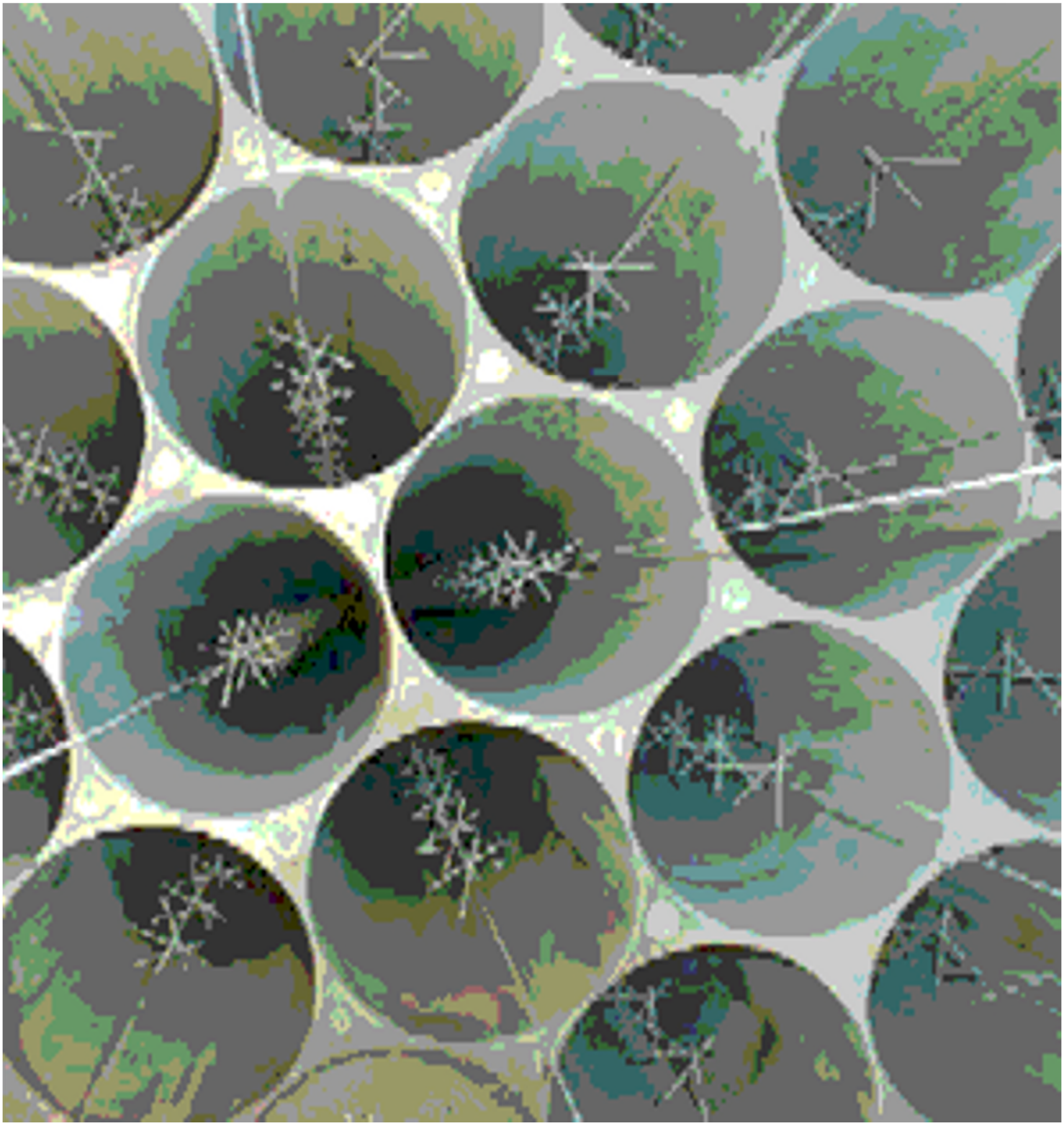


HUGO PETERSEN
Verfahrenstechnischer Anlagenbau

GAS CLEANING
Aerosol Separation for High Performance

www.hugo-petersen.de

Formation of Aerosols

The origin for the formation of impurities in the atmosphere is of diverse reason. Large sized particles of dust and droplets appearing in the environment are generated by sprays and turbulences of liquid and solid material. Considerably finer particle distribution of liquid and solid impurities is formed by condensation resp. chemical reaction. The precipitation of these fine particles / aerosols requires very specific and high efficient techniques.

The following scheme demonstrates the various sizes of components in conjunction with gases.

