EURO SUPPORT
MANUFACTURING

CATALYST ESM 464

For the
removal of Oxygen
from gases

EURO SUPPORT 464

Catalyst for the adsorptive and reactive removal of oxygen and carbon oxide from inert gases and hydrogen

INTRODUCTION

The ever-increasing demands for high purity gases, used not only in the chemical industry, are stimulating the use of high activity catalysts for the removal of impurities. Oxygen is a major impurity in inert or reactive gases and therefore reducing its concentration is a subject of continual interest. Inertization of reactors and the reaction space in many polymerization processes is just one example in which these high purity gases are used. Chemisorption with subsequent catalytic reaction always offers an economical and effective way to purify gases. Copper catalysts are frequently used in the above-described applications. Our product ESM 464 is a highly effective supported copper catalyst.

The catalyst is used in the referenced DEOXO unit in CHEMOPETROL comp. Litvinov. The goal of using this catalyst is the removal of oxygen from nitrogen, which serves for the inertization of the pilot plant unit for polyolefin production.

CATALYST TECHNICAL PARAMETERS

APPLICATION:	*Purification of inert gases and hydrogen*
CHEMICAL AND PHYSICAL PROPERTIES:	*~ 30 wt.% Cu in a highly dispersed form on a silicate carrier*
PHYSICAL FORM:	*cylindrical tablets 5 x 5, or 5 x 3 mm*
BULK DENSITY:	*750 ± 50 kg/m^3*
COPPER SURFACE AREA:	45 m^2 Cu/g$_{Cu}$
CRUSHING STRENGTH:	*25 ± 5 MPa*
OPERATING TEMPERATURE:	*20 – 250 °C*

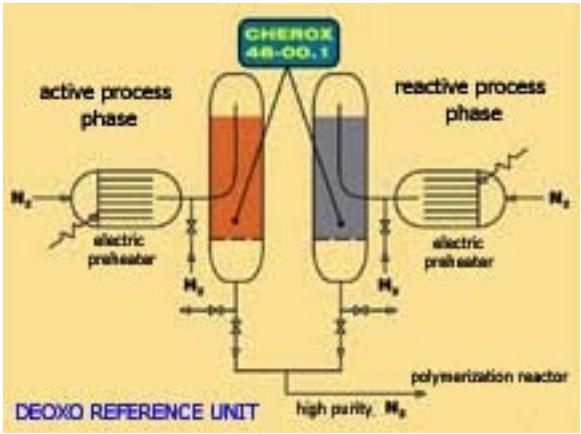
There are two general applications for the removal of oxygen from gases:

First application:

CATALYST APPLICATION AND OPERATING CONDITIONS AT REFERENCE UNIT

CATALYST VOLUME:	*2,8 m^3*
BULK DENSITY :	*700 kg/m^3*
SPACE VELOCITY (GHSV) :	*1700-2000 $Nm^3.h^{-1}.(m^3_{cat})^{-1}$*
OPERATING PRESSURE:	*9,5 - 10 bar*
INLET CONCENTRATION OF O_2:	*0,5 – 1ppm, Short time 10 – 6000 ppm*
OUTLET CONCENTRATION OF O_2:	*0,06 – 0,14 ppm*
CYCLE TIME BETWEEN REACTIVATION:	*2 - 3 months*
NUMBER OF REACTIVATIONS :	*14*
LIFE TIME:	*min. 4 years*
with the effective time operation	*min. 20 000 hrs*

Catalyst ESM 464 has been developed in order to achieve long life time combined with high throughput rates at low concent-ration of residual oxygen. The high reactive stability and crush-ing strength of ESM 464, combin-ed with its low bulk density makes it the catalyst of choice in this application.



Second application:

ESM 464 in general removes oxygen from gases containing a maximum of 1.0 to 1.5 vol.% O_2. In this case, it is possible to achieve a purity of 1-5 ppm. For the adsorption of oxygen, room temperature is sufficient. The total amount of oxygen that is adsorbed by the catalyst, however, largely depends on the temperature.

The catalyst is supplied in the unreduced state. For the in situ reduction, we recommended the following procedure:

Activation of catalyst:

The catalyst can be activated in either a tubular reactor with heat-exchange or more often in an adiabatic-type reactor. The reduction starts in either reactor by heating the catalyst in a stream of nitrogen to a temperature of 140 to 160°C. Subsequently, hydrogen is added to the nitrogen at such a rate that a temperature of 250°C is not exceeded. The reduction should be completed at a temperature of min. 230°C with undiluted hydrogen.

Advisable conditions for the adiabatic reactor:

Starting temperature:	160°C
Starting H_2 concentration:	max. 2 vol.%
Space velocity of the reduction mixture:	200 $Nm^3/m^3.hr$

Reactivation of catalyst:

In general, the catalyst can be reactivated as often as is required.
The period of the reactivation depends on the oxygen content in the feed gas. Catalyst ESM 464 removes 15 – 17 m^3 $O_2/m^3_{cat.}$ from nitrogen at an operating temperature 150^0C and space velocity of ~ 2 000 hr^{-1}.
Dust, oil, condensed water, salts and sulphur compounds reduce the activity and life of the catalyst. The reactivation condition also depends on the temperature used in the purification period. The higher the temperature in this period, the lower the concentration of H_2 that must be applied in the reactivation period. After adsorption of oxygen at room temperature, the pure hydrogen can be used at a temperature of 200°C. When adsorption of oxygen is usually performed, e.g. at about 150°C, the catalyst should be reactivated using H_2 diluted to 30 - 50 vol.% at 200°C, until water is released and finally in a stream of pure hydrogen.

EURO SUPPORT 464 catalyst in reduced form is *pyrophoric*. Spent reduced catalyst must therefore be either carefully oxidized or wetted with water before to its discharge.