

CORNING

Corning Incorporated is the world leader in specialty glass and ceramics. Corning's Advanced-Flow™ reactors are specially designed for the seamless transition from lab feasibility to process development to industrial-scale to multi-ton production of chemicals. Corning® Advanced-Flow™ reactors are designed to meet the needs of pharmaceutical, fine, and specialty chemical companies who are seeking process optimization of a particular reaction or a wide portfolio of reactions. These reactors comprise highly engineered fluidic modules that integrate heat-transfer and mass-transfer in a single piece of equipment. These easily scalable reactors enable seamless, cost effective solutions for fast scale-up and time to market. Corning® Advanced-Flow™ reactors increase the efficiency, scalability, yields, and quality of chemical processing while reducing environmental impact, performance variability, and cost.

Regional Contacts

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CORNING

From Feasibility to Industrial Production Corning® Advanced-Flow™ Reactors

Higher yields, lower costs

Corning innovation brings significant performance benefits to the chemical processing industry through Corning® Advanced-Flow™ reactors — a full range of reactor products suited to meet the needs of a particular reaction or a wide portfolio of reactions.

Continuous-flow chemical production utilizing Corning® Advanced-Flow™ reactors can provide:

- Seamless scale-up
- Increased production yields
- Lower overall production costs
- Enhanced plant safety
- Higher product quality
- Decreased waste generation and energy consumption
- Faster product time to market

Corning® Advanced-Flow™ reactors can be effectively run on reactions with miscible and immiscible liquids, and gases and liquids containing some amounts of small solid particles, with dimensions up to 200 microns.

Many different types of reactions are well suited for Corning's reactor equipment, including:

- Nitrations
- Oxidations
- Brominations
- Chlorinations
- Grignards
- Alkylations
- Organo-metallics
- Hydrogenations
- Polymerizations,
... and others

Corning® Advanced-Flow™ reactors can be integrated into existing chemical processing infrastructures and designed upon request to ATEX and GMP standards. Corning's reactors can be easily incorporated into industrial systems via standard connectors, helping customers migrate to Corning's technology with little or no downtime.

Customers Include

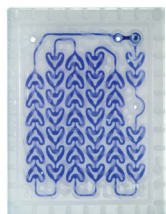
ABA Chemicals Corporation
Acoris
Albany Molecular Research Inc. (AMRI)
Applied Physics Laboratory (APL)
Arch Pharmalabs Ltd.
Arkema Inc.
Ash Stevens Inc.
BASF SE
Beijing Risun Chemical Technologies Institute Co., Ltd
Center for Process Analysis and Control (CPAC)
Changzhou University
Cosmos
CPI Ltd.
DAELIM Chemical Co., Ltd.
Dalian Huiyuan Fine Chemicals Co., Ltd
Dongyue Biochem Co., Ltd
Dow Corning
DSM Fine Chemicals Austria Nfg GmbH & Co. KG
Finchimica S.p.A.
Georgia Tech
Ghent University
Henan Academy of Sciences
Jaas
Jiangsu Lee & Man Chemical Ltd.
Jiangsu ZW Pharmaceutical Co., Ltd.
Jiangxi Normal University
Jiangsu Yoke Technology Co., Ltd
Jubilant Life Sciences Ltd.
Juhua Group Corp.
La Maison Européenne des Procédés Innovants (MEPI)
Laviana
Lianhe Technology
Marktech
Massachusetts Institute of Technology (MIT)
Medichem S.A.
Nanjing University of Technology
Nanjing University Huaian High-Tech Institution
Nanjing Yuande Pharmaceutical Chemical Co., Ltd.
National Institute of Advanced Industrial Science and Technology (AIST)
Pcas
Peking University Shenzhen Graduate School
Porton
Research Institute of Nanjing Chemical Industry Group (SINOPEC)
Sanofi
ScinoPharm Taiwan Ltd.
Shandong Brother Tech
Shandong Luba Chemical Co., Ltd.
Shandong Moris Technology Co., Ltd
Siegfried Ltd.
Technology Research Institute of Shanghai Huayi Group
The McQuade Group Florida State University
The Ryu Group
University of Saskatchewan
Zhejiang Guobang Pharmaceutical Co., Ltd.
Zhejiang Yongtai Technology Co., Ltd
...and others

Corning® Advanced-Flow™ Reactor — Seamless Scale-Up from Laboratory to Production

High flexibility — Metal-free reaction path

Low-Flow Reactor

- Low internal volume
- Run continuous chemical processes at laboratory
- Use minimal quantities of reactants to run test

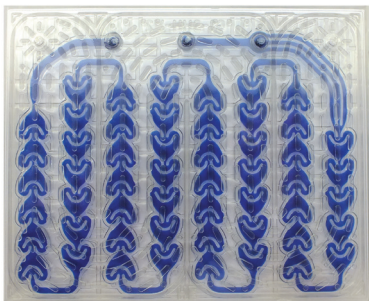
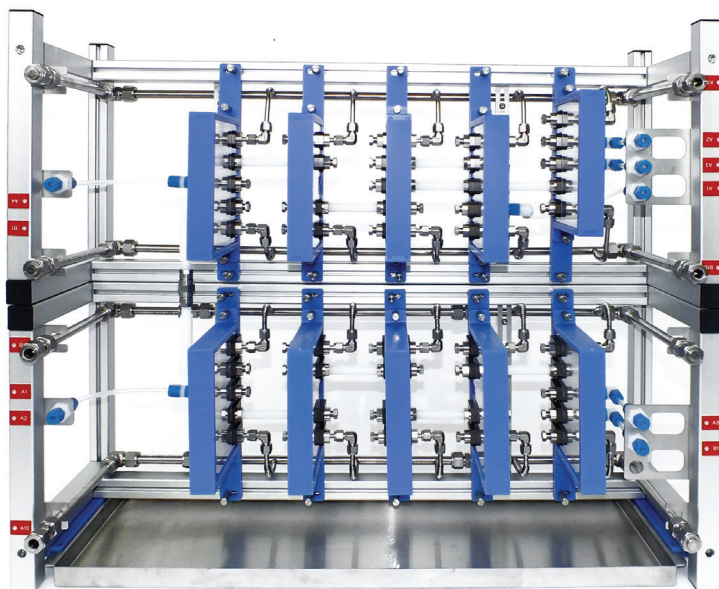


