Product Information
Microwave-induced Oxygen Combustion (MIC)

Accessories for closed system oxygen combustion in Multiwave 5000 further extend the wide application spectrum of Anton Paar's high-performance Microwave Reaction System in Analytical Chemistry.

Combustion of flammable samples in an oxygen atmosphere (*e.g.* oxygen bombs or Schöniger flasks) is widely used for preparation of samples for the subsequent determination of non-metal elements by *e.g.* ion chromatography or ion-selective electrodes.

Several EPA and ASTM methods are readily available for the analysis of combustible solids and liquids based on sample preparation by oxygen combustion and describe the above-mentioned procedures more in detail.

Multiwave 5000 with Rotor 8NXQ80 can be easily upgraded with quartz sample holders and gas loading check valves to perform oxygen combustion.

1.1 How Does it Work

Usually, 50 - 500 mg of combustible solid samples are used.

Powdered samples have to be pelleted in order to ensure a complete combustion. Otherwise smaller particles can be swept out of the sample holder by turbulent gases generated during the combustion and result in an incomplete combustion.

Each sample is put onto an impregnated filter paper onto a quartz sample holder. The loaded holders are placed into the quartz vessels, which are filled with a suitable absorption solution, like buffer or acidic solutions. The vessels are closed and loaded into Rotor 8NXQ80. After placing the rotor into Multiwave 5000, the vessels are filled with 10 - 20 bar of oxygen by using a special gas loading device. This device can be directly connected to the standard oxygen supply of a laboratory. The quartz vessels are filled via a gas loading check valve, which is used instead of the standard venting screw of the vessel.

Once microwave irradiation is applied, the impregnated filter paper in the vessels and thus the samples are ignited by the microwave irradiation.

During combustion in an oxygen atmosphere, samples are converted into gases or solids (*e.g.* halides, oxides).

Non-metal elements can be collected in weak alkaline absorption solutions and subsequently measured as anions with ion chromatography. Metals are usually absorbed directly in diluted acids. Samples containing silicates (*e.g.* plant material, coal) might show lower recovery rates as metal ions could be partially trapped inside combustion residues, which may not be fully soluble in diluted acids.

In all cases, a refluxing step of 5 to 15 min immediately after the combustion step is recommended to obtain accurate recoveries.

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Benefits

- Convenient handling of NXQ80 quartz vessels for oxygen combustion, much easier than the handling of steel bombs
- No need for fumbling with ignition wires
- No handling of electrical connections necessary
- High sample throughput – simultaneous combustion of up to 8 samples
- Higher chemical resistance of NXQ80 quartz vessels versus steel-made oxygen bombs
- Reduced risk of contamination due to the absence of metal surfaces inside the combustion chamber
- Lower limit of detection for the analysis of certain metal ions (e.g. Hg) due to low acid concentrations (no additional dilution steps necessary)
- No special accessories for corrosive samples required (e.g. steel bombs typically have to be made of special alloys or require additional quartz liners)
- Unique combination of combustion and digestion in the same run

Fields of Application

Sample preparation for analysis of non-metal and metal elements in combustible solids (the list is not intended to be exhaustive):

- Biological samples
- Food, animal feed
- Wood, chipboard
- Paper, cardboard
- Resins, polymers (e.g. PS, PP, PE, PVC)
- Organic compounds
- Solid waste
- Coal, coke

Limitations

Incomplete combustion might result either from using a too high sample amount or from lack of oxygen (caused by leakage of the vessel or insufficient oxygen pressure).

Combustion of (highly viscous) liquid samples is possible if the sample is absorbed on several sheets of filter paper. In this case, place the impregnated filter paper on top of the sample.

Samples with high fluoride content may affect the stability and life-time of the quartz vessels, especially if an acidic absorption solution is used.

To enable a thorough absorption of analytes, a refluxing step and a subsequent cooling step should always follow the combustion step.

Please refer to the *Microwave-induced Oxygen Combustion – Instruction Sheet* (E38IB012EN) for a more detailed description of the procedure.

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Ordering Information

104690 Gas Loading Set II

Included:

17224 4-Way-Valve Station

Basic equipment for all kinds of gas and liquid handling applications with all connection hoses and connectors to the gas supply.

102811 Hose 2m incl. Loading Connector

2 m PTFE hose with a connector to the 4-way-valve station and a screw loading connector male fitting to the gas loading check valve of the vessel.

17385 Connecting Piece Hydrolysis

Made of PEEK to connect the 4-Way Valve Station to the syringe adaptor of the Multiwave 5000 reaction vessel.

104689 Oxygen Combustion Set II

The Oxygen Combustion Set II contains all accessories which are necessary to adapt 4 pieces of Pressure Vessel NXQ80 (104276) for the microwave-assisted oxygen combustion.

Anton Paar supplies neither oxygen nor appliances for pressure control of loading of oxygen.