

# FLOWRENCE® SYSTEMS

Proven technology validated by leading catalyst suppliers and research institutes.

Accurate, reliable, and flexible multi-parallel reactors systems.



## Highest data quality

Reproducible results with accurate microfluidics distribution. Large isothermal zone with perfect catalyst-feed contacting.



## Safe to operate

Inherently safe small-scale reactor technology with minimal chemicals hold up with very fast flushing times.



## Fast screening

Reduced time-to-market with high throughput testing for process optimization and catalyst screening.



## Lower costs

Lower Total Cost of Ownership with small scale testing compared with large scale. Achieve important cost savings per experiment.



## Small footprint

Smallest footprint in the market with low infrastructure costs. Increase the number of reactors in your lab with minimal spare required.



## Validated by Customers

Flowrence® technology extensively used by catalyst suppliers and research institutes to accelerate their catalyst R&D.

## FLOWRENCE XR

16 Reactors

Our most accurate system with a broad operating window. Designed for fast catalyst screening with outstanding repeatability and reproducibility.



## FLOWRENCE XD

4 Reactors

Avantium's most flexible and easy to use system with a broad number of proven applications. Designed for early-stage catalyst R&D.



## FLOWRENCE XP

16 Reactors

Our most advanced system combining all technology of the Flowrence® XR with independent control per reactor for kinetic studies and process design.



## FLOWRENCE XC

4 Reactors

This system was purposely designed for benchmarking of commercial catalysts.



## PROVEN APPLICATIONS

- ✓ Ammonia Synthesis and Decomposition
- ✓ CO<sub>2</sub> (and CO) Valorization
- ✓ Dry Reforming of Methane (DRM)
- ✓ Fischer-Tropsch, Synthesis of Methanol, Ammonia, and Higher Alcohols
- ✓ Selective Acetylene Hydrogenation
- ✓ Hydrocracking, Hydrotreating, ULSD, Dewaxing, and Vegetable Oil
- ✓ Naphtha Reforming, Transalkylation, Metathesis, and other Aromatics
- ✓ Oligomerization

	<b>XD</b>		<b>XR</b>			<b>XP</b>		<b>XC</b>	
Unit Dimensions W x H x D (mm)	1000 x 1500 x 850 4 reactors		M (1776 x 1320 x 865) XL (2470 x 1320 x 865) 16 reactors			XL (2470 x 1320 x 865) 16 reactors		1000 x 1500 x 850 4 reactors	
Reactor Heating System	1 block of 4 reactors (<0.5°C reactor-to-reactor)		4 blocks of 4 reactors (<0.5°C reactor-to-reactor)			16 reactors with iRTC (<0.5°C reactor-to-reactor)		4 reactors with iRTC (<0.5°C reactor-to-reactor)	
Reactor Types LxOD (mm)	300x3	561x6	300x3	561x3	561x6	561x3	561x6	561x3	561x6
Inner Diameter (mm) Stainless Steel (< 550°C)	2 / 2.6	2 / 3 / 4 / 5	2 / 2.6	2 / 2.6	2 / 3 / 4 / 5	2 / 2.6	2 / 3 / 4 / 5	2 / 2.6	2 / 3 / 4 / 5
Inner Diameter (mm) Quartz (< 925°C)	2	2 / 4	2	2	2 / 4	2	2 / 4	2	2 / 4
Temperature Ranges (°C) isothermal zone tolerance ± 1°C	100 – 800 *Option: 100 – 925		50 - 550 100-800			50 - 550		50 - 550	
Catalyst Volume (mL) (isothermal zone)	0.2-0.6	0.4 - 2.0	0.2- 0.6	0.4-1.0	0.4 - 2.0	0.4 - 1.0		0.4 - 1.0	
Pressure Ranges (barg)	2 – 80 *Option: 0.5 – 180		2 - 100 0.5 – 180			2 - 80 0.5 – 180		2 – 20 *Option: 2 - 50	
Reactor Pressure Control	Standard (±0.5 barg) *Option: Advanced (±0.1 barg)		Standard (±0.5 barg) *Option: Advanced (±0.1 barg)			Advanced (±0.1barg)		Advanced (±0.1barg)	
Gas Feed Lines (#Gas Feeds)	<b>Up to 6 + Diluent gas</b> He, Ar, N <sub>2</sub> , H <sub>2</sub> , CH <sub>4</sub> , CO <sub>2</sub> , C <sub>2</sub> H <sub>4</sub> , C <sub>2</sub> H <sub>6</sub> , O <sub>2</sub> /Inert (≤5%), CO, Other gases		<b>Up to 7 + Diluent gas</b> He, Ar, N <sub>2</sub> , H <sub>2</sub> , CH <sub>4</sub> , CO <sub>2</sub> , C <sub>2</sub> H <sub>4</sub> , C <sub>2</sub> H <sub>6</sub> , O <sub>2</sub> /Inert (≤5%), CO, Other gases			<b>Up to 7 + Diluent gas</b> He, Ar, N <sub>2</sub> , H <sub>2</sub> , CH <sub>4</sub> , CO <sub>2</sub> , C <sub>2</sub> H <sub>4</sub> , C <sub>2</sub> H <sub>6</sub> , O <sub>2</sub> /Inert (≤5%), CO, Other gases		<b>Up to 6 + Diluent gas</b> He, Ar, N <sub>2</sub> , H <sub>2</sub> , CH <sub>4</sub> , CO <sub>2</sub> , C <sub>2</sub> H <sub>4</sub> , C <sub>2</sub> H <sub>6</sub> , O <sub>2</sub> /Inert (≤5%), CO, Other gases	
Gas Distribution (With pressure measurement)	TinyPressure Microfluidics with integrated pressure measurement								
Liquid Feed	Pump-Coriolis dosing system (ambient, cooled)		Pump-Coriolis dosing system (ambient, cooled, heated 80°C)			Pump-Coriolis dosing system (ambient, cooled, heated 80°C)		Pump-Coriolis dosing system (ambient, cooled, heated 80°C)	
Liquid Distribution	Microfluidic Distribution		Microfluidic Distribution Option: Active Liquid Distribution (with automatic isolation valves)			Active Liquid Distribution (with automatic isolation valves)		Microfluidic Distribution	
Reactors Effluent Handling (Off-line Analysis Connection)	Full heated circuit up to 180°C		Full heated circuit up to 200°C with sequential on-line full gas phase sampling						
Liquid Sampling (G/L Separation)	Option: Parallel liquid sampling (4 x 20ml vials)		Option: Automated liquid sampling (4 rows x 16 vials x 8ml) with sequential on-line gas phase sampling				Option: Parallel liquid sampling (4 x 20ml vials)		

Avantium R&D Solutions proudly stands as the leading provider of advanced catalyst testing units and services. We help customers developing better and more efficient catalysts with the world's best high-throughput technology.

