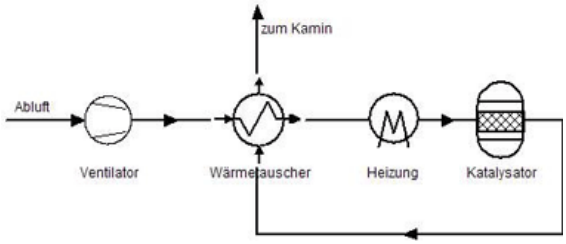
THERMIC CATALYTIC OXIDATION

Description/application

The catalytic exhaust gas treatment (catalytic oxidation) is generally known to most people as application in motor vehicles. It serves for the treatment of contaminated process air with organic compounds in industrial applications mainly. In this context it is often called catalytic post-combustion.

In the case of low organic contamination of the air and therewith low heating value the catalytic oxidation can be brought to the required reaction temperature by integrated heating systems (electricity or propane).



functional principle

Operating mode

A catalyst is a compound accelerating chemical reactions. For burning processes the catalyst reduces the activation energy for the initiation of a burning and therewith the ignition temperature extensively. So, the oxidation can take place with relatively low temperatures.

Hence following advantages arise:

- small dimensions of plants,
- quick heating,
- simple construction of the plants,
- low maintenance and simple operation,
- very high efficiency,
- low material demand and abrasion.

Operation

Delta Umwelt-Technik GmbH has planned, manufactured and successfully deployed plants for the catalytic oxidation for many different applications in the last years.

Depending on the composition of the exhaust fumes to be treated the plants for the catalytic oxidation are designed differently. In the simplest case they contain the following plant compounds: catalytic reactor, burner for the process gas heating, blower/fan for the transportation of the stream of process gas, heat exchanger to save energy and the necessary measuring and control devices.

Adequate filters have to be added, if the stream of process gas is contaminated with high dust concentrations, for instance. The dust would depose on the catalyst surface resulting in a reduction of its activity.

Low concentrations of hydrochloric acid are arising in form of inorganic oxidation products through the oxidation of chlorinated contaminants. In this case a gas scrubbing has to follow the burning.

Catalysis

The application of catalysis requires a careful planning and analysis of the treatment problem. The complexity of the homogeneous catalytic reaction shows the following underlying mechanism:

1. convective transport of the educts in the gas space,
2. diffusion of the educts through the barrier layer,
3. diffusion of the educts through the pores,
4. physisorption and/or chemisorption of the educts,
5. surface reaction,
6. desorption of the products,
7. pore and barrier layer diffusion.

Safety and explosion prevention

Since the contaminants to be treated can be potentially explosive, in some cases explosive protection regulation arrangements have to be done adapted to the application. These can include:

- concentration control (self monitored) and fresh air feed from mixing and aeration outlets at too high concentrations,
- emergency cut-out at too high concentrations (> 20–40 % UEG) and insertion of nitrogen,
- integration of a suction pipe to the plant, made of conductive material/steel (prevention of electrostatic charge),
- flame prevention in the pipes before and after following treatment steps.

Depending on the application the plant for thermic catalytic oxidation can be inspected by a surveyor for explosion prevention and supply the required documents.

Examples/references

The application at **VW Nutzfahrzeuge Hannover GmbH** with a very high VOC contamination and the remediation of the former **Lankwitzer lacquer producing plant with a high BTEX contamination** are examples for the integration of the thermic catalytic oxidation.