Gas chromatography.
## With HiQ® specialty gases.

Unlimited range of applications

Gas chromatography (GC) is a widely used method for separating and analysing organic compounds. There are a variety of applications for gas chromatography in every laboratory and in different processes within several industries. For example within the chemical, petrochemical and pharmaceutical industries: measurements of any kind of organic compounds, like process control as well as product control. Also for environmental measurements: aromatic pollutants in air and water, detection and measurements of pesticides etc. These are only a few examples of applications for which GC plays an important role. The range is basically unlimited.

Basic principles of GC

Chromatography is the process of separating a mixture into individual components. Through the separation process, each component in the sample can be identified (qualitatively) and measured (quantitatively). There are several kinds of chromatographic techniques with corresponding instruments. Gas chromatography is one of those techniques. GC is used for compounds that are thermally stable and volatile (or can be made volatile). Because of its simplicity, sensitivity and effectiveness in separating components, GC is one of the most important analytical tools in chemistry.

The basic operating principle of a GC involves evaporation of the sample in a heated inlet port (injector), separation of the components of the mixture in a specially prepared column and detection of each component by a detector. At the end of the process, the amplified detector signals are often recorded and evaluated using an integrator or a PC with appropriate software to calculate results.

The sample is introduced into a stream of inert gas, the carrier gas, and transported through the column by the flow of this carrier gas (see illustration below). The column can be a packed column or a capillary column, depending on the properties of the sample. As the gas flow passes through the column, the components of the sample move at velocities that are influenced by the degree of interaction of each component with the stationary phase in the column. Consequently, the different components separate. Since the processes are temperature-dependent, the column is usually contained in a thermostatically controlled oven. As the components elute from the column, they can be quantified by a suitable detector and/or be collected for further analysis.

Carrier gas   Detector gas   Sample inlet   Detector   Signal

Column
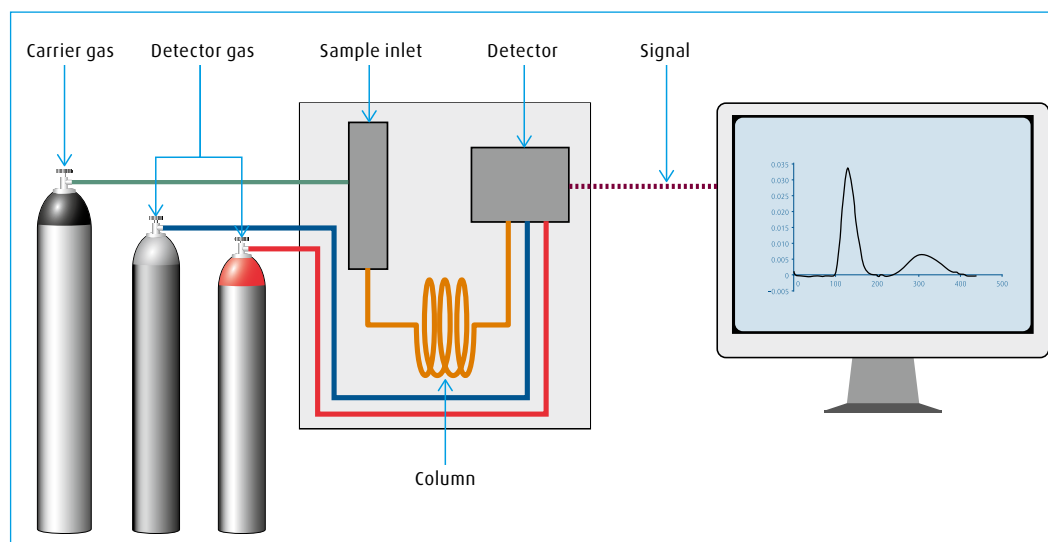
Detectors

There are a variety of types of detectors and the choice of the detector depends on the type of component(s) to be detected and measured. The most common detectors are: flame ionisation detectors (FIDs), thermal conductivity detectors (TCDs), electron capture detectors (ECDs), alkali flame ionisation detectors – also called nitrogen/phosphorous detectors (NPDs), flame photometric detectors (FPDs) and photo ionisation detectors (PIDs). Several of these detectors are described in greater detail in separate leaflets.

Carrier gases

The carrier gas has an important role transporting the sample through the column and into the detector. The carrier gas must be inert or at least must not react with the stationary phase in the column. Helium, nitrogen, argon and hydrogen are commonly used as carrier gases. The choice depends on the type of detector, column, application and safety requirements (Hydrogen is explosive). But the choice of the carrier gas is also dependent on requirements in terms of separation efficiency and speed. Hydrogen has the lowest viscosity of all gases, thereby provides the highest mobile phase velocity and therefore the shortest analysis time. Helium, on the other hand, gives the best overall performance and peak resolutions for many applications, making it an optimum choice of carrier gas in those cases.

The purity of the carrier gas is another important factor. Impurities, especially hydrocarbons, cause base line noise and reduced sensitivity and might increase detection limits. Traces of water and oxygen may also decompose the stationary phase, which leads to premature destruction of the column.

Make up and detector fuel gas

Detectors need different auxillary gases to run, depending on their detection processes. FID, NPD and FPD need a mixture of synthetic air and hydrogen to create a flame, whereas ECD runs on nitrogen and/or on a methane mixture in argon. In a TCD, the make up and detector gases are the same as the carrier gases. For an overview, see the table below. As for carrier gases, the purity of the gas is crucial for the performance, maintenance and lifetime of the detector.

Detector	Carrier/detector gas					
	H_2	He	Ar	N2	CH_4/Ar	Synthetic Air
FID	■●	■▲		■▲		●
TCD	■▲	■▲	■	■▲		
ECD	■	■		■▲	■▲	
FPD	■●	■	■	■▲		●
NPD	●	■▲		■▲		●
PID	■▲	■▲		■▲		

■ Carrier gas　　● Detector gas　　▲ Make up gas

Product program for gas chromatography

Linde offers a wide range of high-purity specialty gases suitable as carrier, make up and detector gases. For process applications, the quality specialty gases, like HiQ Argon 5.0, HiQ Helium 5.0, HiQ Hydrogen 5.0 and HiQ Nitrogen 5.0, are commonly used for analysis. For quality control and R&D analysis, the higher quality specialty gases will be appropriate. For special detectors, such as ECDs, particularly specified gases are available.

Moisture traps and other purifiers are not necessary when you use the recommended gases, equipment and purging routines from Linde.

More information

Please look into the respective leaflet covering your detector, the HiQ product program or contact your local Linde sales representative to find the gases that suit your analytical method(s) and application(s). Valuable information can also be found on our website http://hiq.linde-gas.com.

Go to the HiQ smart phone site: