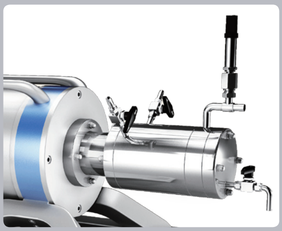
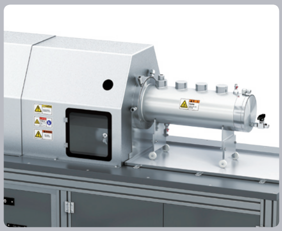
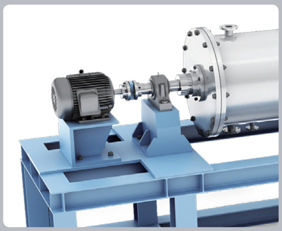
LCTR®-series







LCTR®-mini / LCTR®-Lab / LCTR®-tera / LCTR®-peta / LCTR®-exa

Laminar

Laminar Co., Ltd.

LCTR®-series

LCTR®-mini / LCTR®-Lab / LCTR®-tera / LCTR®-peta / LCTR®-exa

Global New Technology

Pioneered in the new field of chemical reactor

Since the establishment in 2010, Laminar Co.,Ltd based on Technology has developed a new concept of chemical reactor named as Taylor Reactor and pioneered in the new fields of chemical reactors. Furthermore, going on to enlarge the general reactor market fields.

To satisfy the needs of all customers, we are continuously studying research and doing the development of reactors.
Resultantly, Laminar possesses the best manufacturing know-hows and a number of Technologies.

The custom made Taylor reactors are also possible as per the special requirements from the chemical manufacturing processes, based on several technologies and know-hows.

As already proved reactor in functionality and reliability in the market, Taylor reactor is exporting abroad from 2013, and now Laminar Co., Ltd is enlarging widely the business fields for Taylor reactors.

Due to innovative R&D activity, we are developing the new functional chemical reactor fields.

Laminar

Characteristics of LCTR®-series

Powerful and uniform mixing ability

Based on the technology of Taylor fluid flow, LCTR® is created and provides two of the greatest advantages of 3 times mass transfer velocity and 7 times mixing force as compared to that of the conventional tank type reactors.

Improvement of physical properties and recovery ratio

Due to uniform mixing technology, it functions the crystals or particles easily to do self-assembly.
By disappearing of dead-zone in the reactor, physical properties(purity, particle size & distribution, degree of crystallinity, high purification ratio) are improved and the purification ratio is also increased.

Easy scale-up

LCTR® can be easily scaled up, starting from 1 L. to 300 L. or more in capacity without any changes of physical properties in product due to that there is no any dead-zones in the reactor as an ideal fluid flow.
Laminar Co.,Ltd is manufacturing from 10 mL reactor for experiment at a Lab. to several tons reactors for mass production.

High productivity

Due to very powerful mixing ability made by Taylor fluid flow, it functions effectively to reduce the reaction time.
LCTR® in particular, has very high productivity for the crystal or particle products having solid-phase transition, by the reduction of production time up to max. 20 times as compared with that of conventional process.

Accurate temperature control

The temp. is controlled outside the jacket consisting of the dual type.
Due to that the reaction region in the jacket is shaped in a small tube, it is excellent to control reaction temp. accurately through transferring heat to the reaction region fast and easily.

Ready-made or custom-made LCTR

LCTR® is made up of a ready-made type and a custom- made type. Also, it can be retrofitted according to the needs of process.

Monitoring system

LCTR® supports the real-time monitoring system in which to check the parameters and the progress of experiment, and LCTR® is stopped if a problem is happened.

Application to all of chemical industry fields

LCTR® is suitable for the fields of electronic materials, fine chemicals, pharmaceutical chemistry, the environment, and our special technologies are protected.

Easy to operate

LCTR® is simple to operate, and anybody can easily produce the products by controlling of a mixing speed and the pump which functions to adjust the feeding rate based on the principle of chemical stoichiometry.

Multi-purposed & processed application

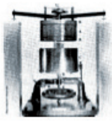
In the fields of synthesizing the chemicals, manufacturing the solid crystal, coating the particles, co-precipitating the particles, separating the ingredients and fermentation, LCTR® can be applied.

