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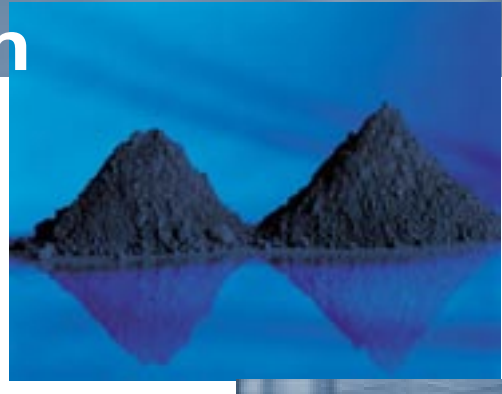
(Ekamai), Sukhumvit Road



Dry Sorption of Harmful Gases

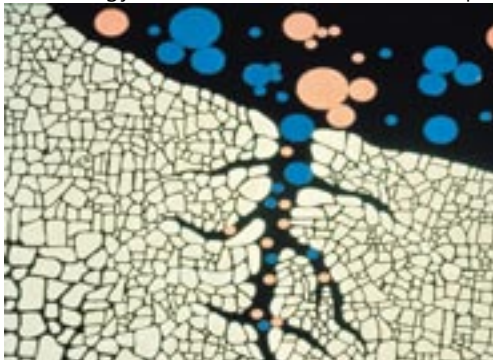


Dantherm Filtration Know-how



Dantherm Filtration - Supplier of Turnkey Plants and Consultant

Since the early '70s, Dantherm Filtration has been a leading manufacturer of dust collection systems with modern filter technology. During the '80s, Dantherm Filtration also started to look at the separation of harmful gases using different sorbents, and produced state-of-the-art flue gas cleaning plants. In 2003, Dantherm Filtration developed its own process technology: the Dantherm Filtrationsorp[®]



We assist and support our customers throughout the whole life cycle of a plant:

- Plant conception
- Profitability analysis
- Authority engineering
- Permission procedures
- Invitations to tender
- Financial aspects
- Detailed planning
- Implementation
- Commissioning, trial operations
- Maintenance and servicing
- Dismantling and disposal



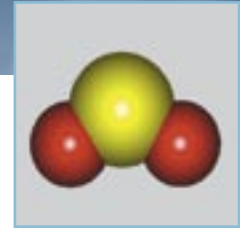
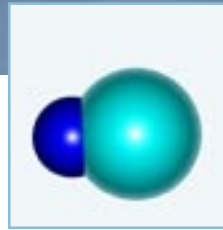
Hg sorption with sulphur impregnated activated carbon following gypsum calcination

Sorption of harmful gases requires a great variety of different additives.

The range extends from carbon adsorbents such as activated lignite, activated carbon and petroleum coke via alkaline additives such as hydrated lime and sodium hydrogen carbonate to more exotic substances such as aluminium oxide or zeolites.

Together with making the right selection of additive or additive mixture, the process choice also plays a major role in offering the customer the most economic and reliable solution.

Dry sorption



Dry sorption of harmful gases

We are not restricted to just one process but offer several different solutions – from purely dry via quasi-dry to wet processes.



Dry sorption of HF with aluminium oxide and regenerative thermal post combustion

Mechanisms of dry sorption

Absorption (Chemisorption)

During chemisorption, the harmful substances (usually acids) react with the sorbent (usually an alkali) producing new harmless compounds (like salts).

One example is the reaction of hydrated lime (Ca(OH)₂) with HCl to calcium chloride.



Adsorption

During adsorption, the harmful substances are not converted chemically but physically bounded to the inner surface of porous solids. The sorption capacity of the various adsorbents depends to a great extent on the temperature and is described by adsorption isotherms. The best known example of this is the adsorption of mercury (Hg) by activated carbon.

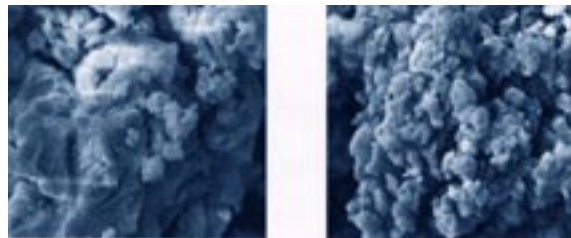
Sorbents



It's the mixture that counts!

