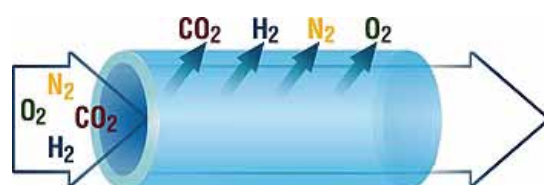


# Tube in a tube Membrane Reactor

Our Gastropod Range

# Our Gastropod

1. Gas Liquid Addition Module
2. Gas Liquid Reaction Module



*Fast, efficient and controllable gas-liquid reactions in flow*

The mixing of gas and liquid phases in continuous chemistry applications can now be achieved in an efficient, controllable and reliable manner thanks to the Gastropod.

The use of gases or volatile components as reagents is often not ideal in batch mode operation due to safety concerns. However, using our semi-permeable membrane flow reactor device we have created a robust gas reactor that allows controlled solubilisation of gaseous reagents into a liquid stream to achieve a wide selection of reactions. We have shown a diverse range of applications using these devices to carry out ozonolysis, carboxylations, hydrogenations, Glaser oxidative couplings, carbonylations, nucleophilic addition of ammonia, hydroformylations using Syngas, coupling Heck reactions using ethylene, as well as aerobic anti-markovnikov oxidative processes.



Gastropod - Gas Liquid Addition Module  
Part Number 25620

Portable Gas Reservoir (FFKM Seals)  
Part Number 30790

- Rapidly generate a continuous gas-saturated solvent stream
- Effortlessly perform gas-liquid reactions in flow
- Optional Portable Gas Reservoir
- Built-in features for safe gas management



# Flow Chemistry Solutions



Gastropod - Gas Liquid Reaction Module  
Part Number 46820

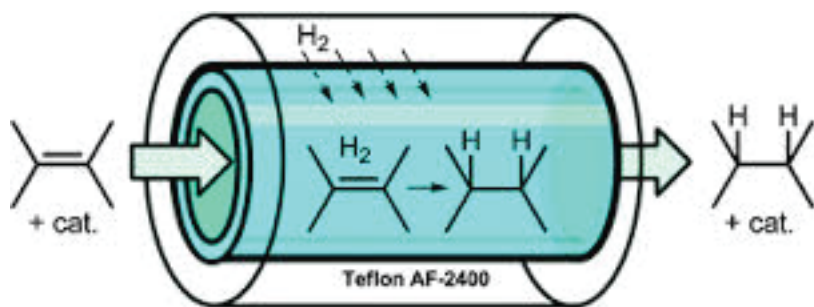
Gastropod - Teflon AF2400 (1m)  
Part Number 29160

Based on an original concept from chemists at Cambridge University and Engineers at Cambridge Reactor Design, the Gastropod allows gas to be delivered to a substrate or solvent stream in a continuous fashion. A Tube-in-a-Tube incorporates a gas permeable membrane tube within a larger diameter Teflon tube. There are two configurations.

In the Gas Liquid Addition Module, the liquid feed flows through the inner tube whilst reactive gas fills the annular area. This pre-dissolves the gas into one of the reagent streams. It is then taken into the main reactor downstream

In the Gas Reaction Module, the gas fills the inner tube and the liquid flows along the annular path so it is easy to conduct heat in and out of the flowing liquid. The advantage of this approach is that gas can be supplied during the course of a reaction - the gas is consumed, and the solubility of the gas need not be a limitation. To facilitate management of the gas input a Gas Manifold fitted with a pressure gauge and safety burst valve is included in the price

In both cases gas-liquid transfer occurs by diffusion across the gas permeable membrane. The Gastropod comes with all the fittings you need to control the introduction of the gas and liquid streams. Provided that the pressure is controlled, bubbles of gas can be avoided and a good residence time distribution can be achieved. The equipment has been used successfully with a number of reactive gases including hydrogen, carbon monoxide, carbon dioxide, oxygen and ozone, as well as with a wide range of solvents such as methanol, THF, dichloromethane and acetonitrile.



## Typical Specifications

- Reactor Vol. 0.28 - 1.12 mL (1-4 m of tubing)
- Gas Pressures 5 - 25 bar
- Flow rates 0.1 - 10.0 mL
- Safety - Very small volume of gas
- Adaptable to CRD's Polar Bear Plus

## Typical Reactions

- Carboxylation Grignard Reagents (CO<sub>2</sub>)
- Carbonylation (CO)
- Glaser Coupling (O<sub>2</sub>)
- Hydrogenation (H<sub>2</sub>)