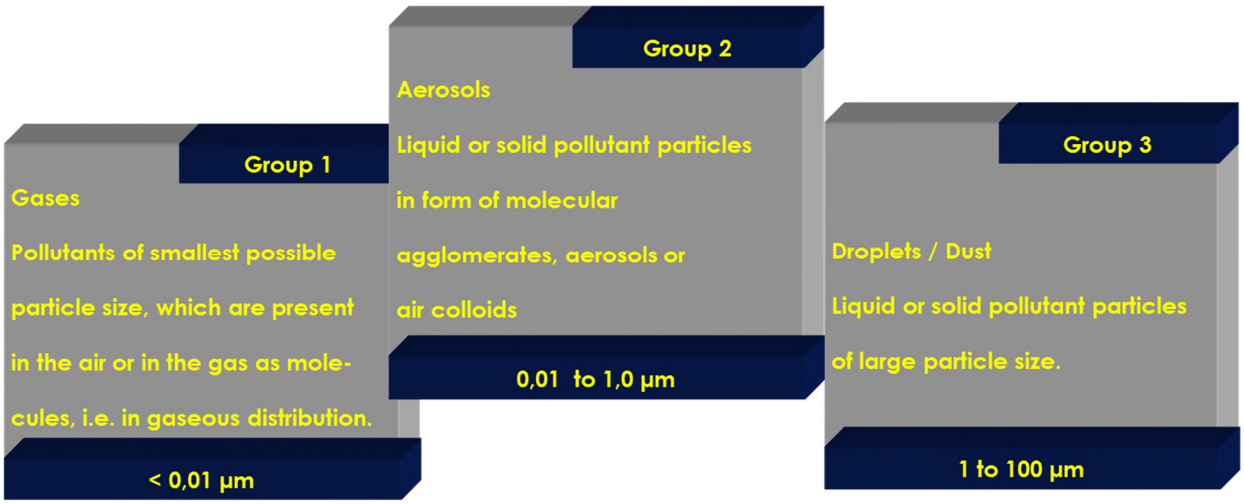


Fig. 1:Category of Pollutants

According to the above scheme the adequate gas cleaning method is chosen. At the same time the boundaries especially with mixtures of the components the methods will vary from application to application.

The engineers of HUGO PETERSEN have a profound know-how in gas cleaning, leading to proven and efficient equipment and plants for the elimination of impurities.

Based on the technical knowledge and the long-standing experience HUGO PETERSEN will offer the tailor-made solution for your application.

Selection of Process

The challenge of technical optimal cleaning is getting greater as finer the particles. A further cost driving factor is the emission level. But not only CAPEX is of interest, OPEX is as of the same importance.

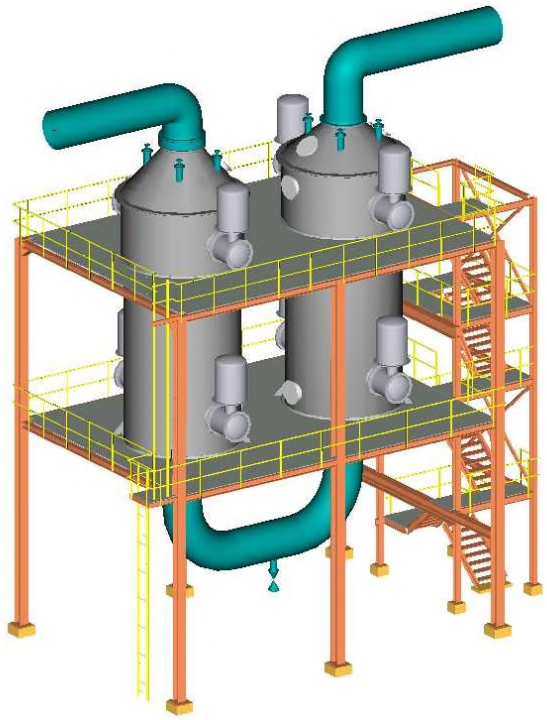
The experience of HUGO PETERSEN's engineers will lead to the adequate process selection.

Technical Information

The Petersen Wet Electro-Static Precipitator removes the finest liquid and solid particles, typically under 1 Micron in size, from the humid gas sources.
Separation efficiencies up to 99.9 % can be achieved.
A pressure drop of less than 30 mm W.C. reduces the power consumption.

