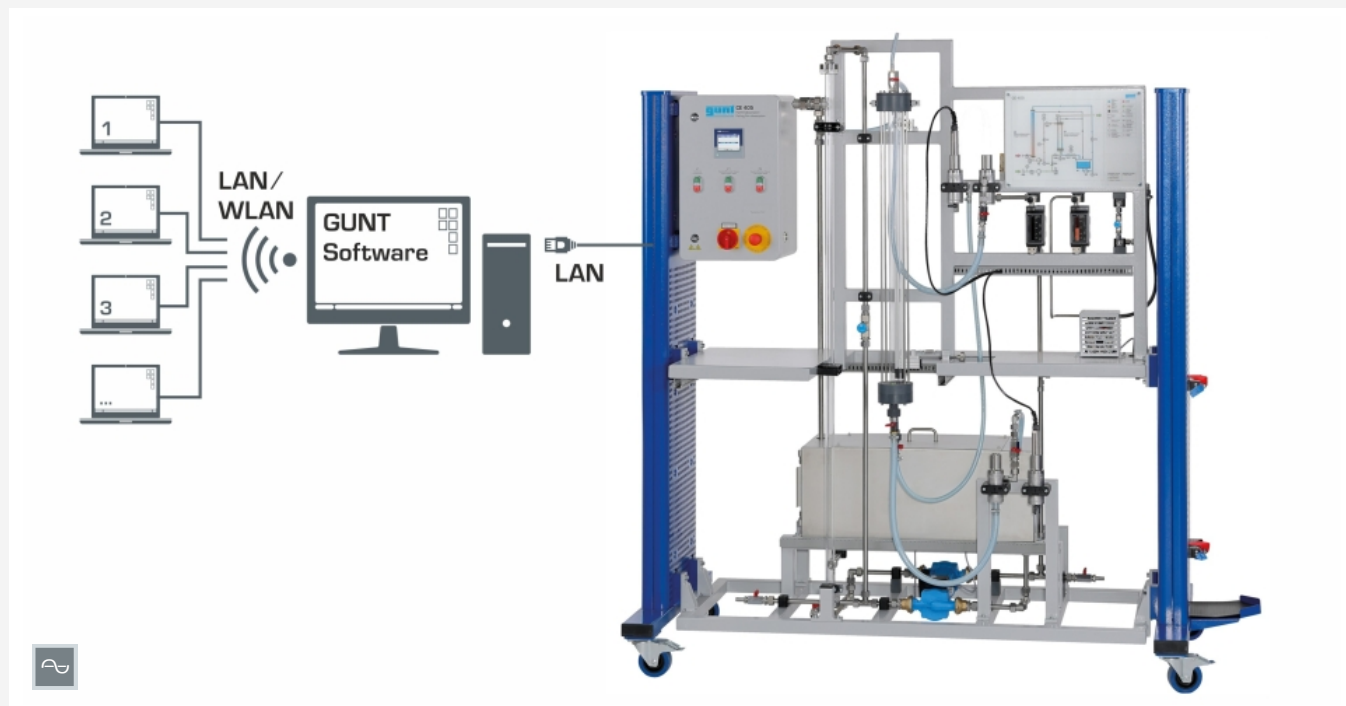


CE 405

Falling film absorption



Network capable GUNT software: control and operation via 1 PC. Observation, acquisition, analysis of the experiments at any number of workstations via the customer's own LAN/WLAN network.

Description

- separation of oxygen by absorption
- continuous regeneration of the solvent with nitrogen by stripping
- safe operation due to use of water as the solvent and non-hazardous gases
- network capability: observe, acquire, analyse experiments via customer's own network

Absorption is used to remove one or more gaseous components from a gas flow using a solvent. Selective absorption is an important industrial process for the treatment of gas mixtures. CE 405 can be used to investigate the basic processes on the water-oxygen-nitrogen system.

A compressor supplies ambient air from below into the absorption column. Water flows down as a thin film at the edge of the absorption column. The air flows upwards centrally in the column. A portion of the air's oxygen is dissolved in the water film. The air flow exits the column at the top. The water containing the dissolved oxygen leaves the column at the bottom and flows into a tank. A pump supplies the water with the dissolved oxygen to the head of the desorption column.

The desorption column is a simple tube in which the water flows downwards. Nitrogen from a compressed gas cylinder enters at the base of the column. The nitrogen rises to the top in the form of dispersed bubbles in the water. The partial pressure of the oxygen in water is higher than the partial pressure in the gas phase (nitrogen). For this reason, a portion of the oxygen passes over from the water into the gas phase (stripping). This process leads to the water's absorbing capacity for oxygen increasing. A pump supplies the solvent regenerated in this way to the head of the absorption column. Transparent materials allow optimal observation of the processes in both columns.

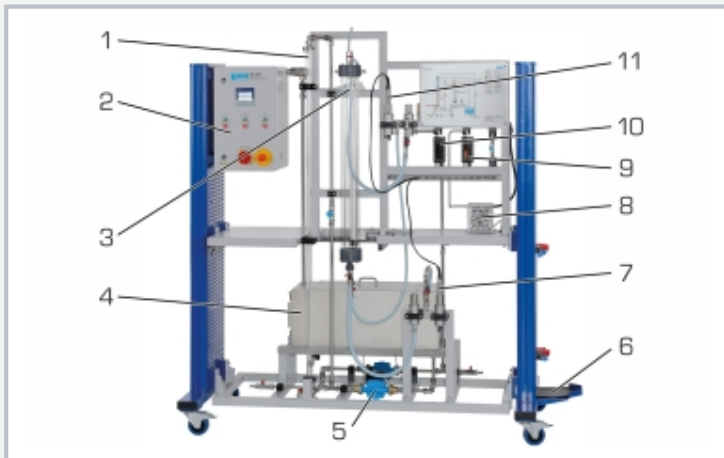
Valves and flow meters make it possible to adjust the flow rates of air and solvent. The oxygen concentration and temperature are continuously measured both upstream and downstream of the absorption column and digitally displayed. The measured values can be transmitted simultaneously via LAN directly to a PC where they can be analysed using the GUNT software.

