

RK-200 Series



It is well known that alkali promotion of the steam reforming catalyst to a certain extent can prevent carbon formation in the steam reformer when operating on feedstocks ranging from heavy natural gas to naphtha. Alkali promotion has also proven useful for preventing hot band formation when reforming natural gas in heavy duty top fired reformers.

For many years, Topsøe alkali-promoted catalysts and Topsøe alkali-free catalyst RKNR have been a favourite choice of the industry for steam reforming of heavy natural gas, LPG and naphtha. This position has been achieved through high catalyst activity combined with superior resistance towards carbon formation.

Topsøe has continually exerted efforts to improve the catalysts, which has materialised into a new generation of alkali-promoted steam reforming catalysts, denominated RK-211, RK-201, RK-212 and RK-202.

RK-200 Series

- Alkali-promoted Reforming Catalysts

The RK-200 Series are nickel-containing catalysts based on a ceramic calcium magnesium aluminate carrier promoted with potassium oxide. The ceramic carrier does not contain any free magnesium oxide; therefore, there is no possibility of hydration of the catalyst during start-up or during operation. The RK-200 Series offers two types of alkali-promoted reforming catalysts:

- Low alkali version, RK-211 and RK-201
- High alkali version, RK-212 and RK-202

The low alkali catalysts contain approximately half a percent potassium oxide and are suitable for processing heavy natural gas and LPG, whereas the high alkali catalysts, with more than one percent potassium oxide are capable of handling naphthas with final boiling point (FBP) up to 200°C (392°F) and aromatic contents up to 20%.

The alkali content on the RK-200 Series catalysts has been optimised and is generally considerably lower than seen for other alkali-promoted catalysts on the

market. Since the alkali has a negative impact on the catalyst activity, the relatively low alkali content is preferable to ensure a high activity of the catalyst. Still the alkali content on the RK-200 catalysts is sufficiently high to enable carbon free operation in the



steam reformer. On the other hand the alkali content is so low that fouling of waste heat boilers can be excluded.

RK-211 and RK-212 are delivered prereduced and in addition to potassium, are also promoted with a noble metal. These features of the catalysts makes them especially suited for the inlet conditions in a steam reforming furnace, where low temperatures are prevailing.

Main Benefits by using RK-200 Series High Strength and Resistance to Condensing Steam

The RK-200 catalysts have retained the virtues of its predecessors, but have furthermore been improved with regard to the physical strength of the catalyst. The catalysts have an unmatched mechanical resistance to condensing steam and liquid carry-over.

Protection against Carbon Formation

The alkali-promoted catalysts are specifically designed to minimise migration of the potassium promoter from the ceramic carrier, thus ensuring protection against carbon lay-down throughout the catalyst life.



Optimised Geometric Shape

The catalysts are produced in the well-known shape of seven-hole cylinders, which provide the combination of very low pressure drop and a high external surface (activity).

Easy Start-up and High Activity

By using prereduced catalyst in the top 15% of the tube the reforming reaction is initiated immediately when exposed to process gas. The hydrogen generated in the top layer rapidly activates the catalyst in the lower 85% of the tube. The easy activation greatly minimises the start-up time.

The superior ability of RK-211 and RK-212 to operate at the low temperatures in the top of the catalyst tube is the result of a special manufacturing technique and the addition of a noble metal promoter. An additional advantage is that the catalysts have been reduced in Topsøe's production facilities in dry hydrogen at an optimal temperature, which results in higher activity than what could be obtained by in-situ reduction.

Application

RK-211/RK-201 and RK-212/RK-202 can operate at all conditions where the use of an alkali-promoted catalyst is advisable, and is applicable in any reformer furnace design.

Heavy Natural Gas and LPG

The reforming of heavy natural gas and off-gases from refineries or LPG only requires the lightly alkali-promoted RK-211 and RK-201 (top layer) in combination with the traditional gas reforming catalyst, R-67-7H.

Naphtha Reforming

Reforming of naphtha requires the extra protection against carbon formation offered by the RK-212 and RK-202 catalysts, which contain higher levels of potassium than the RK-211/RK-201. Depending on the characteristics of the naphtha and the operating conditions, RK-212/RK-202 are used in combination with a bottom layer of RK-201 or R-67-7H.

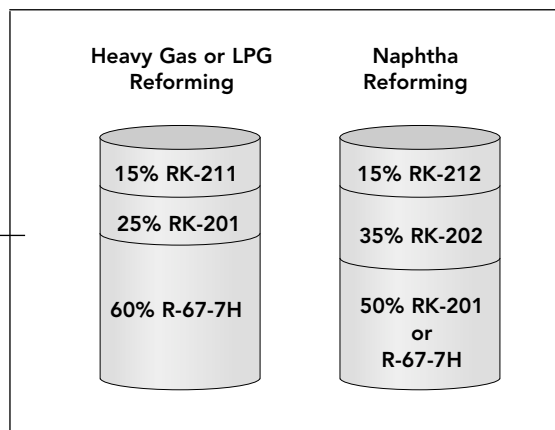
LOW ALKALI VERSION

	RK-211	RK-201
NiO (WT %)	(Prereduced)	>15
Ni (WT %)	>10	-
SiO ₂ (WT %)	<0.2	<0.2
K ₂ O (WT %)	>0.3	>0.3
CARRIER	Balance	Balance
SHAPE	7 hole	7 hole

HIGH ALKALI VERSION

	RK-212	RK-202
NiO (WT %)	(Prereduced)	>15
Ni (WT %)	>10	-
SiO ₂ (WT %)	<0.2	<0.2
K ₂ O (WT %)	>1.0	>1.0
CARRIER	Balance	Balance
SHAPE	7 hole	7 hole

TYPICAL CATALYST COMBINATIONS



Proven by performance

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