Both mechanisms, adsorption and absorption, can be combined by mixing different sorbents. The efficiency of the sorption process depends on many factors, such as:

- **Particle size**
- **Homogeneous distribution of the adsorbent**
- **Residence time of the sorbent in the process**
- **Specific inner surface**
- **Temperature**
- **Moisture level**



For example, the hydrated lime Spongiacal[®] has a far better efficiency for SO₂-separation than conventional hydrated lime.

Conditioned dry sorption with hydrated lime

The efficiency rate for SO_x-separation increases noticeably with an increased moisture level of the waste gas. By conditioning i.e. increasing the moisture level, the hydrated lime consumption can be reduced considerably.

In practice, here evaporation coolers or rotation atomisers are frequently used, generating an extremely fine droplet spectrum.

The evaporating droplets cool the waste gas and thus also improve the efficiency.



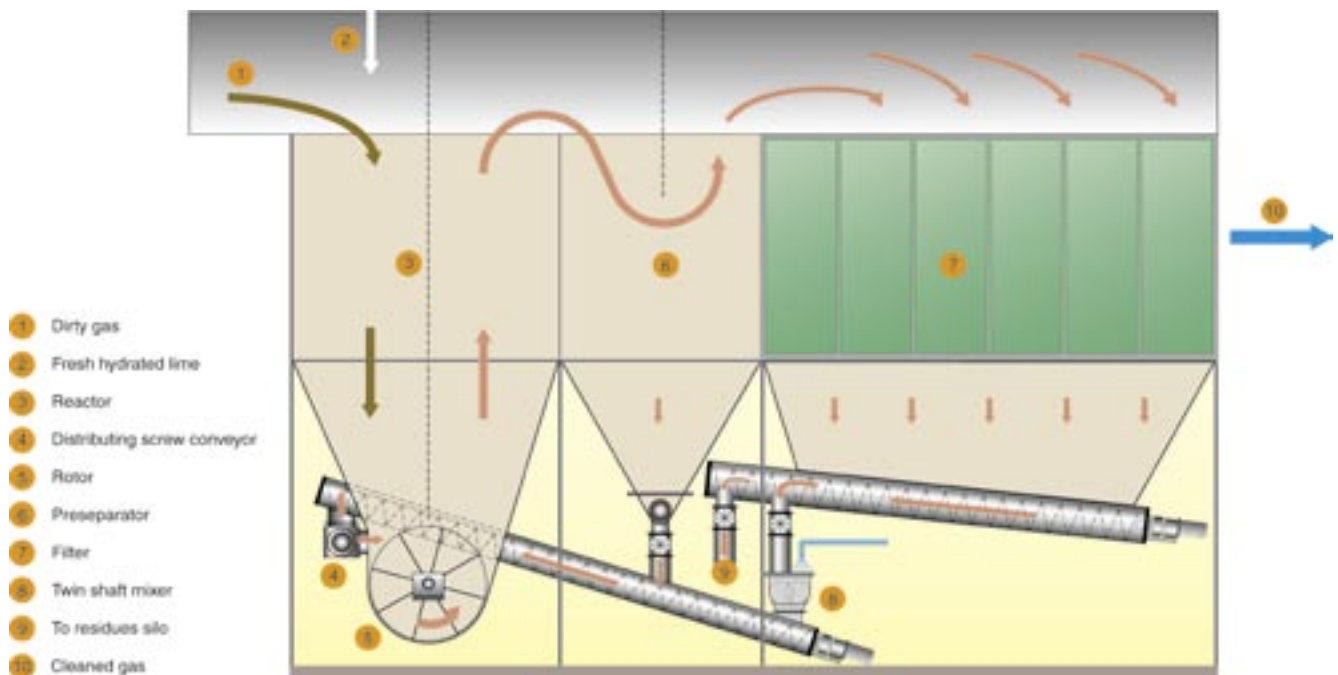
DISAsorp[®]



DISAsorp[®] - Process

Direct humidification of the hydrated lime improves the efficiency even further. The hydrated lime particles are surrounded by an extremely thin liquid film which evaporates very quickly so that dry hydrated lime is precipitated in the following filter. The moistened recirculated product flows as easily

as dry dust. During evaporation, a zone with almost 100% relative humidity forms directly around the hydrated lime grain. Depending on the different other process parameters such as temperature and residence time separation rates of approx 95% are possible for SO_x.