The HUGO PETERSEN Wet Electrostatic Precipitators are used in following processes:

- sulphuric acid production plants,
  - such as Cu, Zn, Pb, Ni, Pyrite-roasters
- residual combustion plants
- calcination processes
- general chemical processes



Pic. 1:Typical Plant Arrangement

Functional Principle

Electrostatic precipitators use electrostatic forces to separate particles contained in the gases. The figure below illustrates this process in a simplified manner. The discharge electrode, normally negatively charged, emits a stream of electrons in the direction of the collecting electrode, which in this case is at zero potential (earthed). The applied high voltage of 40...70 kV is responsible both for the development of the corona and the formation of the electric field between the electrodes.

In the vicinity of the discharging corona the gas becomes ionised, i.e. ions migrate to the positive electrode (collecting electrode).

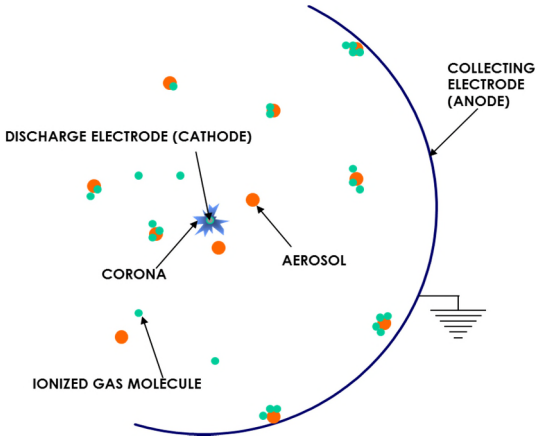


Fig. 2: Principle of Electrostatic- Precipitation

The particles to be separated from the gas initially at different potentials (positive negative neutral) now possess negative potential because of ionic bombardment and ionic diffusion. Only in this condition they are affected by the forces in the electrostatic field and can be precipitated.

In the electric field the charged particles, like the ions, begin to migrate to the collecting electrode. In accordance with Stokes' law this migration is impeded by gas viscosity, but nevertheless the electrostatic forces are stronger and prevail.

Design Features

Material of Construction

The casing of the wet electrostatic precipitator can be supplied in different materials

- plastic material
- homogeneously lead lined steel
- flake lined steel
- stainless steel

The internals like the precipitation electrodes are made of

- PPs, PVC-C, etc.
- Acid resistant austenites
- or even lead

The emission electrodes are mainly austenites and on request Pb with a steel-core.

Pic. 2:WESPs in Regen Plant

The materials used are selected in accordance with the particular conditions in a plant. For a majority of applications, where high corrosion resistance is required..

Dry Insulators without Air Purge

The insulators for the four high-tension support grids are electrically heated only, thus eliminating the ingress of air diluting the gases.

Layout

The electrostatic precipitators can be designed for either top or bottom gas inlet to suit the plant's layout. The T/R (Transformer / Rectifier) set is located directly on top of the ESP.

Optimization and Piloting

As the Deutsch-Equation shows:

$$\eta = 1 - e^{\left(-\frac{A}{V} \times w\right)}$$

A precipitator with a fixed geometry can only be improved in efficiency, if the migration velocity is increased, meaning intensifying the charging density.

Following an intensive research work the efficiency of the PETERSEN WESP could be intensified to a 10 times higher charging saturation as shown in the graph below. Resulting in smaller equipment and lower emissions

More than 14 different type of emission electrode shapes were tested, different tube size examined and ratios between anode and cathode piloted, before the todays design were released.

