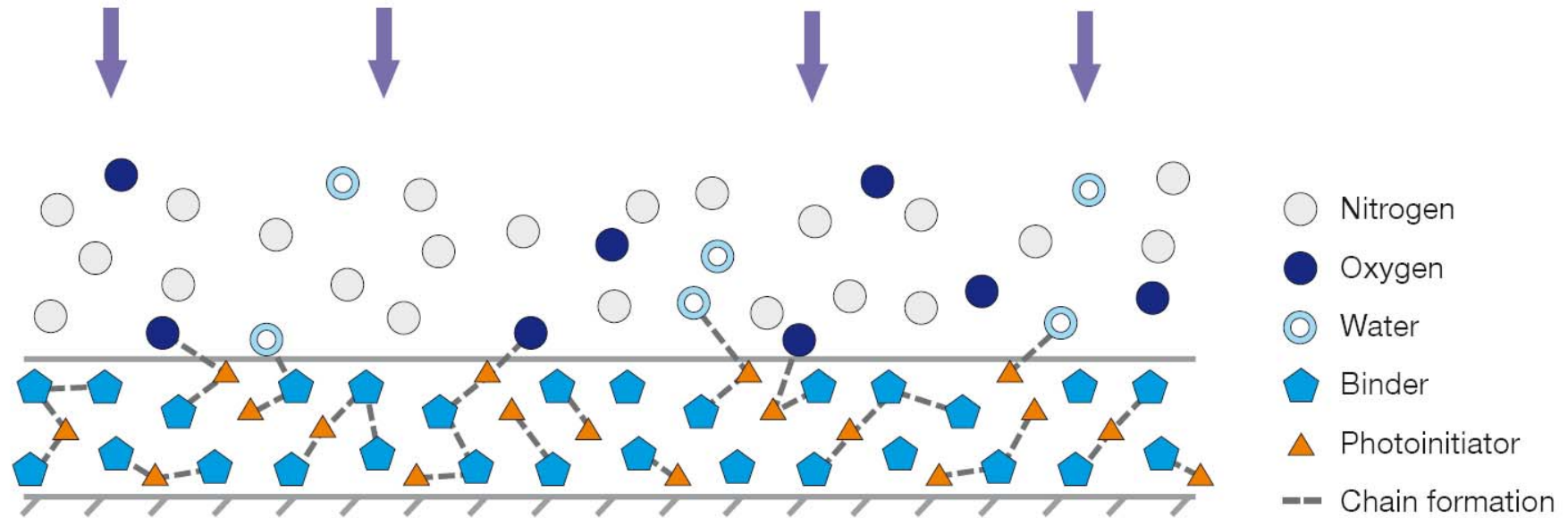


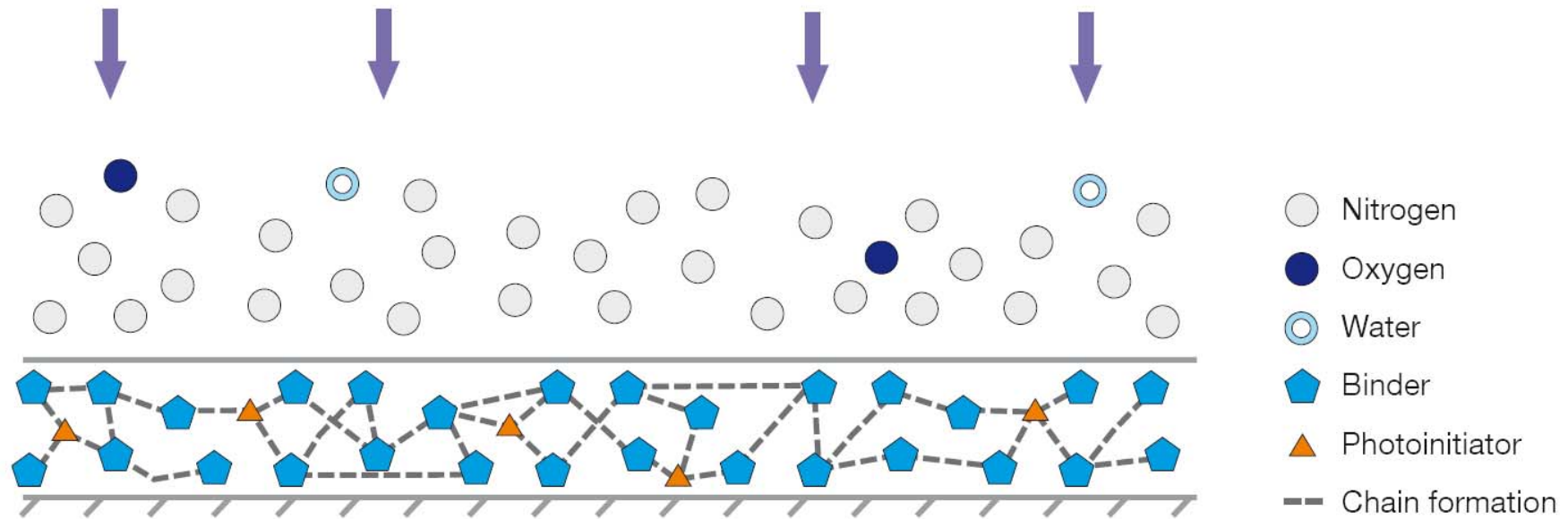


Nitrogen reduced printing

UV curing under ambient conditions



UV curing in O₂-reduced atmosphere



ADVANTAGES

- Less Photoinitiators
- Better Crosslinking
- Reduced risk of migration
- Reduced risk of odours

BUT

- Chemicals (inks / lacquers / silicones) must correspond to the conditions of the inert chamber and the UV system
- Requirements (residual oxygen level, power level) must be defined



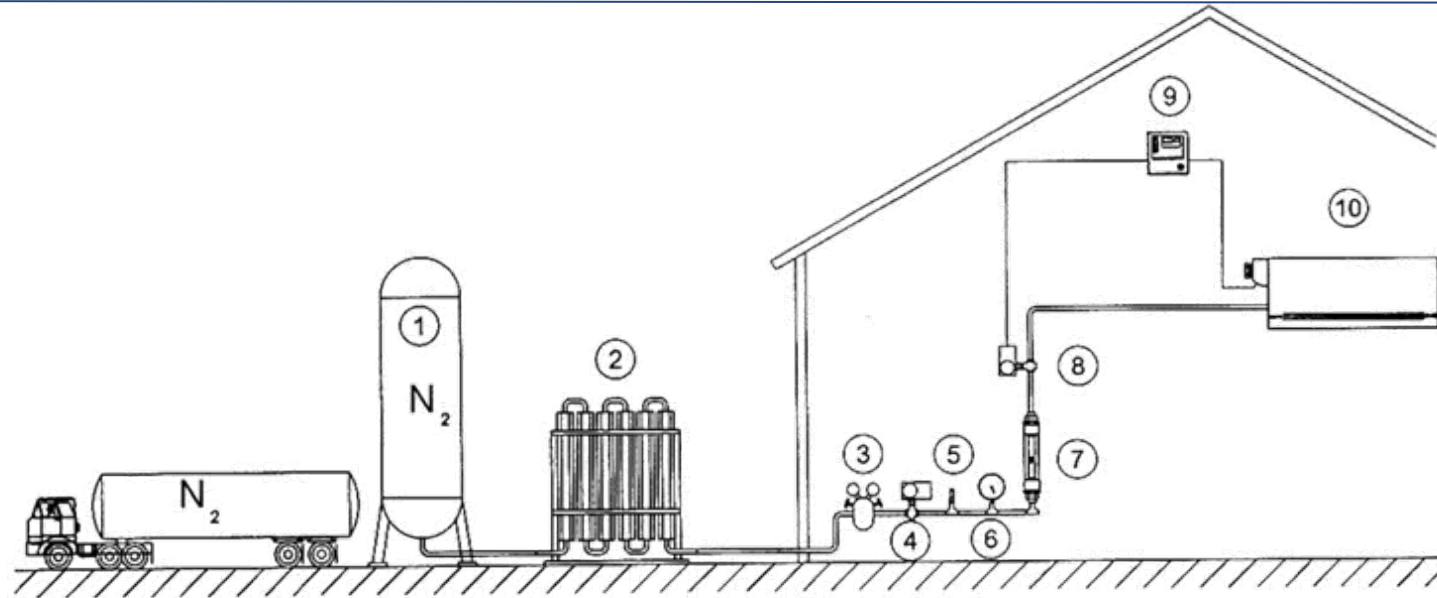
Residual oxygen requirements

TYPICAL VALUES

- Remark: 1 % = 10000 ppm
- < 50 ppm (0,005%) for silicones
- < 200 ppm (0,02%) for printing inks
- < 500 ppm (0,05%) for varnishes



Nitrogen supply



- ① Nitrogen filling station
- ② Evaporator (temperature after the evaporator 20 °C, if necessary with ancillary heating)
- ③ Pressure reducer/ regulator (constant pressure, regulation range 4 - 6 bar)
- ④ Shutoff valve with choke (hand or electric valve, electric valve de-energized when shut)
- ⑤ Safety valve (7 bar)
- ⑥ Manometer (0 - 10 bar)
- ⑦ Flow meter (protective cover required)
- ⑧ Control valve (hand or motor valve)
- ⑨ Residual oxygen meter / nitrogen regulation
- ⑩ IST unit

