



PK-7R

Low Temperature
Methanation Catalyst





Methanation Catalyst

Methanation involves final removal of CO, CO₂ and trace quantities of O₂ from process gas in hydrogen and ammonia plants. For many years nickel catalysts have been giving adequate performance provided that the operating temperature has been sufficiently high. However, the typical operating temperature for methanation catalyst has gradually decreased due to more efficient shift catalysts and improved CO₂ removal systems. At lower operating temperatures, many plants have experienced unacceptable CO and CO₂ leakage from the methanator when using traditional catalysts.

Topsøe's highly active, prereduced methanation catalyst **PK-7R** is a nickel type catalyst based on an alumina carrier. It was developed to operate at inlet temperatures down to 190°C/375°F, a performance which has been proven in the industry since its introduction in 1994.

In plants, where the methanator is operating in low temperature range, PK-7R has provided full conversion of carbon oxides as opposed to traditional methanation catalysts used in the same service.

Advantages of PK-7R

Low Operating Temperature Capability

In most plants, process gas entering the methanator is heated from a relatively low temperature to the required inlet temperature by heat exchange with the methanator effluent gas. With more efficient CO

shift and CO₂-removal technology available today, the temperature increase in such methanators will inevitably decrease and lead to a lower methanator inlet temperature. In these cases, use of conventional methanation catalysts may no longer ensure a full CO and CO₂ conversion.

The capability of PK-7R to operate at low temperatures will ensure that CO and CO₂ are fully converted at an operating temperature of 190°C/375°F. Furthermore, the lower level of the operating temperature will often lead to savings in energy consumption.

Prereduced for Higher Activity

The superior activity and capability of PK-7R to operate at low temperatures are a result of Topsøe's optimised catalyst production and prereduction technology. PK-7R is reduced in our catalyst manufacturing plant under carefully controlled conditions, which cannot be reproduced in industrial plants and result in a substantially higher nickel surface area, which is preserved during the entire operating lifetime.

Low Pressure Drop

With the ring-shaped PK-7R catalyst, a 50% reduction in pressure drop is achieved relative to the conventional spherical or cylindrical shaped methanation catalysts. This shape also yields a higher catalyst activity resulting from a higher external surface/volume ratio.



TYPICAL CHEMICAL AND PHYSICAL CHARACTERISTICS FOR PK-7R

Ni (WT %)

> 23

SIZE, OD X ID

5 x 2.5 mm
3/16" x 3/32"

OPERATING
TEMPERATURE RANGE

190 - 450°C
375 - 840°F



Excellent Resistance towards Poisoning

The controlled prereduction of PK-7R, combined with the high nickel surface area, ensures an excellent resistance towards catalyst poisoning.

High Thermal Resistance

PK-7R has a very high thermal stability and can tolerate temperatures as high as 700°C/1300°F. Consequently, the catalyst can withstand temperature excursions caused by upsets in CO₂ removal systems or other operating problems. The extraordinary thermal stability of PK-7R also minimises catalyst deterioration by ageing, thereby ensuring a long lifetime.

Catalyst Operation

Ease of Handling, Loading and Activation

PK-7R is stable in air at ambient temperatures and, with a few extra precautions, may be handled and loaded in the same manner as conventional methanation catalysts. Because PK-7R is delivered prereduced, no special procedure is required to activate the catalyst. The catalyst is simply exposed to process gas at normal operating conditions and methanation begins immediately.

Normal Operation and Catalyst Lifetime

The high activity of PK-7R allows operation at inlet temperatures as low as 190°C/375°F with fully satisfactory conversion of all carbon oxides and oxygen. Typically, the maximum recommended temperature for continuous operation is 450°C/840°F.

The temperature increase across the methanation catalyst depends on composition of feed gas.

The approximate temperature rise is

- 75°C/135°F per mole% CO
- 60°C/108°F per mole% CO₂
- 165°C/297°F per mole% O₂ converted

Deactivation of methanation catalyst generally results from thermal ageing, poisoning by impurities in the process gas or excessive carry-over of solvent from the CO₂ removal system. PK-7R possesses exceptional resistance towards thermal ageing and poisoning and a charge of PK-7R is expected to provide excellent performance for more than 10 years.

After Sales Service

Topsøe provides assistance and follow-up service during the lifetime of the catalyst charge in form of regular performance evaluations and troubleshooting, if required.

A complete catalyst manual including step-by-step procedures for loading and operation of the PK-7R catalyst, is supplied in connection with catalyst purchase.

Topsøe R & D

Topsøe's worldwide services to the chemical, petrochemical and refining industries are based on a fundamental understanding of heterogeneous catalysis, including development and production of catalysts, process technologies and engineering services.

Quality catalysts – proven by performance

Topsøe's unique integrated approach has resulted in profitable solutions providing catalysts in the areas of:

- Feed Purification
- Adiabatic Steam Reforming
- Steam Reforming
- CO Shift Conversion

► **Methanation**

- Ammonia Synthesis
- Methanol Synthesis
- Formaldehyde
- Sulphuric Acid
- Refinery Hydroprocessing
- DeNOx and DeSOx
- Combustion of VOC

Based on many years of experience, the development of Topsøe catalysts is dedicated to provide a second-to-none performance. This means that focus always is on key factors such as enhancement of high and stable activity, long operating life, high resistance to poisoning, low pressure drop, energy savings and reduced emissions.

Customised after sales service

Topsøe's after sales service relies upon an on-going exchange of information between the client and us, to provide clients with relevant and most up-to-date information. The four pillars in Topsøe's service programme are:
Frequent Contact and Discussions,
On-site Supervision, Evaluation of Plant Performance and Troubleshooting.

Visit www.haldortopsøe.com for more information.

The information and recommendations have been prepared by Topsøe specialists having a thorough knowledge of catalysts. However, any operation instructions should be considered to be of a general nature and we cannot assume any liability for upsets or damage of the customers' plants or personnel. Nothing herein is to be construed as recommending any practice or any product in violation of any patent, law or regulation.

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