KOC

The flexible and effective way to lower afterburn in your FCC unit

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It has been demonstrated that platinum is very effective in catalyzing the oxidation of carbon monoxide (CO) to carbon dioxide (CO_2). Application of a platinum-based CO combustion additive, such as Albemarle's KOC, is an easy and flexible way to reduce afterburn in your FCC unit.

Albemarle's KOC-15 and KOC-18 CO oxidation promotion additives are manufactured so that platinum is uniformly distributed across the surface of a specially designed, high-stability alumina support. This support and the evenly distributed platinum give you the most effective platinum catalysis for conversion of CO to CO_2. KOC-15 and KOC-18 differ only in their metal contents, with KOC-18 having the highest level.

$$2C + O_2 \rightarrow 2CO \ (\Delta H = 9.2 \text{ kJ/g}) \quad [1]$$

$$2CO + O_2 \rightarrow 2CO_2 \ (\Delta H = 23.4 \text{ kJ/g}) \quad [2]$$

Figure 1: During the combustion of coke, carbon is converted relatively easily to CO, but further reaction to give CO2 can be slow. As a result, reaction [2] may occur in the dilute phase, the cyclones and the flue-gas lines, and thus result in afterburn.

Afterburn

In the regenerator, the coke on spent catalyst is burnt in presence of oxygen (O_2) from air to produce CO and CO_2 (Figure 1). The conversion of carbon (C) to CO_2 occurs largely via the initial production of CO. Reaction [1] occurs relatively easily, but reaction [2] can be slow.

Under ideal conditions, the reaction is complete in the dense phase, i.e., all the O_2 is converted during partial-burn operations or only CO_2 is present (all the CO is converted) in full-burn operations. However, it is often observed that the reaction is incomplete in the dense phase, and that further reaction occurs in the dilute phase, which results in an increase in temperature above the dense bed. This phenomenon is called afterburn.

The afterburn reaction (oxidation of CO to CO_2) occurs in the dilute phase, the cyclones and the flue-gas lines when O_2 and CO pass the bed and into the dilute phase and the oxygen level exceeds a temperature-dependent minimum. This will happen when the air or the catalyst in the dense bed in the regenerator is not optimally distributed. Afterburn results in high temperatures that may cause serious metallurgical damage, especially in cyclones and flue-gas lines, which will cause unscheduled shutdowns and losses due to downtime.

KOC performance

Comparison of KOC-15 and competitors' combustion promoter additives in a CO conversion test showed that KOC-15 gives the highest conversion of CO to CO_2 (Figure 2). The activity of the promoters was determined by monitoring the conversion of CO to CO_2 during oxidation treatment of a CenturionMax spent FCC catalyst with 2 vol% O_2 in a nitrogen atmosphere at 1292°F (700°C). The platinum level in the inventory was kept constant by varying the additive intake (0.5 to 2 wt%).

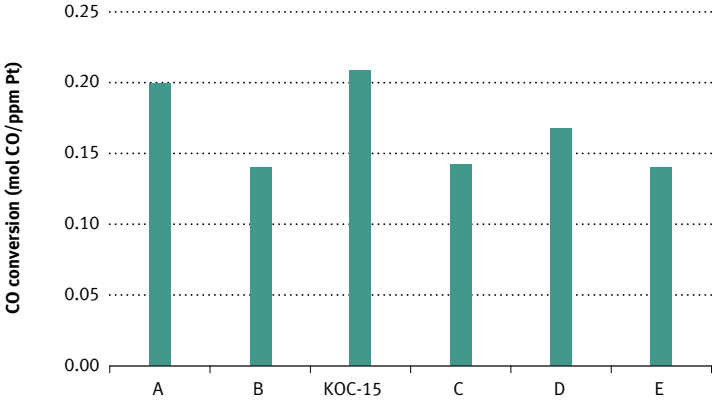

Figure 2: KOC-15 showed the highest conversion of CO into CO_2 in a CO conversion test. in this test, carbon on spent catalyst was oxidized by reaction with O_2 (2 vol% in nitrogen atmosphere) at 1292°F (700°C).

Application of KOC is a very effective and flexible way to counter afterburn problems. The high dispersion of the platinum on the inner surface of the particles and proper distribution of the particles over the catalyst inventory will give the highest efficiency afterburn control that you can reach with CO combustion promoters. KOC has proven performance and is currently in use in numerous commercial FCC units worldwide.

KOC physical properties

KOC-15 and -18 have high attrition resistance and bulk density, and a particle size distribution of close to that of the catalyst in circulating inventory for high retention in the unit (Table 1). KOC-15 and KOC-18 differ in platinum levels, with KOC-18 having the highest concentration.

Typical properties		KOC
Attrition index	wt%	1.0
Average bulk density	g/cm^3	1.00
Particle size distribution (0–20 µm)	wt%	2
Particle size distribution (0–40 µm)	wt%	7

Table 1: KOC typical properties.

Packaging

KOC is available in containers, moisture-proof bags in a drum, drums or large bags. Moreover, we can blend the additive in Albemarle host catalyst to improve the additive dispersion in your unit even further.

For more information on this or other Albemarle products and technologies, please contact your Albemarle representative.

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