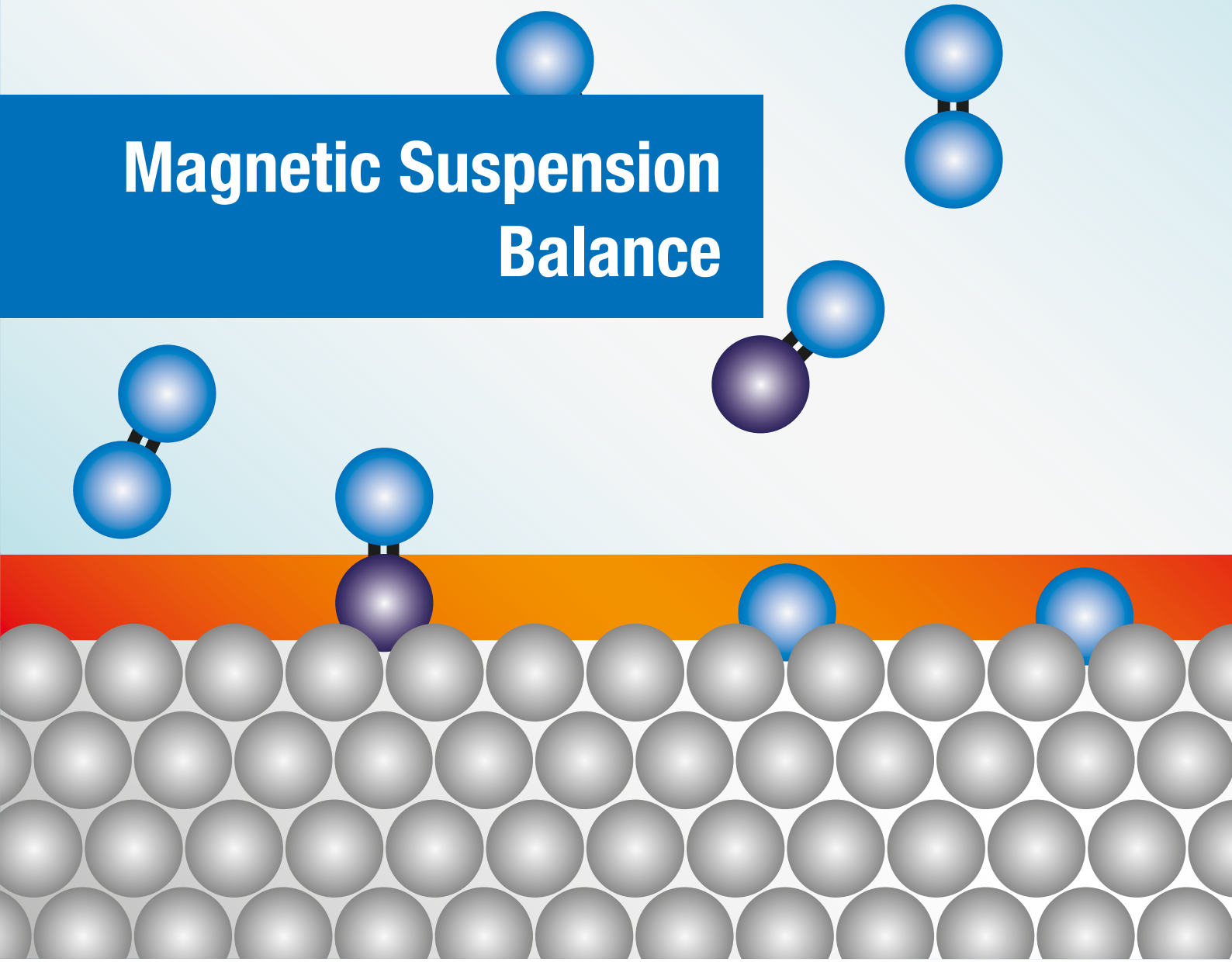
Magnetic Suspension Balance



LINSEIS

Magnetic Suspension Balance

LINSEIS TGA L87 MSB

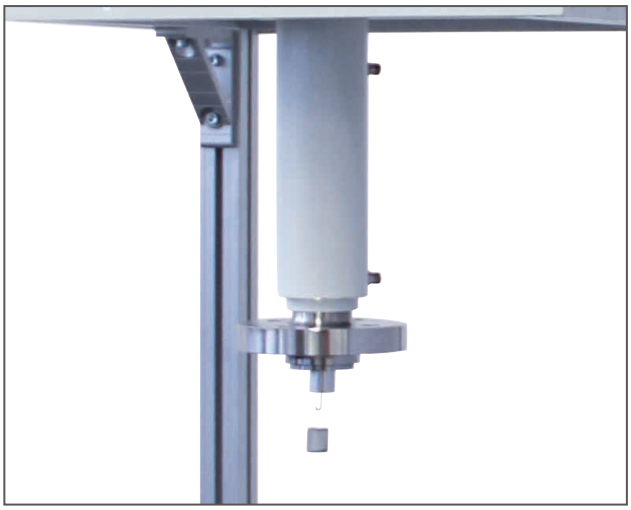
With the magnetic suspension balance gravimetric measurements in a wide temperature and pressure range and under aggressive media can be done. Such a magnetic suspension balance consist of a balance for recording the measurement values, a suspension coupling which carries the weight of the sample, a sensor for the position measurement of the levitation part and a control unit to control the suspension coupling.

The contact-less transmission of the sample weight is realized with a levitation magnet and a holding magnet. The levitation magnet consists of a permanent magnet and the holding magnet consists of an electromagnet hanging on the balance. The position sensor delivers the actual position of the levitation magnet and the PID controller makes a stable levitation position with the electromagnetic force as the actuating variable. Through the magnetic coupling a micro balance can be set up at environmental condition. Therefore the balance is protected from high temperatures, pressure and aggressive media.

Quantity to be measured with the magnetic suspension balance

With the magnetic suspension balance dimensions like
- sorption,
- diffusion,
- surface tension
- and density

can be measured easily.



Furthermore chemical reaction e.g.
- decomposition
- and combustion

will be recorded and production processes can be simulated (coating, polymerisation, dehydration, etc.).

Applications

- production of plastic
- exhaust gas cleaning
- foodstuff manufacturing
- supercritical fluid extraction
- gasification of coal
- soil detoxification
- purification and storage of natural gas and hydrogen
- analysis of membrane of fuel cells
- waste incineration
- research about process technology and chemical technology

