶ Effect of preventing axial diffusion by gas-liquid slug flow