DISAsorp[®] for SO_x reduction

The larger the quantity of recirculated product, the better the filtration rate and the lower the moisture level in the recirculated product.

In the DISAsorp[®] process, a rotor actively accelerates the recirculated product upwards. This allows high recirculation rates (1: 100) even when the plant is not operated at maximum load.

The rotor is placed in the deflection part of the reactor. The external humidification of the recirculated product takes place in a twin shaft mixer where the corresponding quantity of water is adjusted by the waste gas temperature.

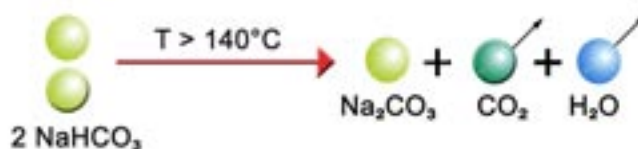
The recirculated product is fed to the reactor by a distributing screw conveyor.

Dry sorption



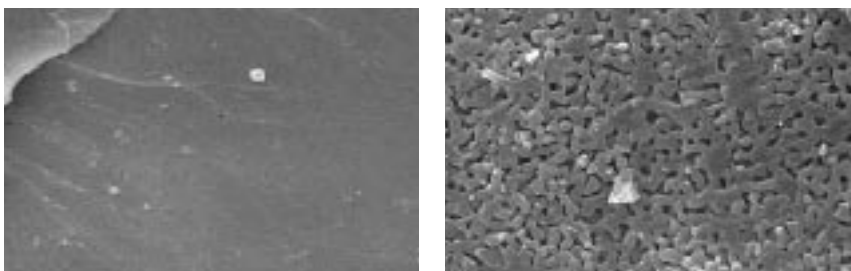
Dry sorption with sodium hydrogen carbonate

In contrast to dry sorption with hydrated lime, when using sodium hydrogen carbonate the filtration rate for SO_x is not improved by lowering the temperature. Here a higher temperature accelerates the break-down of sodium hydrogen carbonate in sodium carbonate, carbon dioxide and water. The sodium carbonate then reacts with the acidic harmful substances.



Thermal activation of sodium hydrogen carbonate

Thermal activation of sodium hydrogen carbonate generates a porous crystal structure. The resulting large adsorption surface allows for outstanding efficiency rates.



The Group



Dantherm Filtration

is a leading supplier of air cleaning systems for a wide range of industries all over the world.

Dantherm Filtration focuses on individual solutions for individual customer needs. Dantherm Filtration combines the experience and expertise of four internationally recognised suppliers - Airmaster, BMD Garant, Cattinair, Nordfab and Ventiltorenverken - to provide its customers with high efficiency, unbeatable reliability, low energy consumption, and full compliance with all mandatory requirements.



Dantherm Filtration has the expertise, experience, organisation and commitment to deliver an efficient clean air solution completed to specification, on budget, and on time.

As of 1 January 2005, Dantherm Filtration is part of the Danish Dantherm Group.

The purchase refers to the nine Dantherm Filtration companies in Denmark, Norway, Finland, France, Germany, Poland, England, the USA and Thailand.

Dantherm Holding is listed at the stock exchange in Copenhagen and is the parent company of the Dantherm Group. The new Group has an annual turnover of approx. 400 million with a workforce of about 2,750 employees.

Dantherm Holding is the mother company of a number of businesses involved in the development, production, sale and installation of systems for industrial ventilation technology.

The various companies operate on a local and global basis with production facilities and sales branches in several European countries, in the USA and in China. Up to now, activities have concentrated primarily on air treatment (cooling) and air ventilation (comfort). The acquisition of Dantherm Filtration corresponds to the strategic objective of becoming one of Europe's largest companies for industrial ventilation technology and air cleaning systems.

