



Oxygen Depolarized Cathode (ODC) Technology

Innovative Chlorine Production for the
Chlor-alkali Industry



Chlor-alkali Industry Outlook

About 60% of all chemical products are produced, directly or indirectly, using chlorine and/or caustic soda. One of the major challenges chlor-alkali industry is facing is the high energy consumption of common salt electrolysis for the production of chlorine and caustic soda.

Chlor-alkali electrolysis requires about 2,500 kWh of electrical energy per ton of chlorine produced (membrane technology). The current annual capacity of chlorine worldwide accounts to about 89 M tons, 5 M tons in Germany.

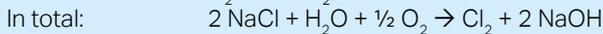
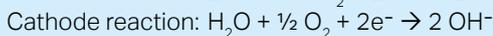
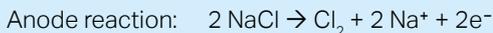
With ODC Technology, energy consumption is reduced about 30% and therefore indirect CO₂ emissions. Implementation of ODC as a standard technology for chlorine production in Germany (5M Cl₂ ton/a) would mean a yearly saving potential of 1% of its national electrical energy consumption.

Chlor-alkali Industry Outlook

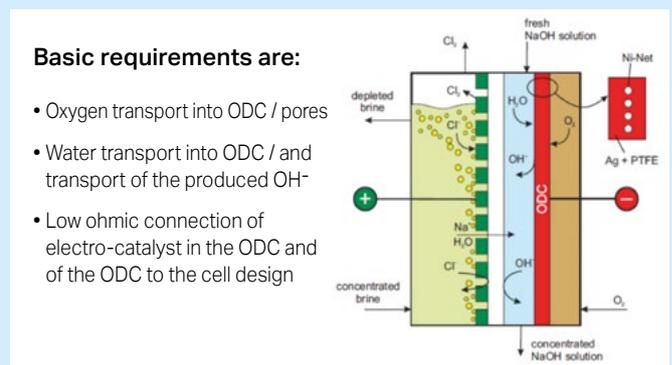
- 30% lower power consumption and indirect CO₂ emissions vs standard chlorine production technology
- No hydrogen production
- Simple handling in manufacturing and installation
- Reliable proven technology – First industrial scale demonstration plant operated by Covestro, proving energy efficiency and technical feasibility

How does ODC work?

In ODC technology, the formation of hydrogen is prevented by electrochemical reduction of oxygen to hydroxyl ions as follows:



The reaction takes place in what is called "three phase zone" of Oxygen Depolarized Cathode.



Basic requirements are:

- Oxygen transport into ODC / pores
- Water transport into ODC / and transport of the produced OH⁻
- Low ohmic connection of electro-catalyst in the ODC and of the ODC to the cell design

Source: Covestro Deutschland AG

About ODC electrodes

ODC electrodes are highly complex structures where electro catalysts, hydrophobic polymer components (like PTFE), support structures and additives interact to form hydrophilic and hydrophobic areas. Development of the ODC electrodes has been performed by Covestro Deutschland AG. Integration of the electrodes in the electrolysis cells has been made in collaboration with ThyssenKrupp Uhde Chlorine Engineers, which has been responsible for the cell design.

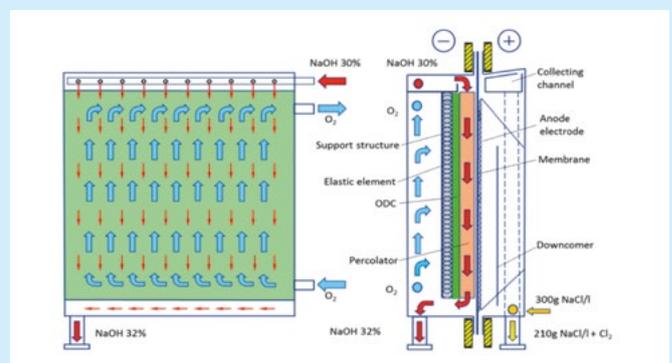


ODC production at Covestro Deutschland AG (Leverkusen)

Principle of ThyssenKrupp Electrolysis Cell Technology

In ODC technology, gas and liquid are separated in the cathode compartment by a percolator, which enables the formation of a caustic film between the membrane and the ODC.

The design of the percolator enables a homogeneous oxygen and caustic pressure distribution over the compartment, leading to an optimum flow performance.



Source: ThyssenKrupp Uhde Chlorine Engineers



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