LCTR® system

HISTORY

Maurice Marie Alfred Couette

Physicist
Viscometer
Heat Engineering



[viscometer]

Heat exchanger

Chemical Reactor

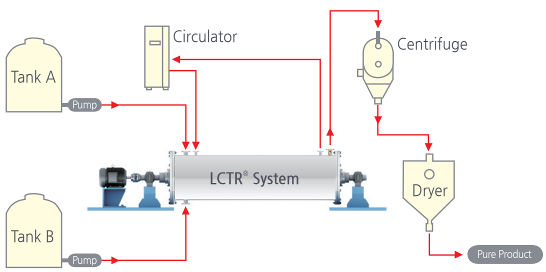
1900 | 1950 | 1980 | 2010

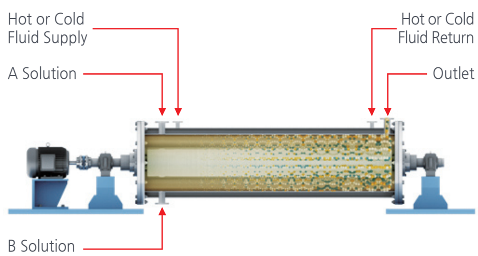
Geoffrey Ingram Taylor

Physicist
Mathematician
Fluid dynamics
Wave theory

Reaction

LCTR® is possible to manufacture the new materials by feeding Gas, Liquid and Solid under the condition of the presence of solvent.





Liquid-Liquid reaction

ex) $LiCl + Na_2CO_3(l) \rightarrow Li_2CO_3$

Gas-Liquid reaction

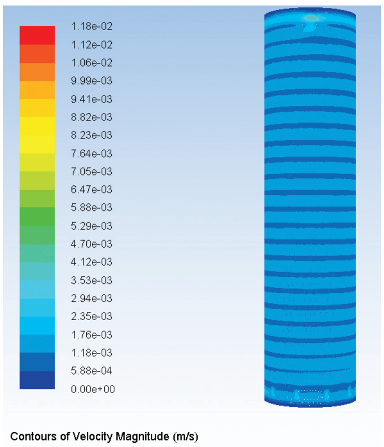
ex) $2LiOH + 3CO_2(g) \rightarrow Li_2CO_3$

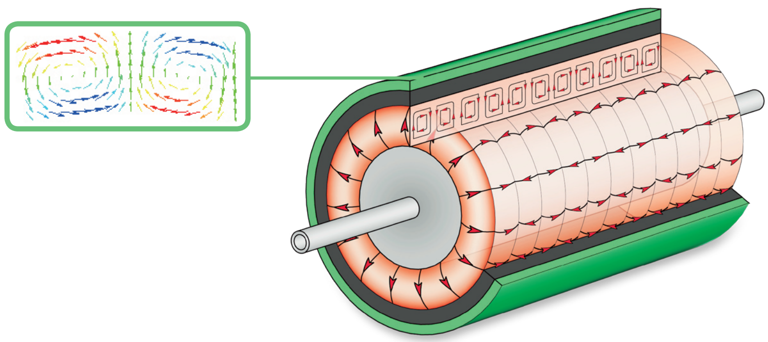
Solid-Liquid reaction

ex) $Al_2CO_3(s) + CuSO_4 \rightarrow Cu\text{-}Al_2CO_3$

Taylor fluid flow

The reactor session is made up with two cylinders, inside and outside, and the solution to be reacted is fed into the space between the inside and the outside cylinder through the feeding ports.
As soon as the inside cylinder is rotated by the motor, the solution is also starting to move and then forming a strong stream in the direction of rotation.
Simultaneously, two forces of Centrifugal and Coriolis are generated so strongly that the solution in the reactor moves fast for the outside cylinder.
The faster the inside cylinder is rotated, The more unstable the flow comes to be.
By this phenomena, the eddy current flow is created regularly in the shape of the double rings each of which is self-rotated in the opposite direction, along the rotated inside cylinder. It is shaped like a band in the reactor.
This means a Taylor flow in which is called.