Learning objectives/experiments

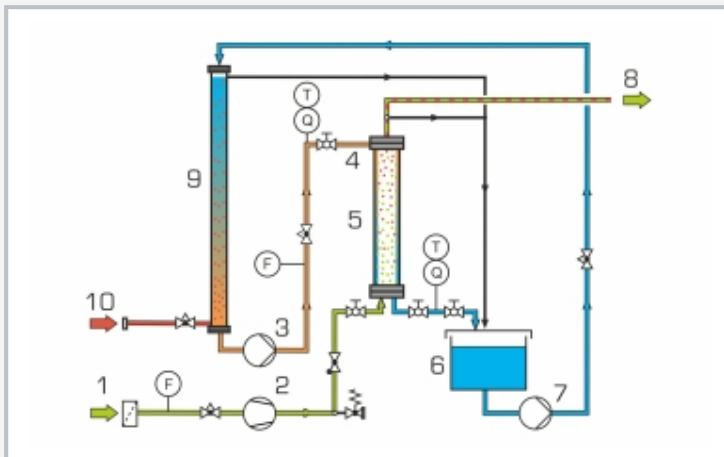
- investigation of the absorption process during the separation of oxygen from an air flow in a falling film column
- balance of the process
- determination of the mass transfer coefficient depending on
 - ▶ volumetric air flow rate
 - ▶ flow rate of the solvent water
- regeneration of the solvent by stripping
- familiarisation with counterflow process

CE 405

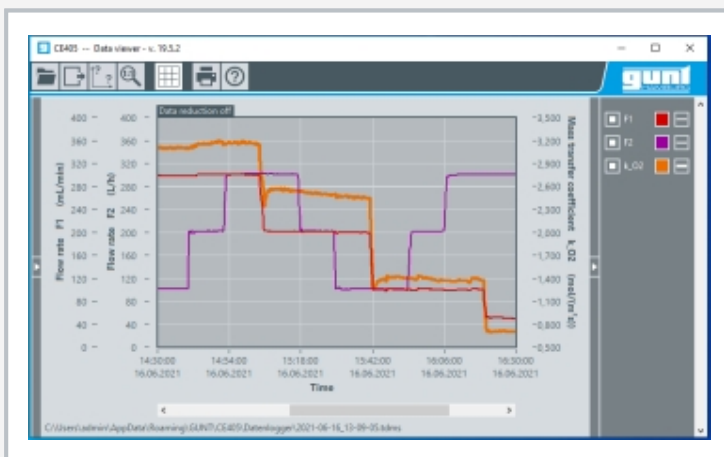
Falling film absorption



1 desorption column, 2 switch cabinet, 3 absorption column, 4 tank, 5 pump, 6 mounting for pressurised gas cylinder, 7 oxygen and temperature sensor downstream of absorption, 8 compressor, 9 flow meter (air), 10 flow meter (water), 11 oxygen and temperature sensor upstream of absorption



1 air inlet, 2 compressor, 3 pump, 4 regenerated solvent, 5 absorption column, 6 tank (solvent with dissolved oxygen), 7 pump, 8 air outlet, 9 desorption column, 10 nitrogen inlet (external); F flow rate, Q oxygen concentration, T temperature



Software screenshot: time function of mass transfer coefficient with water and air flow rate

Specification

- [1] transparent falling film column for the absorption of oxygen from the ambient air in water
- [2] continuous regeneration of the water (solvent) in a transparent desorption column by stripping with nitrogen
- [3] compressor supplies ambient air to the falling film column
- [4] 2 pumps supply water between the columns
- [5] valves and flow meters to adjust the flow rates of air and solvent
- [6] sensors rerecord oxygen concentration and temperature upstream and downstream of the absorption column
- [7] digital displays for all measuring values
- [8] network capability: observe, acquire, analyse experiments at any number of workstations with GUNT software via the customer's own LAN/WLAN network
- [9] data acquisition via customer's own network or via direct LAN connection with GUNT software under Windows 10

Technical data

- Absorption column
- inner \varnothing x height: 32x890mm
 - material: glass
- Desorption column
- inner \varnothing x height: 24x1650mm
 - material: PMMA
- 2 pumps
- max. flow rate: 58L/min each
 - max. head: 3,7m each
- Compressor
- max. positive pressure: 2bar
 - max. flow rate: 23L/min

Tank, stainless steel: capacity: approx. 50L

Measuring ranges

- flow rate: 38...380mL/min (water)
- flow rate: 36...360NL/h (air)
- temperature: 2x 0...50°C
- oxygen concentration: 2x 0...20mg/L

230V, 50Hz, 1 phase; 230V, 60Hz, 1 phase
 120V, 60Hz, 1 phase; UL/CSA optional
 LxWxH: 1930x790x1980mm
 Weight: approx. 135kg

Required for operation

nitrogen gas cylinder with pressure reducing valve
 PC with Windows recommended

Scope of delivery

- 1 trainer
- 1 set of accessories
- 1 GUNT software
- 1 set of instructional material