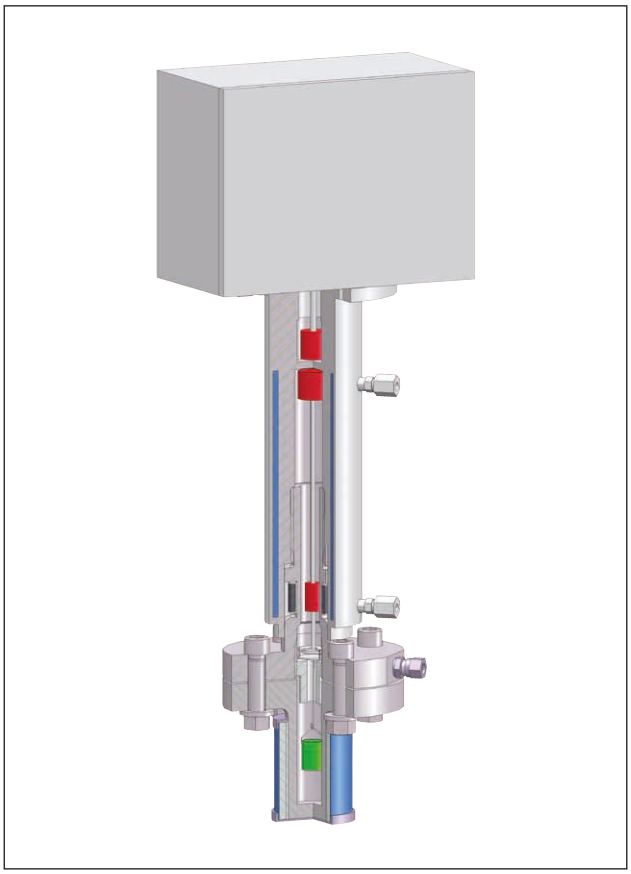
LINSEIS MSB High Temperature Version

Heater	Temperature	Pressure
SiC / Graphite	1400°C	50 / 100 bar
SiC / Graphite	1550°C	50 / 100 bar
Graphite	1800°C	50 bar

Technical Specifications

Model	Metal Version
Pressure Range	UHV to 350 bar
Temperature Range	-196 to 2400°C
Sample weight	50g, 25g, 10g, 1g
Resolution	10µg, 1µg, 0.1µg
Evolved Gas Analysis	MS/FTIR possible

Special custom versions can be realized.



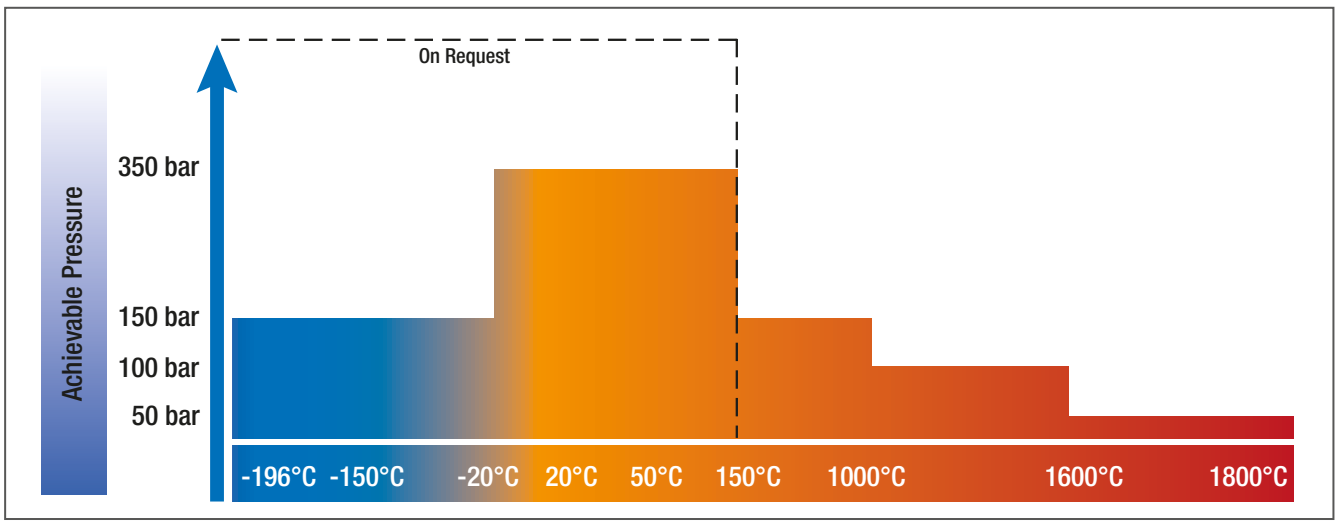
Metal version

The metal version can be used for a wide application area. Measurements from ultra high vacuum up to 350 bar and a temperature range from -196 to 2400°C are possible. Furthermore corrosive and toxic media are insertable. This will be possible with special coatings of the metal measurement cell.