Flow rates: (ml/min) 2 to 10

Single plate volume: (ml) 0.45

G1 Standard Evaluation Reactor

- Small internal volume
- Scalable from test to production
- Process development and optimization tool
- Evaluate technical and commercial benefits of continuously running chemistry

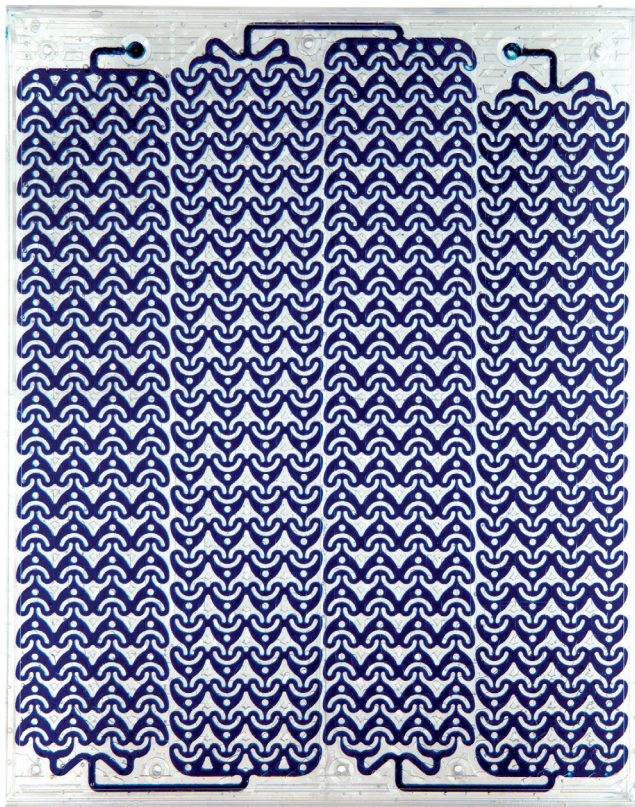


30 to 200

8 to 11

G3 Glass Reactor

- Large internal volume
- Continuous production of large amounts of chemicals—several tons/year
- Realize potential of full scale economy

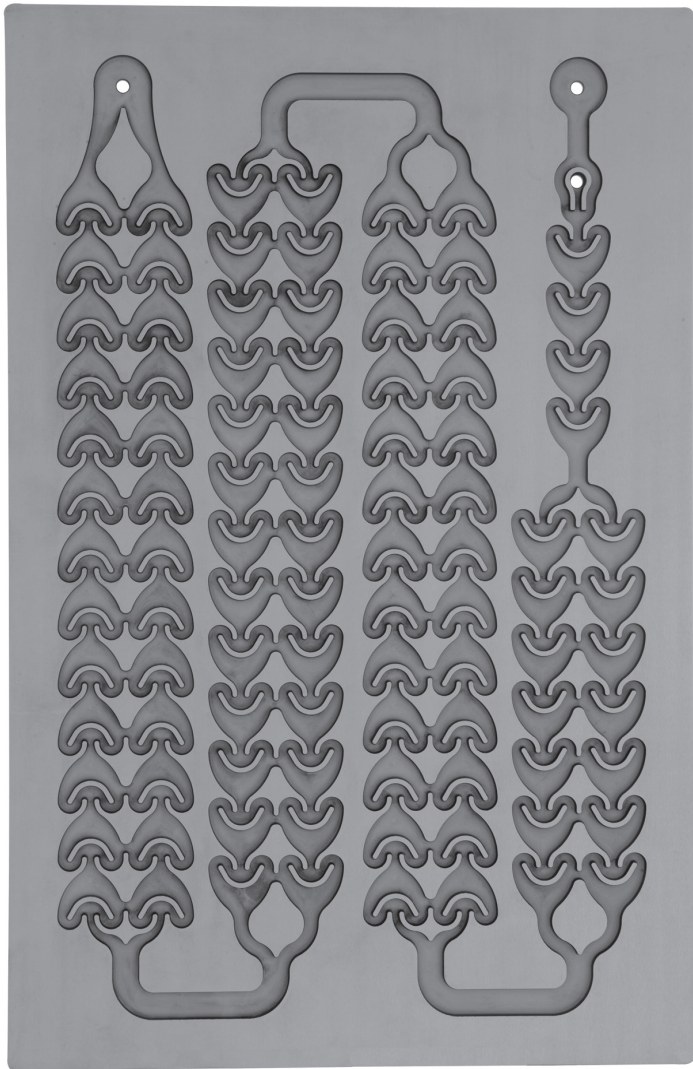


400 to 2000

55 to 65

G4 Ceramic Reactor

- Large internal volume
- Reduced footprint
- Processing capability >300 kg/hr
- Superior corrosion resistance



1000 to 5000

200 to 260

Boundary Conditions

Design Conditions	Process Path	Heat Exchange Path
Temperature (°C)	-60 to 200	-60 to 200
Pressure (barg)	0 to 18	0 to 6

Corning's Broad Portfolio of Advanced-Flow™ Reactors — G1, G3, and G4