Cathode material of Lithium ion battery, precursor

Class	Batch Reactor	LCTR Reactor
Fluid mixing method	Macro-mixing	Micro-mixing
Mass transfer velocity (m/s)	1	3.3
Mixing intensity (W/kg)	0.8	5.8
Reaction time (h)	16	2
Span($[D_{90}-D_{10}]/D_{50}$)	0.5	0.2
Tap Density(g/mL)	2.1	2.2

Batch + Tubular

Batch

Tubular

Batch + Tubular

The development of a ideal chemical reactor functioning the continuous manufacturing system for high purity materials by utilizing fully the advantages of both Batch (easy to operate, the use of mixer, easy to check in operation) and Tubular (high purity production, high reproducibility, east to produce nano-materials)

Cost

- Minimize labor cost (full automation)
- Reducing electrical cost
- Reducing buying cost for raw materials
- Reducing space and buying additional equipment

Productivity

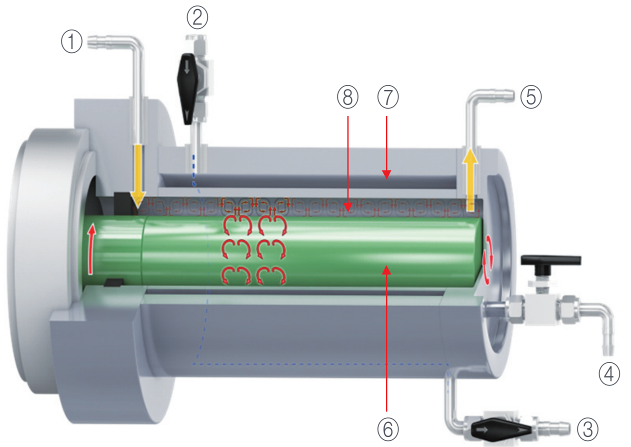
- Shorten the developing time on a commercial scale
- High productivity
- Easy to control the process

Marketability

- Pioneering a new market
- Increasing market size
- Applicable to all materials

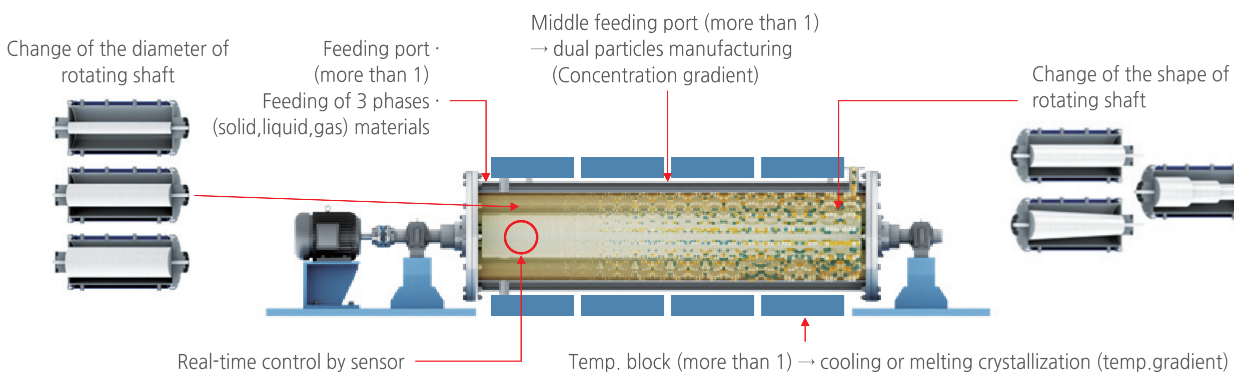
LCTR® Inner structure and manufacturing option

Inner structure



① Feeding port
② Out-let of the solution used for controlling temp
③ In-let of the solution used for controlling temp
④ Drain for the reacted solution
⑤ Out-let of the material reacted in slurry
⑥ Rotating shaft
⑦ Temp. control section
⑧ Reaction section

Manufacturing option



LCTR®-mini

LCTR®-mini-H

LCTR®-mini-V

	LCTR®-mini-H	LCTR®-mini-V	LCTR®-mini-VH
Capacity (mL)	5 ~ 10	5 ~ 10	5 ~ 10
Max. reaction temp. (℃)	80	150	300
Max. rotation speed (rpm)	1500	1500	1500
Material	SUS316L & Glass & Tefleon	SUS316L & Glass & Tefleon	SUS316L
Dimension L/W/H (mm)	410 * 200 * 240	220*150*470	300*330*710
Weight (kg)	5	4	8

LCTR®-Lab

LCTR®-Lab

LCTR®-Lab Ⅱ

LCTR®-Lab-VH

	LCTR®-Lab	LCTR®-Lab II	LCTR®-Lab-VH
Capacity (mL)	100	200	100
Max. reaction temp. (℃)	150	150	600
Max. rotation speed (rpm)	1500	1500	1500
Material	SUS316L & Tefleon	SUS316L & Tefleon	SUS316L
Dimension L/W/H (mm)	850 * 300 * 430	1000*400*510	600 * 850 * 1850
Weight (kg)	50	60	120

