Main Features and Common Options

FlowCAT Compact

The most popular version of FlowCAT easily fits into standard fume hoods and provides all the essential features:

- Tubular reactors in stainless steel or Hastelloy as well as other material choices
- 6, 12, 18 and 24mm diameter with working length ~15cm (volume from ~4ml to 60ml), Longer reactors with multiple heating zones are also possible
- Pressure ~200bar and temperatures to 550°C (sub-ambient options available)
- Coiled reactors in metal and plastics, 1/16" and 1/8" diameter. Coiled reactors fit the same heating mantle as tubular reactors allowing complete interchangeability. The reactor lengths can be varied to suit the application
- Gas and liquid feeds are precisely controlled and fully automated. The total number of feeds can be configured to suit the application. Heat-tracing of liquids is also achievable
- Preheating and pre-mixing is arranged at the top of the reactor before the catalytic portion is reached
- Back-pressure regulation plus product collection and sampling are included. The special miniature design of the G/L separator and a robust, small and simple pressure regulator avoids the need for complex pressure separators

FlowCAT Customised

Custom process flow sheets sometimes require special platforms due to the extra equipment required. This can include additional feed preparation, more complex product handling, including recycling, possibly after drying or compression.

Higher throughput versions are also available for pilot scale production which may require a different set-up, to accommodate larger feed and product containers.

Multiple Reactors

Multi-reactor versions with reactors operating in series and/or parallel can also be built, with each reactor independently controlled.

Advanced Analytics

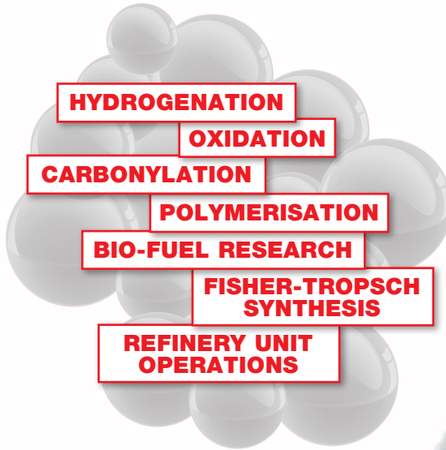
The merging of analytical data from GCs, HPLCs and spectroscopic probes (such as FT-IR) with process data is achievable, which saves time for the user but also opens up the possibility of including feedback control based on the analytical results.

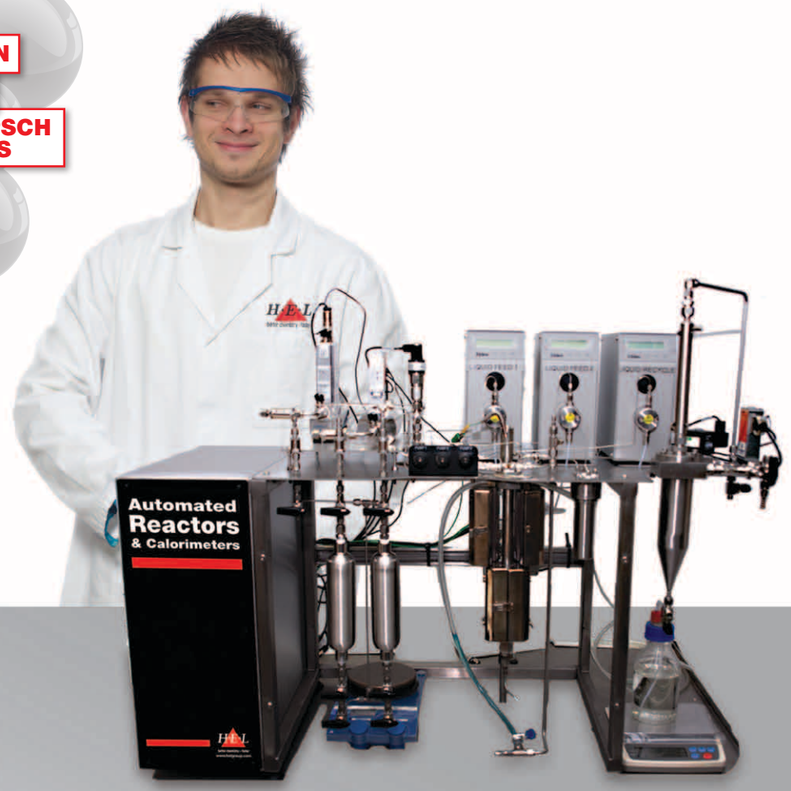
FlowCAT users include:

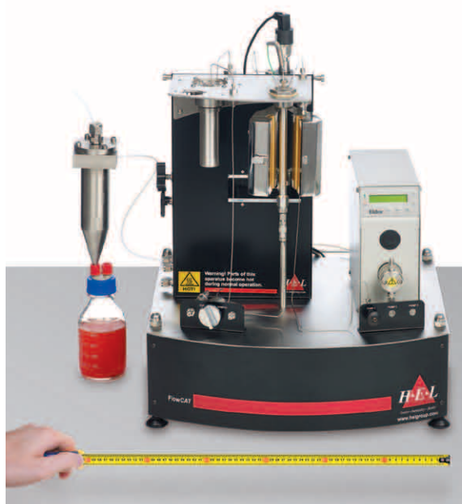
- Albermarle
- Cambridge University
- Pfizer
- Procter & Gamble
- PetroChina
- BP
- Indian Oil Corporation
- Süd-Chemie
- University of Science Malaysia
- and more...

