Carbon2Chem®

L-III | Up-Scale of Innovative Gas Purification Processes

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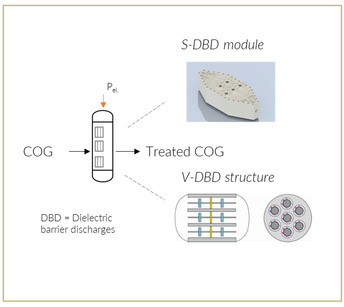
The appropriate cleaning of the steel mill gases (SMG) is essential for their use as a raw material in the chemical industry. Various methods are being investigated in the subproject L-III. Some are advanced techniques that have already been adapted to SMG in the technical center. Other processes were still in a very early stage at the beginning of the project and had to be developed in the laboratory. The following passages show the current status of these processes and give an insight into the transfer to industrial scale.

Coke oven gas treatment with non-thermal plasma

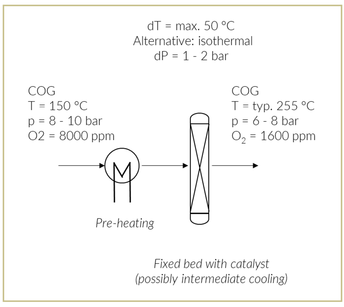
To remove traces of oxygen from coke oven gas (COG) a non-thermal plasma is used, which initiates the conversion of oxygen with the oxidizable components of the coke oven gas, such as hydrogen. The gas flow to be treated is fed without preheating into a plasma reactor, in which the DeOxo reaction takes place at ambient temperature and atmospheric pressure. Depending on the requirements of the application, the plasma can be formed in the entire gas phase (volume DBD|UMSICHT) or partially on defined surfaces in the reactor (surface DBD|RUB). In order to develop the technology in the relevant application environment, a laboratory plant was built in the technical center.



Basic sketch of coke oven gas cleaning using non-thermal plasma technology.

Thermo-catalytical removal of oxygen

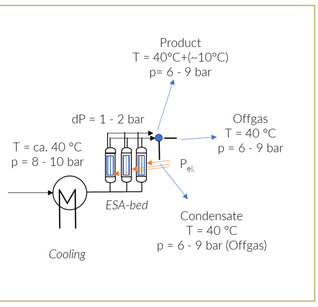
Oxygen from COG can also be removed by the application of an appropriate catalyst. As catalyst either Pt or NiMo/CoMo is used while conversion rates up to 90% can be achieved. For recent investigations the feed gas is preheated to a temperature of 250 °C at a pressure of 8-10 bar and catalyst poisons (H_2S and COS) were added to the gas streams. Current challenges are investigations with real gases and the optimization of catalyst recipe and type in terms of variable catalyst poisons. Experimental setup for verification and optimization in operational environment has been realized. Adaptation of this technology to Basic Oxygen Furnace Gas (BOFG) is also possible.



Basic sketch of coke oven gas cleaning using thermo-catalytical removal.

Electric Swing Adsorption

The process is used to remove higher carbon molecules (especially aromatics) from coke oven gas by means of electrothermally induced alternating adsorption. In gas cleaning, it could be used as a pre-adsorber before the H_2 removal. Desorption can be flexibly controlled and condensate can be separated from the off-gas. Various carbon-based adsorbents are being investigated. A flow-through bed is to serve as the electrode. Important key figures such as performance and energy for desorption as well as pressure losses have been determined. Current challenges are the identification of trace components and optimization of the process. Application to other gas sources (e. g. BOFG) is planned.



Basic sketch of coke oven gas cleaning using electric swing adsorption.

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A KEY BUILDING BLOCK FOR THE CLIMATE PROTECTION

CO_2 reduction by cooperation of process industrial sectors