ALBEMARLE®

DuraSOx™ – Highly attrition-resistant SOx reduction additive without performance compromise

DuraSOx SOx reduction additive is the culmination of intensive development work focusing on obtaining the most attrition-resistant SOx additive on the market without any performance compromises. It follows in the footsteps of Albemarle's longest marketed SOx additive, KDSOx®, in that both take advantage of Albemarle's patented hydrotalcite technology.

SOx reduction additives are designed to capture and remove the oxidized sulfur compounds present in the FCC unit regenerator and release them in the FCC riser. On release, the sulfur exits the FCC unit as hydrogen sulfide along with the cracked products in the reactor effluent. The hydrogen sulfide is easily processed in the gas plant downstream of the FCC unit.

Extensive studies in the 1970s looked at the absorption of SOx by various metal oxides and concluded that catalysts based on MgO, Al_2O_3, $MgAl_2O_4$ (spinel), La_2O_3 and CeO_2 were most suitable for FCC operations. The introduction of hydrotalcite ($Mg_6Al_2OH_{16}$), which is an anionic layered clay, improved the Mg/Al ratio to 3:1 from 1:2 compared with other leading technologies. The importance of the Mg/Al ratio becomes apparent when the mechanism for capture and subsequent release of sulfur via additives is considered. Figure 1 illustrates the reactions catalyzed by SOx reduction additives.

Magnesium acts as the capturing medium by forming magnesium sulfate in the regenerator. Sulfur released from the magnesium sulfate in the riser effectively regenerates the particle and makes it available to capture sulfur again in the next pass through the FCC unit.

Albemarle pioneered and patented hydrotalcite-based additive technologies and first entered the SOx additive market in the 1980s. It is estimated that today about 70% of the worldwide use of SOx additives is based on this technology. Albemarle's patented hydrotalcite-based technology is the preferred option for reducing SOx emissions from FCC units because it offers the highest amounts of magnesium available in the market and, consequently, the highest reduction in SOx emissions.

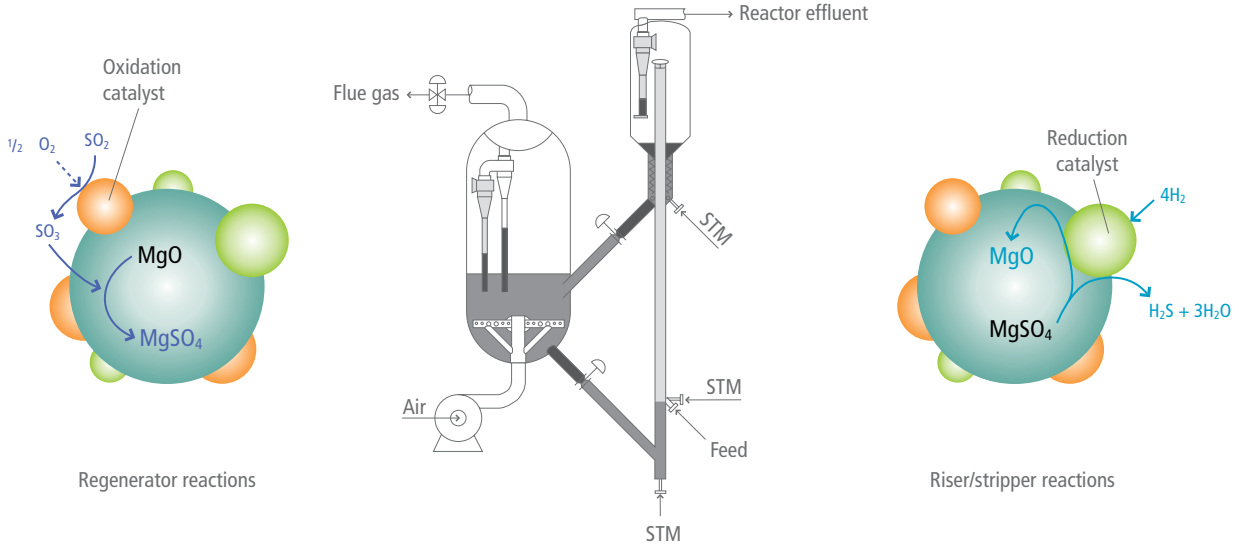

Figure 1: The sulfur capture (left) and release (right) reactions occurring during the use of Albemarle's SOx reduction additives.

DuraSOx is recommended for the following types of FCC units:

- full-combustion operation
- downstream power recovery turbines and expanders
- loss-sensitive units
- opacity compliance issues stemming from the use of soft SOx reduction additives
- FCC units operating under consent decrees with the US Environmental Protection Agency
- performance-oriented FCC units.

A novel binding process is the key behind the success of DuraSOx. Figure 2 shows the clear attrition improvement over KDSOx additive. It should be noted that the attrition index of KDSOx is equal to that of most fresh FCC catalysts.

Besides being more attrition resistant, the binding process utilized in DuraSOx enables more active sites to be incorporated into each additive particle.

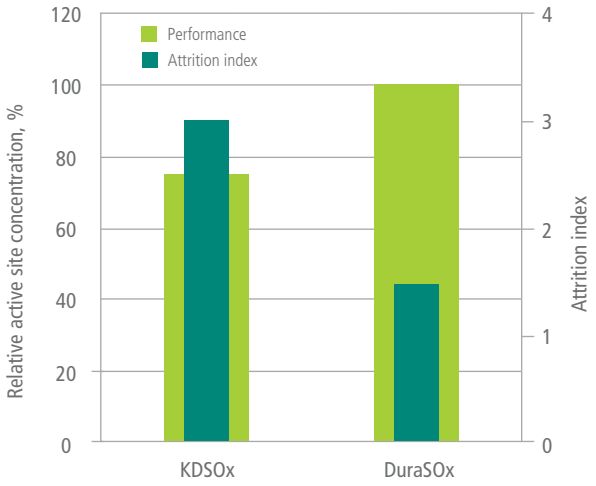

Figure 2: Attrition resistance improvements provide the opportunity to add more active ingredients and boost performance.

Typical product properties	↘
Additive name	DuraSOx
Application	SOx reduction
Attrition index, wt%	1.5
Average bulk density, g/ml	0.84
Surface area, m^2/g	145
Particle size distribution (0–40), %	10
Particle size distribution (0–20), %	1

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

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