Density

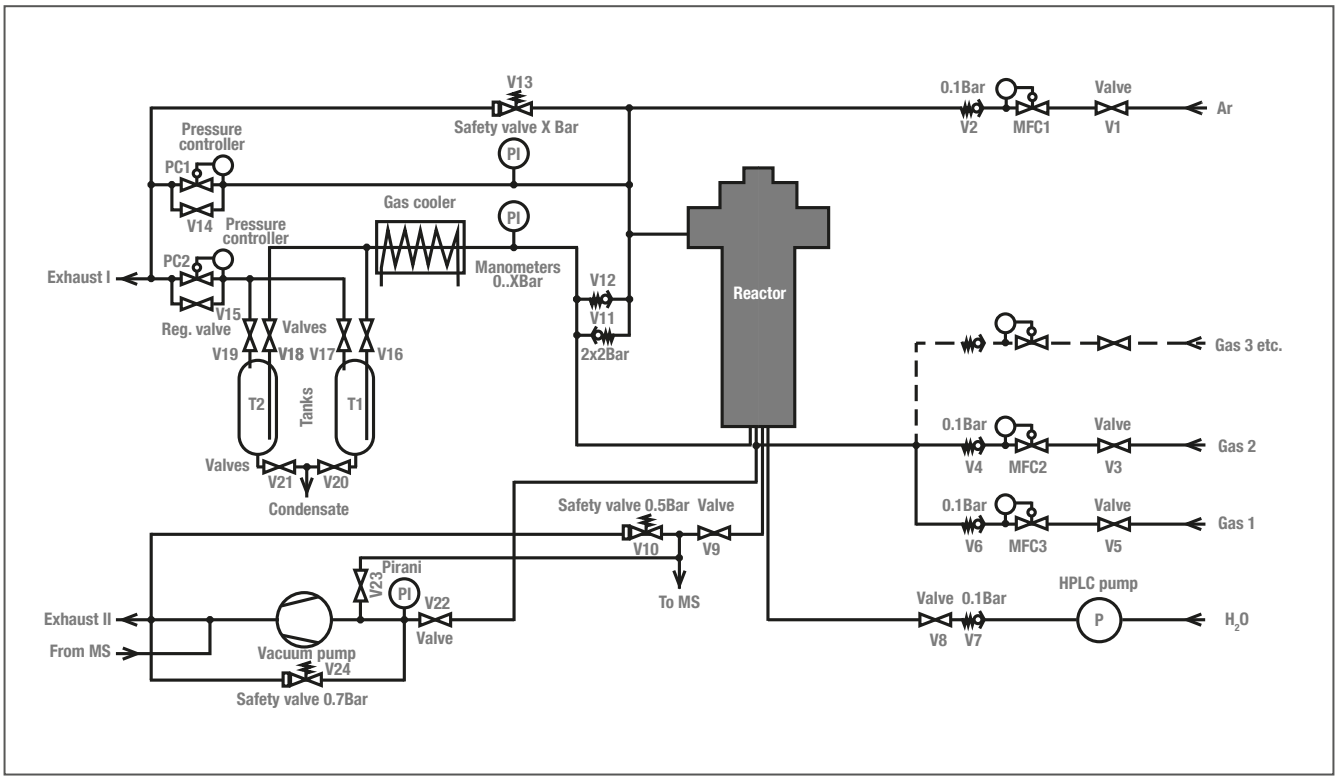
With the Archimedes´ principle the density can also be analyzed with the magnetic suspension balance. A mass with known volume will be weighed. With the buoyancy of the sample the density will be calculated. With a compact construction of the magnetic suspension balance the density can be analysed in a large temperature and pressure range.

