Improving FCC Economics with Light Olefins Additives

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The refining industry is well versed in the use of ZSM-5 light olefins additives for the incremental production of propylene for chemical and polymer applications and butynes for alkylation unit feedstock. However, light olefins additives are also capable of providing significant flexibility in operating the FCC unit, providing additional economic benefits for the refiner.

Grace delivered incremental profitability to a refiner who took an early turnaround on a catalytic reformer. The refinery was octane short and there was no opportunity to increase riser temperature. Grace recommended the use of a light olefins additive to boost the overall octane from the FCC complex. The use of ZSM-5 increases the yield of C3 and C4 olefins to feed the alkylation unit and any other units designed to create gasoline range material from FCC olefins. The effect of ZSM-5 on the conversion of gasoline olefins to LPG olefins can be seen in Figure 1.

The ability of ZSM-5 to increase the light olefins yield from the FCC is due to the size and shape of its micropores. The small pores of ZSM-5 allow rapid diffusion and cracking of low octane, linear hydrocarbons from the gasoline into LPG range olefins, leaving the gasoline richer in aromatics and hence octane value.

As a result of ZSM-5 cracking, the incremental light olefins production from the FCC results in higher alkylate yields. Alkylate is a refinery blending stream that is high in both motor and research octane. At the same time, the yield of FCC gasoline generally drops at constant riser temperature, but the octane is increased, with general increases ranging from 0.3 to 0.7 numbers.

When the total octane properties of the FCC gasoline and alkylate are added together, there is an increase in the octane of the total gasoline pool from the FCC complex. This is a valuable economic option when the FCC unit is running at reduced feed rates and there is available capacity in the alkylation unit. By varying the concentration of light olefin additive in circulating catalyst inventory, the refiner can take advantage of available capacity in the alkylation unit while independently optimizing the riser outlet temperature. This option may be especially helpful in the fall and winter, when higher LCO yields are generally desirable but a loss in volume gain across the FCC is not.

Grace Davison is the leading supplier of high activity, high stability light olefins FCC additives. OlefinsMax®, OlefinsUltra®, and OlefinsUltra® HZ additives are being used in over 70 FCC units worldwide. They continue to provide economic value for the refiner by generating incremental propylene, additional feed for alkylation and an increase in gasoline octane.