

Atomic absorption spectrometry. With HiQ[®] specialty gases.

AAS flame method

Atomic absorption spectrometry (AAS) has been used in laboratories for about 40 years. With this method, more than 50 metals and metalloids can be quantitatively analyzed down to the trace range. The significant advantages of AAS are its high selectivity and detection sensitivity. For this reason, the process has rapidly achieved a position of importance in the field of scientific analysis.

AAS has many uses in different industries. Many raw materials are examined, and AAS is widely used to check that the major elements are present and that toxic impurities are lower than specified. In the mining industry, the amounts of metals, e.g. gold in rocks can be determined by AAS to see whether it is worth mining the rocks to extract the gold. In the agricultural industry, animal fodder is analyzed for possible metal impurities. Also within clinical and environmental analysis, AAS is an important analytical technique.

Analysis using the AAS flame method

The AAS technique makes use of the wavelengths of light specifically absorbed by an element. Atoms of different elements absorb characteristic wavelengths of light.



Metal elements or metalloids in an aqueous sample are vaporized and thermally atomized by a flame. The flame is created by a fuel and oxidizing gas. A specific element-related spectral light (source: hollow cathode lamp) is radiated through the atomization cell, and a certain wavelength is filtered out of the line spectrum of the element by a monochromator. The difference in intensity between the sample and the reference beams produces a signal which is directly proportional to the total number of free atoms present of the element under analysis. A calibration curve is constructed by running samples of known concentrations under the same conditions as the unknown. With the flame method, a detection limit of a few mg/kg (ppm) is achieved.

Fuel and oxidizing gases

Depending on the element under analysis, various types of flames, i.e. flame temperatures, are used. The type of flame most frequently used in flame AAS is the acetylene/air flame (2200–2400 °C).

In the case of heat-resistant, oxide-forming elements, such as Al, Si, V, Ti, an acetylene/nitrous oxide flame (2600–2800 °C) provides a more favorable chemical, thermal and optical environment.

The hydrogen/air flame (2000–2050 °C) offers certain advantages in analyzing readily atomizable alkali metals, such as Cs, Rb, K, Na. However, matrix effects are frequently observed with this type of flame.

HiQ[®] product program

The HiQ[®] specialty gas product program offers a wide range of gas qualities and equipment that fulfill the demands concerning analytical techniques of AAS.

Acetylene for AAS

Linde recommends the following gas qualities for creating a flame for the AAS analysis:

Specifications

	AAS acetylene 2.6 (C ₂ H ₂)
Air	≤ 0.4 %
PH ₃	≤ 5 ppm
H ₂ S	≤ 1 ppm
Product code	2000

As the cylinder pressure falls, the acetone content (vapor pressure) in acetylene rises. This causes errors in the measurements for elements whose sensitivity depends heavily on the composition of the fuel and oxidizing gas. For this reason, instrument manufacturers recommend that acetylene cylinders should only be used up to a residual pressure of 6-7 bar.

C₂H₂ cylinder regulator

For a recommendation, please contact your local Linde representative.

Oxidizing gases

	Instrument synthetic air 5.0	AAS nitrous oxide 2.0 (N ₂ O)
O ₂ +N ₂		≤ 0.9 %
CO	≤ 1 ppm	
CO ₂	≤ 1 ppm	
C _n H _m	≤ 0.1 ppm	
H ₂ O	≤ 3 ppm	
Product code	2141	2104

In addition to appropriate safety precautions, the use of acetylene/nitrous oxide requires a different burner than the use of an acetylene/air flame.

Recommended central gas supply

REDLINE® central specialty gas supply systems for inert and non-reactive gases. Group green for single gas supply panels designed for pure gases and mixtures.

Group blue for single stage supply panels with internal purging designed for high-purity gases and mixtures, including flammable gases.

**Recommended cylinder regulators**

REDLINE® single stage regulator C200/1 is recommended. The regulator can be plain or equipped with a shut-off valve (type A) or a needle valve (type B).

For AAS analysis, we recommend C200/1 A in brass.

REDLINE®		Outlet pressure		Product code
		bar	psi	
Single stage	C200/1 A, brass	0.2-3	3-45	3100
Single stage	C200/1 A, brass	0.5-6	8-85	5467

More information

Please look into our HiQ® catalog 'Biotech, chemical, petrochemical & pharmaceutical', visit our website <http://hiq.linde-gas.com> or contact your local Linde sales representative.