FlowCAT

Mini Flow Reactor for Catalytic & Thermal Conversions







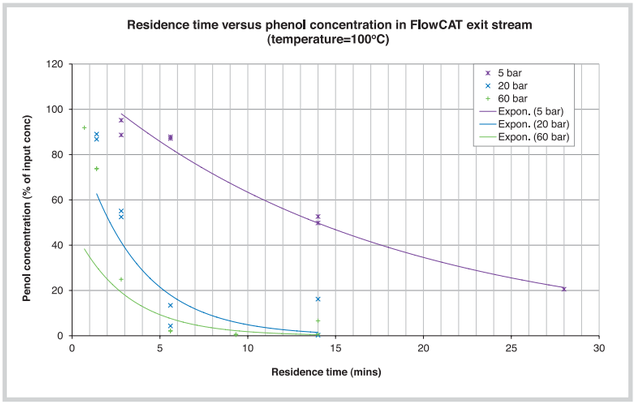
H·E·L
better chemistry – faster

Flexible Options To Meet Your Requirements

Fixed Bed/Plug Flow/Trickle Flow Reactor

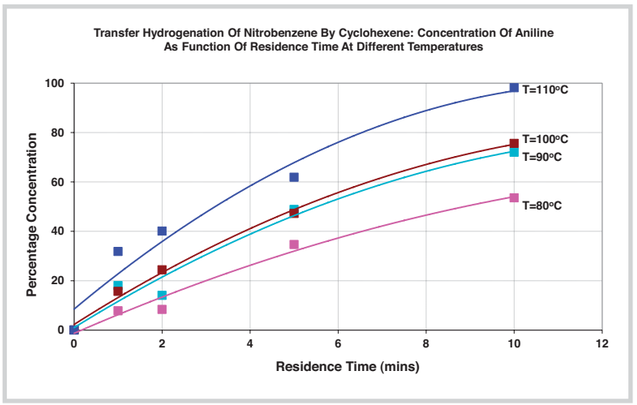
Tubular reactors in the form of pipes with flanges are used in the FlowCAT. These are available in a range of sizes with standard diameters.

The most common application of flow reactors is in heterogeneous catalysis, where the gas/liquid mixtures are passed over a solid catalyst bed, typically at elevated temperature and pressures. The reactor diameters vary between 6, 12, 18 and 24mm with volumes ranging from ~4 to 60ml.



The change in reactant concentration with residence time at different pressures for a typical heterogeneous hydrogenation reaction

Liquid/Liquid Reactions & Thermal Processes



An example of the change in product concentration with residence time at different temperatures for a typical homogeneous hydrogenation reaction

Feed Preparation

- Mixing is achieved by passing reagents through an inert packing material
- Pre-heating to the reactor temperature is achieved by heating the top section of the reactor, also filled with the inert packing material
- Heated feed vessels and heat traced pipes allow high viscosity liquids and solids to be pumped efficiently

The FlowCAT is a computer controlled platform for the development of continuous flow chemical processes, running at up to 200bar and 550°C. It takes gas/liquid feeds and delivers the product: everything in-between is included.

The flexible design allows screening, optimisation and scale-up of both homogenous and heterogeneous chemistries in the same unit and can incorporate a combination of gas and liquid feeds.

Gas/Liquid Separation

A custom designed miniature “cyclone” efficiently separates the gas and liquid phases. This can be heat-traced or cooled according to process needs. The off-gas can be further treated as required and the flow rate can also be recorded.

Liquid & Gas Dosing

A variety of liquids can be used, ranging from high volatility to virtually solid at room temperature, by using suitable feed vessels, combined with the correct pump type and sometimes, heat tracing of lines. Multiple feeds are possible.

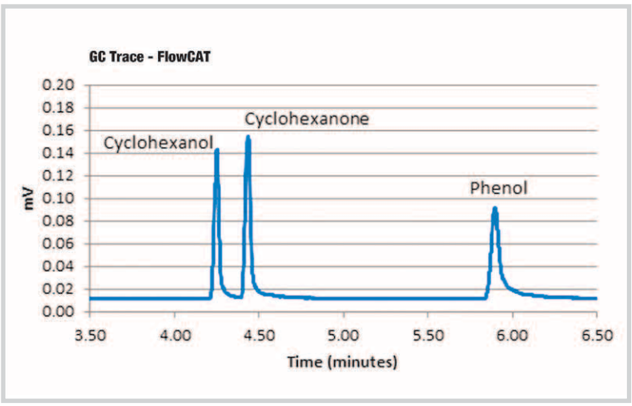
Highly volatile liquids (e.g. ethylene and CO_2) as well as gases can be dosed using special mass flow controllers, including gas blending before feeding.

Sampling & Analytical Integration

Manual or automated sampling of selected gas or mixed phase streams can be routed directly to a GC (with heat-tracing if necessary).

The contact closure triggering the GC runs can also be set in the HEL WinISO software. Real-time product analysis is available with special FT-IR (and other) probes.

Spectral files can also be time-stamped and the process information appended. These files can also be viewed in real time in separate (graphical) windows, at the same time as the process information.



An example GC trace sample taken from a FlowCAT

Recycle

The FlowCAT can accommodate additional components to enable recycling of both liquid products and excess gas. This can include further processing (e.g. drying, and compression) if necessary for process development.

www.helgroup.com