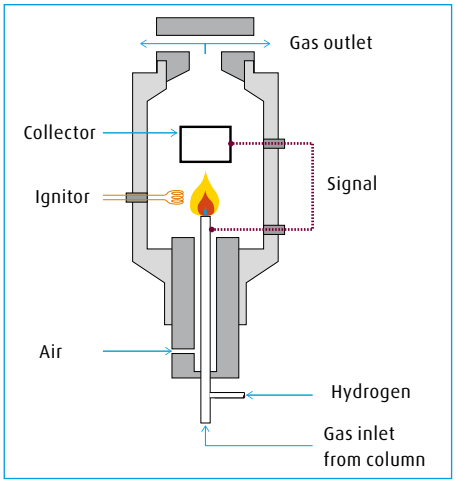
Flame ionisation detector.
Gas chromatography with HiQ® specialty gases.

Gas chromatography

Information about gas chromatography in general can be found in the application sheet “Gas chromatography” (GC).

Flame ionisation detector

The flame ionisation detector (FID) is one of the most used detectors for gas chromatography. The application area is wide. For example, petrol for airplanes, kerosines, are carefully analysed with the FID as a routine control. The composition of the kerosines is of great importance for the energy conversion. A completely different area is the packaging of food. Your take-away hamburger comes in an insulating polystyrene box. During the processing of polystyrene, different hydrocarbons are added to create the end-product. When polystyrene is used within the food industry, it is crucial that the product is analysed for any residues of the hydrocarbons, since they can influence the quality of the food and harm your health.



Analysis using the FID

The FID is well suited for analysis of hydrocarbons, such as methane, ethane, acetylene etc., but also for organic substances containing hydrocarbons and for volatile organic compounds (VOCs). In an FID, the sample undergoes combustion in a hydrogen/synthetic air flame. Ions and free electrons are formed in the flame. The charged particles produce a measurable current flow in the gap between two electrodes in the detector. The resulting current flow is of greater strength than the signal produced by the pure carrier gas and the fuel gas flame alone. This signal differential provides information about the sample. The current is proportional to the ion formation which depends on the composition of the separated sample.

The FID is a general detector which, after additional configurations, can be used for the analysis of more specific components. For example, by placing a methaniser ahead of the FID, components containing carbon can undergo catalytic conversion to methane and thereby become suitable for FID analysis. Carbon monoxide (CO) and Carbon dioxide (CO_2) are commonly analysed this way. For the determination of organic nitrogen/phosphorus compounds, a different FID configuration is needed. The sample passes a heated alkali source, where charged particles are formed in contact with the alkali source. This method is normally named alkali flame ionisation, but it is also referred to as thermionic detection. The detector used for this method belongs to the group of detectors in which thermal energy is used as source for ionisation. This method is often also called nitrogen/phosphorous detection; the acronym for the corresponding detector is NPD.

Flame ionisation detectors are extremely sensitive and have a wide range of linearity. Their only disadvantage is that they consume the sample.

Gases

An important facet of the FID is the use of a carrier gas to transfer the sample from the injector through the column and into the FID. The carrier gas must be inert and may not be adsorbed by the column material. Helium or nitrogen are normally used as carrier gases for the FID, sometimes hydrogen is also used.

The detector gases, hydrogen and synthetic air, respectively serve as fuel gas and oxidising gas during the combustion process. Since hydrocarbon impurities, moisture and oxygen produce a greater baseline noise which has an adverse effect on the detection limit, these impurities in the detector gases should be kept as low as possible.

Like all chromatographic analytical processes, gas chromatography is a relative method, i.e. calibration with a standard mixture is required, both to check linearity and as calibration for the sample.

HiQ® product program

The HiQ specialty gas product program offers a wide range of pure gas qualities, calibration mixtures and equipment as well as components that fulfill the requirements in terms of analytical techniques, such as gas chromatography using a flame ionisation detector.

Carrier, make up and detector gases

Instrument grade pure gases such as synthetic air, helium, hydrogen and nitrogen are commonly used used as carrier , make up and detector gases. HiQ Helium 5.0 supplied in a cylinder is helium at purity 99.999 % and not more than 10 part per million (ppm) total reported impurity level. HiQ Helium 6.0 is helium at purity 99.9999 % and not more than 1 ppm total reported impurity level.
To obtain optimal analytical results, Linde recommends the following gas qualities for analysis using an FID:

Specifications

	HiQ Helium 5.0	HiQ Nitrogen 5.0	HiQ Hydrogen 5.0	HiQ Synthetic Air 5.0
O_2	≤ 2 ppm	≤ 2 ppm	≤ 2 ppm	
C_nH_m	≤ 0.5 ppm	≤ 0.5 ppm	≤ 0.5 ppm	≤ 1 ppm
H_2O	≤ 3 ppm	≤ 3 ppm	≤ 3 ppm	≤ 5 ppm
N_2	≤ 5 ppm		≤ 5 ppm	
Product code	115	135	125	215

For research and special quality control analysis, higher purities are available, e.g. the HiQ 6.0 grade gases qualities. You will find those and other purities in the HiQ product program.

Reduce the number of cylinders or H_2 volume in your lab

Alternatives are:	HiQ 40% Hydrogen in Nitrogen	Product code 2536
	HiQ 8.5% Hydrogen in Helium	Product code 2534
	HiQ 40% Hydrogen in Helium	Product code 2535

Where the use of cylinder hydrogen is restricted, the HiQ hydrogen generator is safe to operate, due to its small contained volume (< 40 ml). HiQ offers a broad range of high purity gas generators for in-house production of Hydrogen, Nitrogen, and Zero Air.

Calibration mixtures

Linde can offer a range of calibration and test gases for the FID to measure and calibrate the linearity of the detector, reproducibility and lifetime performance of the columns.

Specialty equipment

Specialty equipment such as BASELINE® cylinder regulators are suitable up to purity 5.0 (99.999%). Supplied in one-stage, or two-stage configurations BASELINE regulators are designed to offer a more stable operation than “industrial” or “technical” quality equipment can provide.

The BASELINE C106 cylinder regulators are suitable for carrier and auxiliary gases as well as calibration gases. The single stage regulator C106/1 is intended when minor fluctuations in outlet pressure due to diminishing inlet supply can be tolerated. The two stage regulator C106/2 is intended for applications requiring constant pressure control and delivery regardless of supply pressure variations. C106 regulators can be plain or equipped with a diaphragm valve (type A) or a needle valve (type B). For the use of an FID, we recommend a plain C106 regulator in brass.

Recommended cylinder regulator

		Outlet pressure		
BASELINE		bar	psi	Product code
Single stage	C106/1, brass	0-3.5	0-50	5725
Single stage	C106/1, brass	0-7	0-100	5726
Two stage	C106/2, brass	0-3.5	0-50	5629

More information

Please consult your local Linde sales representative or visit our website http://hiq.linde-gas.com to get more information.

Go to the HiQ smartphone site:

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