LCTR®-tera

LCTR®-tera 3100

LCTR®-tera 3200

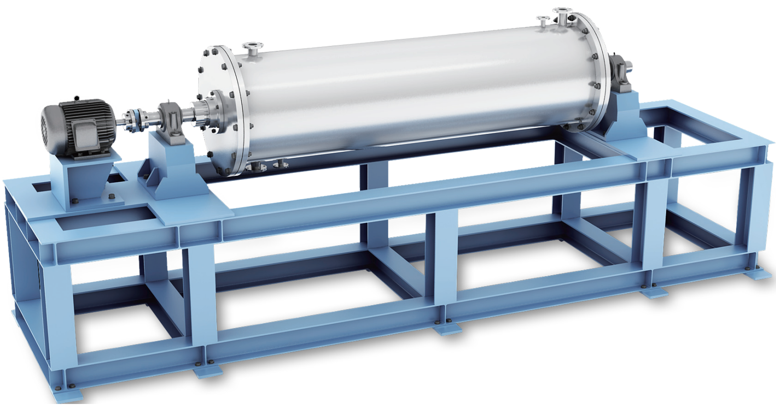
	LCTR®-tera 3100	LCTR®-tera 3200
Capacity (L)	0.5~1.5	0.5~1.5
Max. reaction temp. (℃)	150	150
Max. rotation speed (rpm)	1500	1500
Material	SUS316L	SUS316L
Control method	PID Control	PLC Control
Dimension L/W/H (mm)	1470*700*1140	1800 * 850 * 1300
Weight (kg)	450	550

LCTR®-peta

LCTR®-peta 5100

	LCTR®-peta 5100
Capacity (L)	8~15
Max. reaction temp. (℃)	150
Max. rotation speed (rpm)	1200
Material	SUS316L & Teflone
Dimension L/W/H (mm)	1800 * 1000 * 1850
Weight (kg)	800

LCTR®-exa



LCTR®-exa 8500

LCTR®-exa 8100

	LCTR®-exa 8100	LCTR®-exa 8500
Capacity (L)	50	1000
Max. reaction temp. (℃)	80	80
Max. rotation speed (rpm)	1000	200
Material	SUS316L & Tefleon	SUS316L & Tefleon
Dimension L/W/H (mm)	3400 * 1300 * 1850	8000 * 2500 * 2500
Weight (ton)	3	10

LCTR® Application fields

Manufacturing process
Crystallization
Re-crystallization
Co-precipitation
Precipitation
Sol-gel process
Polymerization
Radical reaction
Coating
Impregnation
Extraction
Core-shell process

Product	
$LiFePo_4$	$Ba(NO_3)_2$
$(NiMnCo)(OH)_2$	KNO_3
Li_2CO_3	$NaHCO_3$
$CaCO_3$	Durene
K_2CO_3	Diiodobenzene
$NH_4H_2PO_4$	Triiodobenzene
NaI	Lysine
SiO_2	Tryptophan
$NiSO_4$	Methionine
$CoSO_4$	GMP
TiO_2	IMP

General types Reactors

Laminar co., Ltd is manufacturing all purpose of reactors based on our own technologies.

Tubular reactor

Catalytic reactor

Autoclave

Emulsifying device

Option

Centrifuge

Solid-liquid separation
Use at the tail of a reactor
Use or non-use depending on the powder condition

Flowmeter

Proposed in accordance with the process conditions

Circulator

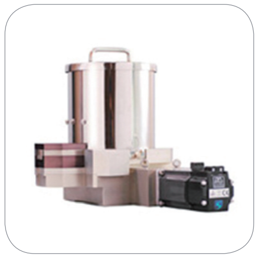
Temp.control of the reaction solution
-25 ~ 150 ℃

Solution feeding pump for Lab.

Max 20 mL/min
Max 6 bar
Materials : PP or PTFE

pH controller

Control by PID



Solid quantitative feeding device

Feeding of powder to the reactor or a storage tank
0.1 ~ 1000 g/min
Materials : SS41

Solution feeding pump for production

Max 200 L/min
Max 16 bar
Materials : PTFE

Electronic scale (weigh the feeding quantity)

Alternative to a flowmeter
0.01 ~ 10 kg
0.001 ~ 1 kg

Solution feeding pump for slurry material

Max 600 rpm
Max 8 bar

pH sensor

Acid & alkali solution
For slurry

Laminar

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