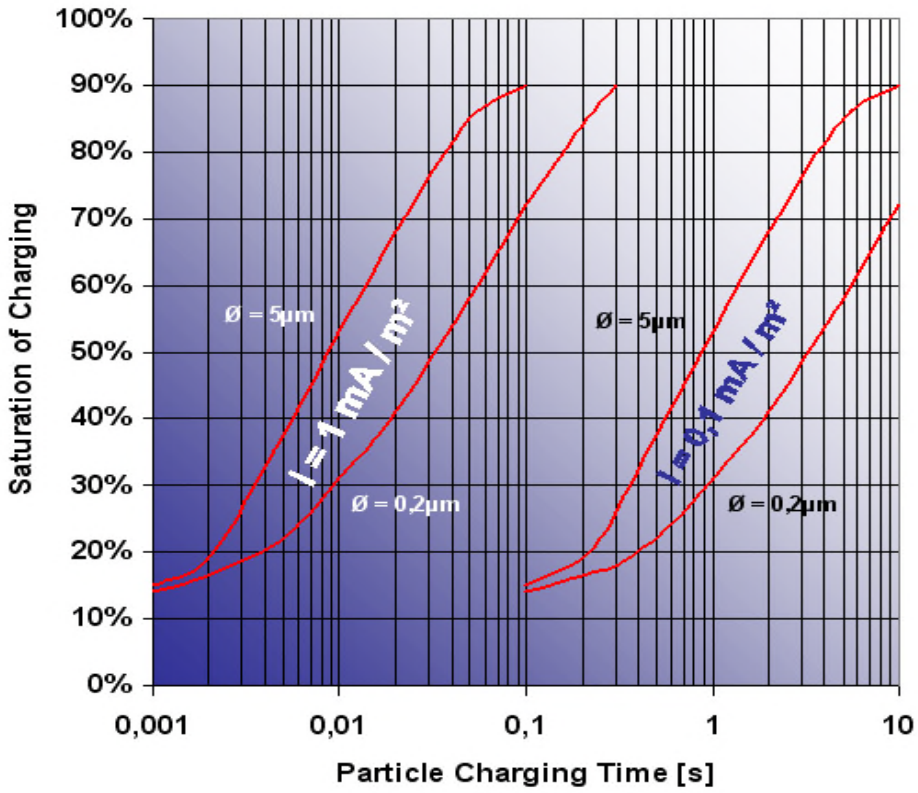


Fig. 3: Comparison of the Classical Starwire and the modern HP-Spike-Electrode

Even today HUGO PETERSEN has not stopped the R & D for the future design of this equipment.

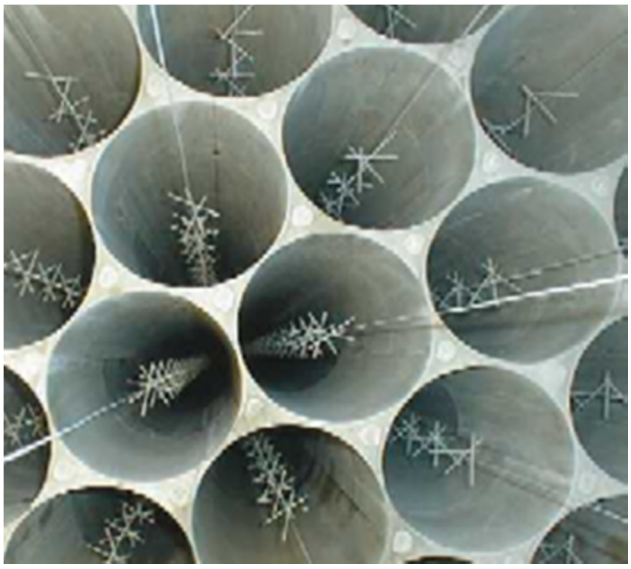
Furthermore HUGO PETERSEN offers even piloting to its clients to find the right process and parameters for design.

The equipment for piloting can be even tailored for the application and will be accompanied by HUGO PETERSEN personnel.

Benefits

Costs

Each unit is custom designed to provide the optimum price-performance ratio for the particular application using a full range of equipment design parameters. Actual test runs on a semi-commercial unit permit significant guarantees to be extended for unusual conditions.



Pic. 3: Electrode Field with the HP-Spikr-Electrode

Maintenance

The use of FRP, Austenites or even 4-5mm thick (10 to 12lb lead) homogeneous lead linings provides a life-long protection.
Fabrication is followed by stringent quality control, including ultrasonic defect detection. The location of the T/R set on the top of the ESP eliminates the necessity of a high-tension cable.

Operation

The electrical heating of the insulator compartments eliminates the necessity for purge air addition. This also prevents any possibility of hazardous back flow conditions occurring during over pressurization. The electrical heating is ideally suited for maintaining the unit ready for operation during periods of plant shutdown.

Construction

The equipment is supplied in a number of prefabricated modules, which are easily assembled, with modest requirements for field labour. There is no requirement for led burners during the site installation.
The units are self-supporting and free-standing and are robust enough to withstand the most stringent seismic loadings. There is therefore a minimum of additional steelwork required. Where steelwork already exists, the equipment can be readily integrated into the system.

Service

On periodic turnarounds and during start-up, HUGO PETERSEN can provide expert assistance in inspecting the equipment should be desired.

References

Turbulence Scrubber, Wet-Electro-Static-Precipitator

Pic. 4: Cleaning off gases by means of absorption and aerosol removal downstream of pyro-metallurgical processes in non-ferrous industries.

Pic. 5: WESPS in Zn-Roasting Plant

Pic. 6:

Gas Cleaning in a Regen Plant The high-performance PES - wet electrostatic precipitator is used for the removal of aerosols and dusts.

Pic. : Complex multistage wet scrubbing unit installed at a metallurgical plant.

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