DISTRIBUTION

- Amount of consumption
- Place (Distance to Distribution)



CONVERSION

- $1 \text{ m}^3 = 1,447 \text{ l}$
- $1 \text{ l} = 0,691 \text{ m}^3 = 691000 \text{ cm}^3$

PRICE EXAMPLES

- Gas bundle $114 \text{ m}^3 = 2,06 \text{ EUR/m}^3$
Ident 51585-
- Gas bundle $157 \text{ m}^3 = 1,85 \text{ EUR/m}^3$
Ident 189888-
- Liquid tank (IST 19000 m^3) = $0,62 \text{ EUR/m}^3$
Ident 47533-

78% of ambient air is nitrogen, 20,9 % is oxygen

3.5

- = 99,95 pureness
- Residual oxigen level max. 400 ppm

4.0

- = 99,99 pureness
- Residual oxigen level max. 50 ppm

4.6

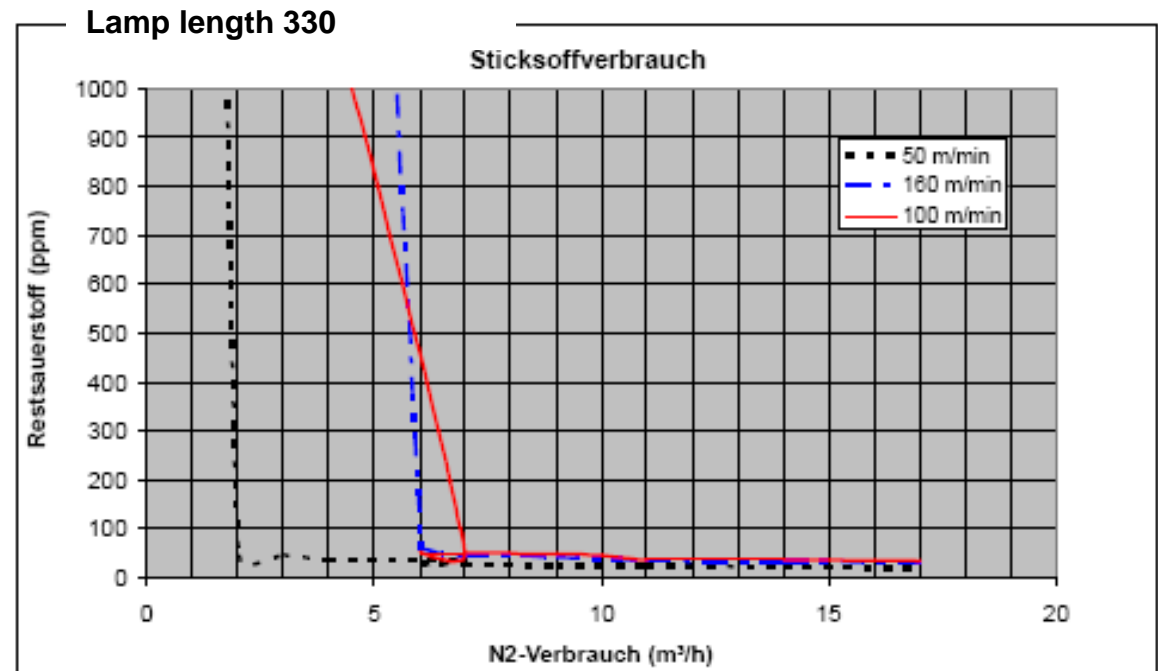
- = 99,996 pureness
- Residual oxigen level = 5 ppm

5.0

- = 99,99 pureness
- Residual oxigen level max. 2 ppm

DEPENDENCIES

- Production time
- Speed
- Opening gap (In- and outlet)
- Substrate
- Lamp length



Residual Oxygen Analyzer

- Electrochemical fuel cells for detection
- Oxygen diffuses to the cathode of the cell
- A current output is produced
- Current is proportional to the concentration of oxygen

ADVANTAGE

- Electrochemical process without the risk of an influence by residual VOC's like on devices using zirconia cells with surface temperatures of up to 650°C and the risk of burning oxygen



Residual Oxygen Control

- Measuring of residual oxygen level
- Closed loop to control the volume of nitrogen feeded into the chamber
- Each nozzle is controlled by a motor driven linear valve, ensuring stable conditions inside the chamber
- If the preselected values can not be reached the system will create a failure signal (different levels possible)