Temperature Control

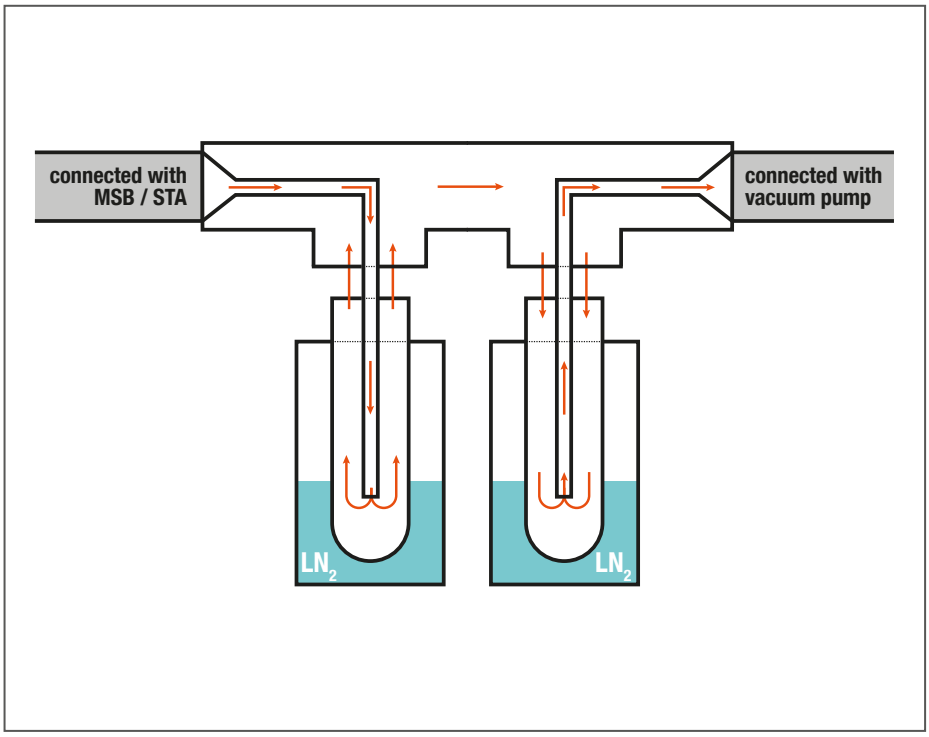


Gas/Vapor Flow Diagram Option

Gas/Vapor Flow Diagram



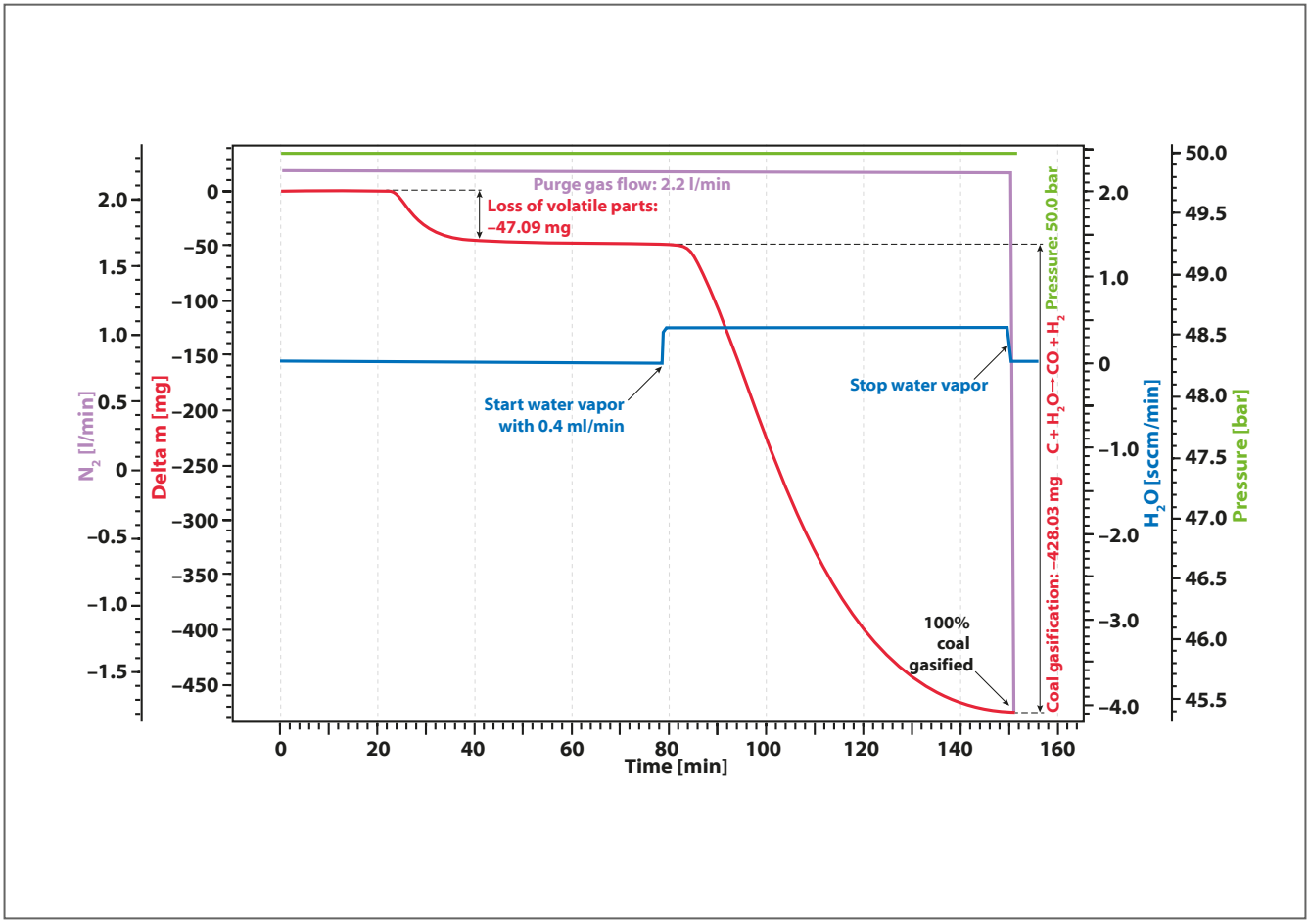
Option: Cooling Trap



The LINSEIS Cooling Trap consists of three glass parts. The tube itself is connected to the vacuum pump at one side and to the gas evolving device on the other side. Additionally there are two glass traps that are connected to the main tube and that are positioned in liquid nitrogen containing Dewar bottles. The whole system works as follows: The vacuum pump is activated and constant vacuum is created in the cooling trap. The outgoing gasses are now directly sucked into the first glass trap that is cooled to -196°C by liquid nitrogen. Most of the condensing compounds in the gas phase will now immediately be trapped as a solid or liquid here. After that, the gas goes up into the bridge part and passes the second cooling stage where the rest of condensing compounds are removed by deep freezing before the gas enters the vacuum pump that is placed at the other end of the cooling trap. The way the outgoing gas takes is shown in the figure.

Application

Coal gasification



A common known application for TGA measurements is the investigation of the so called coal gasification or hydro gasification. This process, where carbon is heated in a water steam atmosphere is used in some catalytical processes, for example to remove carbon monoxide (CO) from exhaust fumes and especially to get valuable organic compounds out from resources like charcoal or biomass.

The whole process can be described like this:

Charcoal or the Carbon parts of Biomass react with water vapour to a mixture of carbon monoxide and hydrogen at higher temperatures. ($C + H_2O \longrightarrow CO + H_2$)

This process can be done with or without additional oxygen. If an oxygen containing atmosphere is used, you will also get additional carbon monoxide according to ($C + O_2 \longrightarrow CO_2$ followed by $C + CO_2 \longrightarrow 2\ CO$)

The third equation, no matter if you use oxygen or not, shows the reaction of carbon monoxide with water to get more hydrogen ($CO + H_2O \longrightarrow CO_2 + H_2$).

So in the end you will get a mixture of carbon monoxide and hydrogen. Those two gases are involved in chemical balances and therefore sometimes it is also interesting, to know how much pressure you have in your system, because the pressure determines on which side of the equation the balance will be.

Finally, the purpose of the coal gasification is, that you can get methanol and methane out of the two created gases carbon monoxide and hydrogen ($CO + 2\ H_2 \longrightarrow CH_3OH$; $CH_3OH + H_2 \longrightarrow CH_4$)

That means with this process you can get from any kind of carbon to the basic building block of almost every organic compound (drugs, polymers, oils, waxes, fatty acids, organic acids and so on).

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